Mackerel Rebuilding Framework
ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FISHERY MANAGEMENT PLAN

Measures to Rebuild the Atlantic Mackerel Stock, Including 2019-2021 Specifications and the River Herring and Shad (RH/S) Cap

Includes DRAFT Environmental Assessment (EA)

Atlantic Mackerel
Scomber scrombus

Prepared by the

Mid-Atlantic Fishery Management Council (Council) in collaboration with the

National Marine Fisheries Service (NMFS)

Council Address

Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201
Dover, DE 19901

NMFS Address

NMFS Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930

Submitted to NOAA: Initial: 10/11/18; Revised: 2/28/19

1.0 EXECUTIVE SUMMARY AND TABLE OF CONTENTS

In this Framework Adjustment to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (MSB FMP) the Mid-Atlantic Fishery Management Council (Council) considered measures to rebuild the Atlantic mackerel ("mackerel" hereafter) stock, including setting 2019-2021 mackerel specifications with the fishery's accompanying river herring and shad (RH/S) cap and other management measures.

The purposes of this action are to rebuild the mackerel stock so that Optimum Yield (OY) can be achieved on an ongoing basis and to implement associated specifications and management measures including the RH/S cap. The action is needed because the recent benchmark mackerel assessment found the mackerel stock to be overfished, with overfishing occurring based on 2016 data (which was the most recent data available for the assessment) (NEFSC 2018). Also, previously-set specifications were for 2016-2018 so new specifications were generally needed for 2019 and beyond regardless of the assessment findings.

After the results of the assessment, the Council deliberated on the issue at its April 2018 meeting and took final action in August 2018 after considering Scientific and Statistical Committee recommendations, public input, MSB Committee recommendations, and staff recommendations. The Council also received related input from the MSB Advisory Panel (AP) on April 13, 2018, and input from the combined MSB and RH/S APs on July 17. The MSB and RH/S Committees met jointly on July 18, 2018 to develop recommendations for the Council. A Fishery Management Action Team also met several times to help develop possible alternatives and related analyses.

The Council has submitted this framework to NOAA Fisheries for approval and implementation. NOAA Fisheries will publish a proposed rule along with this Environmental Assessment for public comment. After considering public comments on the proposed rule, NOAA Fisheries will publish a final rule with implementation details, as long as the action is ultimately approved by NOAA Fisheries.

The purposes of this document are to explain the potential actions and analyze their impacts on the human environment, including any impacts to Endangered Species Act (ESA) listed species and marine mammals protected under the Marine Mammal Protection Act (MMPA). The proposed alternatives are expected to result in positive benefits to the nation by restoring the sustainability of the mackerel resource and achieving OY on an ongoing basis while simultaneously limiting non-target impacts to RH/S. This action should not result in significant impacts on any valued ecological components from the perspective of the National Environmental Policy Act (NEPA). Because none of the preferred alternatives are associated with significant impacts to the biological, social, economic, or physical environment, a "Finding of No Significant Impact" (FONSI) may be made and an EA satisfies the impact analysis requirements of NEPA. Summaries of the preferred alternative and expected impacts are below. Details of all alternatives and their impacts are in Sections 5 and 7, respectively.

Summary of Preferred Alternatives and Rationales

The preferred rebuilding Alternative 1c, is projected to rebuild mackerel in slightly under 5 years. Since the rebuilding catches are higher than what would occur under the Council's current standard risk policy, the Council would adjust its risk policy to indicate that in this case of mackerel rebuilding initiation, the risk policy of the Council is adjusted to use the 5-year rebuilding timeline for mackerel in Alternative 1c. The associated Acceptable Biological Catches (ABCs) are 29,184 metric tons (MT), 32,480 MT, and 33,474 MT (these are higher than the 2018 ABC of 19,898 MT). The benchmark mackerel assessment, considered to be the best available scientific information, indicates that these catches will set the mackerel stock on a course to be rebuilt within five years, i.e. by 2023. 10,000 MT would be deducted for expected Canadian landings, 1,209 MT would be set-aside for expected recreational catch, and a 3% management uncertainty buffer would be utilized (which is a change from the current 10% buffer but other preferred measures (2d – see below) will slow the fishery such that a 10% buffer is no longer appropriate). In addition, 0.37% of expected commercial catch would be set aside for expected discards. These measures do allow commercial landings to increase from the current 9,177 MT to 17,371 MT in 2019, 20,557 MT in 2020, and 21,517 MT in 2021. In the Council's judgement, this rebuilding approach addressed the legal requirement to "specify a time period for rebuilding the fishery that shall…be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities,…and the interaction of the overfished stock of fish within the marine ecosystem…" While a shorter rebuilding timeline could be possible biologically, when considering the needs of fishing communities and the interaction of mackerel in the ecosystem, a 5-year rebuilding timeline was determined to be most appropriate, as further discussed in this document.

To effectively utilize the available commercial landings, the Council selected Alternative 2d (which was 2e in the original motion and August 2018 briefing materials). Under this alternative, when 90% of the DAH is projected to be landed, trip limits of 40,000 pounds would be implemented for Tier 1-3 directed permits and 5,000 pounds for incidental/open access permits. When 98% of the DAH is projected to be landed, a 5,000 pound trip limit would be implemented for all permits for the rest of the fishing year to cover remaining incidental catches. The existing initial Tier 2 (135,000 pounds) and Tier 3 (100,000 pounds) trip limits would remain the same, as would the Tier 3 7% limit. If in November and December of each year NMFS determines that keeping the mackerel fishery open longer than the set percentage triggers (in any phase of the fishery) is unlikely to cause a DAH overage, then NMFS shall have the discretion, based on a projection, to not close (or not further close) the fishery so that optimum yield can be harvested. The Council determined that Alternative 2d would best achieve optimum yield and facilitate effective operation of the mackerel fishery. The reduction of the open-access incidental permit trip-limit upon closure of the directed fishery from 20,000 pounds to 5,000 pounds mirrors the reductions in trip limits that the directed fishery experiences when the directed fishery closes. Better post-closure control of fishing under the open-access incidental permit will also help minimize the potential for ACL overages given the open access status of the incidental permit.[1]

[1] The MSB "4" permit is described in the permit application instructions as "Atlantic Mackerel Incidental Catch." The permit description notes that with this permit vessels "May commercially fish for Atlantic mackerel in the…

To continue to control RH/S catch in the mackerel fishery, the Council selected Alternative 3b and 3d. Under 3b the RH/S cap would scale with the mackerel DAH based on the 0.74% ratio used in 2015. The ratio of cap to all catch on mackerel trips (accounting for mostly co-caught Atlantic herring) would be about 0.53%. This is a lower ratio than used in 2018 (2018: 0.89% to mackerel quota or about 0.64% to all catch) so there would still be a strong incentive to avoid RH/S, but since the mackerel quotas are proposed to increase, the absolute value of the RH/S caps would increase from 82 MT currently to 129 MT in 2019, 152 MT in 2020, and 159 MT in 2021. To ensure active avoidance when mackerel landings are low, the Council added a provision via Alternative 3d where the cap starts at 89 MT and only increases beyond 89 MT if the fishery can first land 10,000 MT of mackerel without hitting the initial 89 MT RH/S cap.

Summary of Impacts

The impacts of Alternative Set 1, which sets the mackerel catch limits, are relatively more substantial than Alternative Sets 2 and 3, which more affect how the fishery operates within the catch limits considered in Alternative Set 1. See section 7 for details.

Target Species Impact Summary

The preferred management measures should allow the mackerel stock to grow and rebuild within 5 years. Changes in mackerel fishing should not impact squid or butterfish due to low catch of those species in the mackerel fishery and separate management measures control catch of those species. While Atlantic herring and mackerel are often caught together, separate management measures in the Atlantic herring fishery should ensure that overfishing does not occur on the Atlantic herring stock. Both no action and the preferred alternative should rebuild mackerel, but no action would rebuild mackerel faster than the preferred alternative.

Non-Target Species Impact Summary

Non-target interactions are relatively low in the mackerel fishery. The higher mackerel landings allowed under the preferred alternatives would have low-negative impacts on non-target species compared to no action, including river herrings (alewife and blueback herring) and shads (American and hickory). The RH/S cap should continue to limit interactions between the mackerel fishery and RH/S.

…(footnote 1 continued) EEZ for up to 20,000 lb of mackerel. This category includes all gear types." The instructions also state "This letter and the enclosures only summarize the legal requirements. Please consult the U.S. Code of Federal Regulations whose guidance for application requirements, permit eligibilities, and related information will always prevail." Those regulations state… "Atlantic mackerel incidental catch permits. Any vessel …may obtain a permit to fish for or retain up to 20,000 lb (7.46 mt) of Atlantic mackerel as an incidental catch in another directed fishery…The incidental catch allowance may be revised by the Regional Administrator based upon a recommendation by the Council…" (https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=1e9802ffddb05d0243d9c657fade956c&rgn=div5&view=text&node=50:12.0.1.1.5&idno=50)

Habitat Impact Summary

Compared to no action, the limited increase in bottom trawling that could result from the preferred alternatives should not have adverse effects on habitat that are more than minimal and/or temporary in nature.

Protected Resources Impact Summary

Compared to no action, the limited increase in trawling effort that could result from the preferred alternatives could have negligible to moderately negative impacts on protected resources.

Human Communities Impact Summary

Compared to no action, the higher mackerel quotas should have positive human community impacts related to the potentially higher mackerel revenues and the associated stimulation of economic activity in communities related to those higher landings. The RH/S cap could limit mackerel landings depending on the RH/S encounter rate, in an approximately similar fashion as currently occurs.

THIS SPACE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS SPACE INTENTIONALLY LEFT BLANK

2.0 LIST OF COMMON ACRONYMS AND ABBREVIATIONS

ABC Acceptable Biological Catch
ACL Annual Catch Limit
ACT Annual Catch Target
ASMFC Atlantic States Marine Fisheries Commission or Commission
B Biomass
CFR Code of Federal Regulations
CPH Confirmation of Permit History
CV coefficient of variation
DAH Domestic Annual Harvest
DAP Domestic Annual Processing
EA Environmental Assessment
EEZ Exclusive Economic Zone
EFH Essential Fish Habitat
EIS Environmental Impact Statement
ESA Endangered Species Act of 1973
F Fishing Mortality Rate
FMAT Fishery Management Action Team
FMP Fishery Management Plan
FR Federal Register
GB Georges Bank
GOM Gulf of Maine
M Natural Mortality Rate
MAFMC Mid-Atlantic Fishery Management Council
MMPA Marine Mammal Protection Act
MSA Magnuson-Stevens Fishery Conservation and Management Act (as currently amended)
MSB Atlantic Mackerel, Squid, Butterfish
MSY Maximum Sustainable Yield
MT (or mt) Metric Tons (1 mt equals about 2,204.62 pounds)
NE Northeast
NEFMC New England Fishery Management Council
NEFSC Northeast Fisheries Science Center
NEPA National Environmental Policy Act
NMFS National Marine Fisheries Service (NOAA Fisheries)
NOAA National Oceanic and Atmospheric Administration
OFL Overfishing Level
OY Optimum Yield
PBR Potential Biological Removal
SARC Stock Assessment Review Committee
SAW Stock Assessment Workshop
SNE Southern New England
SSC Scientific and Statistical Committee
U.S. United States
T1, T2, T3 Trimesters 1, 2, and/or 3 of the Longfin Squid Fishery
VTR Vessel Trip Report

Notes: "Mackerel" refers to "Atlantic mackerel" unless otherwise noted. Likewise “herring” alone refers to Atlantic herring.

3.0 LISTS OF TABLES, AND FIGURES

3.1 List of Tables

3.2 List of Figures

THIS SPACE INTENTIONALLY LEFT BLANK

4.0 INTRODUCTION, BACKGROUND, AND PROCESS

4.1 Introduction and Background

Based on a recent benchmark assessment (NEFSC 2018), the mackerel stock was declared overfished, with overfishing occurring in 2016. Rebuilding projections (i.e. projections using the methods from the recent benchmark assessment) indicate that overfishing should have ended by 2018. Related reports have been posted to the Northeast Regional Stock Assessment Workshop (SAW) report webpage: https://www.nefsc.noaa.gov/saw/reports.html. F40% was recommended as the proxy for FMSY (fishing mortality at "maximum sustainable yield") and was estimated to be 0.26. F40% was selected as a proxy for FMSY due to consistency with the Canadian reference point and ability to prevent stock collapse for stocks with similar life histories. F40% produces 40% of the "spawning stock biomass per recruit" (equivalent to lifetime egg production) relative to that produced by an unfished stock. Fishing mortality (F) in 2016 was estimated to be 0.47, so overfishing was occurring in 2016. The biomass target is the SSB associated with the FMSY proxy or "SSBmsyproxy," and is estimated to be 196,894 MT. The 2016 spawning stock biomass (SSB) was estimated to be 43,519 metric tons (MT), or 22% of the SSB target so mackerel is "overfished" (below 50% of the target). Past assessments (which used different methods and data) appear to have been overly optimistic about the stock's productivity, and too many fish were caught over a long period of time. Once rebuilt, the MSYproxy (i.e. the proxy for maximum sustainable yield) is estimated to be 41,334 MT (total catch, U.S. plus Canada).

The mackerel fishery is currently managed with an annual quota, in-season proactive accountability measures, and reactive accountability measures requiring paybacks of catches that exceed the Annual Catch Limit (ACL). The stock's Total Acceptable Biological Catch (ABC) in 2018 is 19,898 metric tons (MT), and after Canadian catch is deducted, the U.S. ABC is 11,009 MT. There is a 683 MT recreational allocation (6.2%) and a 10,327 MT commercial allocation (93.8%). There is a 10% management uncertainty buffer of 1,033 MT, resulting in a commercial annual catch target (ACT) of 9,294 MT. The management uncertainty buffer exists in case this high volume fishery overshoots its ACT before a closure. 1.26% is set aside for expected discards, leaving a commercial quota or Domestic Annual Harvest (DAH) of 9,177 MT (20,231,356 pounds). There are no recreational regulations other than angler registration through a state or federal registry/license.

When the fishery starts each year, the various commercial mackerel permit categories start with different trip limits. Tier 1 has an unlimited trip limit, Tier 2 has a 135,000 pound trip limit, and Tier 3 has a 100,000 pound trip limit. The open access incidental permit has a 20,000 pound trip limit. When the fishery reaches 95% of the DAH, all permits have 20,000 pound trip limits. When the fishery reaches 100% of the DAH, all permits have 5,000 pound trip limits.

The mackerel fishery also operates under a river herring and shad catch cap (RH/S), which closes the directed mackerel fishery and implements a 20,000 pound trip limit for all permits once 82 MT of RH/S has been projected to be caught in the directed mackerel fishery. In 2018, the RH/S cap closed the mackerel fishery effective February 27, 2018, at which point approximately 88%

of the mackerel DAH had been harvested. The RH/S cap is currently 82 mt, which is a 0.89% ratio of RH/S to the mackerel DAH (9,177 MT X 0.0089 = 82 MT). Other fish, primarily Atlantic herring (herring) are also retained on trips that catch mackerel. All kept fish on mackerel trips are counted against the cap. This means that the approximate ratio that the fishery must stay below to catch the full mackerel quota, considering past co-catch of mackerel and herring, is 0.64% of RH/S to all kept catch on mackerel trips (defined as trips that catch more than 20,000 pounds of mackerel).

The MSA on Ending Overfishing and Rebuilding

Section 304(e)(3) of the MSA states:

> "Within 2 years after…notification…the appropriate Council…shall prepare and implement a fishery management plan, plan amendment, or proposed regulations…to end overfishing immediately in the fishery and to rebuild affected stocks of fish…"

All options under consideration would end or prevent overfishing according the best available scientific information (i.e. the 2018 mackerel benchmark assessment) in 2019 and beyond. The projection methodology reviewed and accepted as part of the mackerel benchmark assessment indicates that overfishing should also not occur in 2018 if the U.S. and Canada catch less than 22,000 MT, which is expected. The Council was notified of mackerel's overfishing status on July 19, 2018, so such regulations would technically need to be completed by July 18, 2020, but they should be implemented in early 2019 if this action is approved.

Section 304(e)(4) of the MSA also states:

> "For a fishery that is overfished, any fishery management plan, amendment, or proposed regulations…shall…specify a time period for rebuilding the fishery that shall--
>
> (i) be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities,…and the interaction of the overfished stock of fish within the marine ecosystem; and
>
> (ii) not exceed 10 years, except in cases where the biology of the stock of fish, other environmental conditions…dictate otherwise;
>
> …allocate both overfishing restrictions and recovery benefits fairly and equitably among sectors of the fishery…"

All options currently under consideration are projected to rebuild mackerel in 7 or less years so (ii) is addressed. Recreational catches have been relatively low in this fishery, and are expected to remain relatively low relative to annual catch limits (ACLs). Pending revisions to historical recreational catch estimates will be integrated into the next assessment update.

That means that the primary considerations are that the stock should be rebuilt in a time period as short as possible, taking into account 1) the status and biology of any overfished stocks, 2) the needs of fishing communities, and 3) the interaction of mackerel within the marine ecosystem. Information on the status and biology of mackerel and interactions within the marine ecosystem (e.g. predation) is provided in Section 6.1. There is some interaction of the mackerel fishery with red hake, which is overfished, but those interactions are relatively small compared to other gear types (additional information is presented in the document below). River herring and shad (RH/S) interactions with the mackerel fishery are also a concern, and are addressed through the RH/S cap on the mackerel fishery.

The alternatives in this document seek to rebuild mackerel to SSBmsyproxy as defined in the recent mackerel assessment (196,894 MT). The Council's Ecosystem Approach to Fisheries Management (EAFM) Guidance Document states "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" and "the Council could adopt biological reference points (overfishing levels or OFL) for forage stocks that are more conservative than the required MSA standard of Fmsy." Acknowledging that the science to evaluate the biological and socioeconomic tradeoffs of more precautionary management is lacking, the Council adopted a policy that it would promote data collection and development of analyses to get to the point where the Council could evaluate the relevant tradeoffs and "establish an optimal forage fish harvest policy."

Views vary on the precaution inherent in using the recommended F40% as a proxy for FMSY (and for the resulting SSBmsyproxy target). Clark 1993, Mace 1994, Gabriel and Mace 1999, and Legault and Brooks 2013 generally recommended F40% for typical stocks. Clark 2002 notes that for typical stocks, fishing at F40% would be expected to result in a target biomass that is 20%-35% of an unfished biomass. Pikitch et al 2012 recommended more conservative approaches for forage species to support predators, and this has spawned ongoing debate (e.g. Hilborn et al 2017 to the contrary).

While the rebuilding target is based on F40%, the Council's risk policy produces catches less than fishing at this overfishing reference point. If the catch from the standard P* approach recommended by the SSC (i.e. 100% C.V. and typical life history) when the stock is at 100% of rebuilt is used for future catch (33,474 MT, 19% lower than MSY), the projection methods from the recent benchmark assessment indicate the mackerel spawning stock should increase to, and stabilize at approximately 150% of the target/rebuilt spawning biomass (MAFMC 2018). This would apply to all rebuilding alternatives. When biomass is above the 100% rebuilt level then P* will return higher ABCs and if those ABCs are caught the biomass will not increase quite as much, topping out around 122% of the target/rebuilt spawning biomass (pers com, Kiersten Curti, NMFS NEFSC, calculated using assessment's projection methodology).

The Council's current risk policy states that the Scientific and Statistical Committee (SSC) should provide Acceptable Biological Catches (ABCs) that are the lesser of rebuilding ABCs or standard risk policy (P*) ABCs. In some alternatives being considered by the Council, the rebuilding ABCs would be higher than the standard P* ABCs. In these cases, the alternatives (1c and 1d) also contain a temporary adjustment of the Council's risk policy to indicate that the Council does want to use the considered rebuilding ABCs. Alternative 1b uses the current, unmodified risk policy. The risk policy adjustment would only apply to this instance of initiating rebuilding for mackerel to consider the effects of rebuilding timelines and would not affect management decisions regarding future ABCs once the stock is rebuilt.

The alternatives also address other management measures needed to implement annual specifications, including the RH/S cap that restricts RH/S catch in the mackerel fishery.

The Council considered information on the status and biology of mackerel, the needs of fishing communities, and the interaction of mackerel in the ecosystem when selecting the preferred alternative, Alternative 1c. A motion was put forth to use a shorter (3-year) rebuilding timeframe, but the Council decided that a 5-year rebuilding timeframe better balanced the needs of fishing communities with the biological potential to rebuild mackerel faster including considering mackerel's role in the ecosystem. The Council received substantial public input that especially given the pending potential reductions in Atlantic herring quotas, having the opportunity to access the mackerel quotas available under a 5-year rebuilding timeline could be important for the stability of fishing communities. The recent benchmark assessment, which represents the best available scientific information, also determined that the presence of mackerel in fish stomachs collected during the NEFSC bottom trawl surveys was generally low from 1973-2016, with spiny dogfish being responsible for 67% of all mackerel as prey occurrences in the NEFSC Food Habits Database. Spiny dogfish still had mackerel only being found in 1% of sampled spiny dogfish. While additional potentially important predators of mackerel are not sampled in the NEFSC trawl surveys, including highly migratory species, marine mammals, and seabirds, the available information does not suggest that the ecosystem will be disrupted if mackerel are rebuilt in 5 years versus a shorter time period (another rebuilding option would rebuild the stock in 3 years). The rebuilding projections also estimate biomass to be 94% of rebuilt after three years under the 5-year rebuilding plan, versus 104% of rebuilt after three years under the 3-year plan, so in terms of overall mackerel abundance in the ecosystem, there is not a substantial difference between the 3-year and 5-year rebuilding timelines after 3 years; mackerel is projected to be largely rebuilt after three years even under the 5-year rebuilding timeline.

4.2 Process

The Council accepted comments at both Council meetings and selected the preferred alternatives in August 2018 to recommend to NOAA Fisheries for approval and implementation. The Council also received input from the MSB AP on April 13, 2018, and input from the combined MSB and RH/S APs on July 17, 2018. The combined MSB and RH/S Committees met on July 18 to provide recommendations to the Council. NOAA Fisheries will publish a proposed rule along with this Environmental Assessment for public comment. After considering public comments on the proposed rule, NOAA Fisheries will publish a final rule with implementation details, as long as the action is ultimately approved by NOAA Fisheries.

4.3 Purpose and Need

The purposes and needs addressed by this action are described in the table below.

Table 1. Purposes and Needs

Need	Corresponding Purpose
Prevent overfishing, given the recent benchmark mackerel assessment that concluded that the mackerel stock is overfished, with overfishing occurring (NEFSC 2018). Achieve optimum yield in the mackerel fishery.	Implement measures to specify levels of harvest and catch of Atlantic mackerel and non-target species consistent with the Magnuson-Stevens Act and the objectives of the FMP, including to end overfishing and set annual fishery specifications.
Achieve the Domestic Annual Harvest allocation in the mackerel fishery without exceeding it or closing the fishery early.	Implement in-season management measures, including management uncertainty buffers, triggers, and post-closure trip limits.
Minimize bycatch of river herring and shad in the mackerel fishery.	Implement catch caps for river herring and shad.

4.4 Regulatory Authority

The MSA states that Fishery Management Plans (FMPs) shall "contain the conservation and management measures… necessary and appropriate for the conservation and management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery." As discretionary provisions of Fishery Management Plans (FMPs), the MSA also allows restriction of fishing by gear/area/time/season. Seasonal management based on attainment of quotas has been previously incorporated into the MSB FMP and this action could modify the existing provisions regarding how the fishery closes due to attainment of the DAH or a portion of the DAH. The RH/S cap was previously implemented under the discretionary MSA provisions providing for conservation of non-target species.

The Council's risk policy was implemented previously via Amendment 13 (http://www.mafmc.org/msb/), which stated that the system would need to be "adaptive" and that "Flexibility is imperative and must allow for timely modifications given the dynamic nature of fisheries and the environment." Changing the desired probabilities of overfishing was contemplated as something that could be accomplished through even the annual specifications process. Major departures from the original risk policy were contemplated as needing to go through either an FMP framework adjustment or FMP amendment. An FMP Amendment would be required for measures not previously contemplated in the FMP. Since all of the measures in this action have been contemplated in the FMP before, a framework adjustment appears appropriate, and is consistent with the intent of the Omnibus Amendment that implemented the risk policy. Risk policy adjustment were explicitly provided for and anticipated by Amendment 13. See also implementing regulations at Title 50, Chapter VI, Part 648, Subpart B, §648.25(a)(1)(ii).

4.5 FMP History and Management Objectives

Management of the MSB fisheries began through the implementation of three separate FMPs (one each for mackerel, squid, and butterfish) in 1978. The plans were merged in 1983. Over time a wide variety of management issues have been addressed including stock rebuilding, habitat conservation, bycatch minimization, and limiting participation in the fisheries. The history of the plan and its amendments can be found at http://www.mafmc.org/fisheries/fmp/msb.

The management goals and objectives, as described in the current FMP are listed below.

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the U.S. commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among U.S. commercial, U.S. recreational, and foreign fishermen.

The MSA defines Optimum Yield (OY) generally as the amount of fish which A) "will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems"; B) "is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor;" and C) "in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery."

The Omnibus ACL/AM Amendment (Amendment 13 to the MSB FMP) defined OY specifically for mackerel as: "The long-term average amount of desired yield from a stock or fishery. OY cannot exceed MSY. For Atlantic Mackerel, OY is the quantity of catch that is less than or equal to the ABC in U.S. waters."

4.6 Management Unit and Geographic Scope

The management unit (fish stock definition) for the MSB FMP is all Atlantic mackerel (*Scomber scombrus*), longfin inshore squid (*Doryteuthis (Amerigo) pealeii*),[2] Northern shortfin squid (*Illex illecebrosus*), and Atlantic butterfish (*Peprilus triacanthus*) under U.S. jurisdiction in the Northwest Atlantic, with a core fishery management area from Maine to North Carolina.

[2] For longfin squid there was a scientific name change from *Loligo pealeii* to *Doryteuthis (Amerigo) pealeii*. To avoid confusion, this document will utilize the common name "longfin squid" wherever possible, but this squid is still often referred to as "*Loligo*" by interested parties.

5.0 WHAT ALTERNATIVES ARE CONSIDERED IN THIS DOCUMENT?

Notes: All of the mackerel stock projections in this document (e.g. Alternatives 1b, 1c, and 1d) utilize the 2018 mackerel benchmark assessment. The projection methods in the benchmark assessment were peer reviewed and accepted by the 64th Northeast Regional Stock Assessment Review Committee (SARC 64 - https://www.nefsc.noaa.gov/saw/reports.html). The Council's SSC also reviewed these specific projections in May 2018 and endorsed them as constituting the best available scientific information (http://www.mafmc.org/s/May-2018-SSC-Report.pdf). The benchmark assessment also indicates that all alternatives will avoid overfishing in all years. No components of these projections utilize anecdotal information or methods outside what was reviewed and accepted by SARC 64 and the Council's SSC. All specifications will be reviewed and potentially revised annually and we also expect that a 2020 mackerel stock assessment update will be available to provide relatively quick feedback on initial rebuilding results.

Combinations: At least one alternative must be selected from each Alternative Set. Full no action, maintaining the status quo, would be 1a, 2a, and 3a. In terms of mackerel specifications, 1a and 2a are no action and can be considered a natural and exclusive pair. If an action alternative is chosen from Alternative Set 1 (1b, 1c, or 1d), then one of those could be paired with any action alternative from Alternative Set 2 (2b, 2c, or 2d). For Alternative Set 3 one alternative from 3a, 3b, or 3c would need to be chosen. If 1a/2a are chosen, then only 3a would be an option (full no action). If action alternatives from Sets 2/3 are chosen, then 3a, 3b, and 3c are options. 3d could be combined with 3b or 3c if one of those two alternatives are chosen.

5.1 ALTERNATIVE SET 1: Rebuilding timelines, Risk policies, OFL, Total ABC, Canadian catch deduction, U.S. ABC, Recreational/Commercial allocation, ACT, and DAH.[3]

Alternative 1a. No action/Status Quo (current specifications roll over with no action)

With no action, no rebuilding plan would be implemented, no changes to the current risk policy would occur, and the current specifications would remain in place, as described in the table below. The fishery's operational details would stay as described in 4.1 1a's Total ABC, 19,898 MT, was 50% of the 1978-2014 median mackerel catch, which a data limited simulation exercise suggested came closest to meeting, while not exceeding, the acceptable probability of overfishing from the MAFMC risk policy. See https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=1e9802ffddb05d0243d9c657fade956c&rgn=div5&view=text&node=50:12.0.1.1.5&idno=50#se50.12.648_120 (§648.20 and §648.21) for additional details on the risk policy and ABC control rules).

[3] OFL = Overfishing level, ABC = Acceptable Biological Catch, ACT = Annual Catch Target, DAH = Domestic Annual Harvest, which is the commercial quota.

No specific rebuilding projections were run for the no-action alternative, but since 1a has the lowest ABCs it would be expected to rebuild it within 3 years since 1b, with higher catches would rebuild the stock within 3 years.

A total of 8,889 MT (45%) is set aside to cover Canadian catches (this was set before Canada increased its quota to 10,000 MT). It was based on a Canadian quota of 8,000 MT plus 889 MT for uncertainty. This leaves 11,009 MT for the U.S. ABC/ACL, split 6.2% recreational (683 MT) and 93.8% commercial (10,327 MT) per the FMP. 10% of the commercial allocation is set aside as a management uncertainty buffer (in case this high-volume fishery is not closed at the exact right time) for an annual catch target (ACT) of 9,294 MT. 1.26% of the ACT is set aside for discards based on previous assessment discard estimates, leaving 9,177 MT for landings or "domestic annual harvest (DAH)."

Table 2. Current Mackerel Specifications (1a)

Current (all numbers are in metric tons)	
Specification	Mackerel 2019 (MT)
Overfishing Limit (OFL)	Unknown
Total Acceptable Biological Catch (ABC) from SSC	19,898
Canadian Deduction (Quota and 10% Management Uncertainty)	8,889
U.S. ABC = Annual Catch Limit (ACL) (Canadian catch deducted)	11,009
Recreational Allocation (6.2% of ACL)	683
Recreational Annual Catch Target (10% less than allocation to account for management uncertainty)	614
Commercial Allocation (93.8% of ACL)	10,327
Commercial Annual Catch Target (10% less than allocation to account for management uncertainty)	9,294
Landings or "Domestic Annual Harvest" (1.26% less than Annual Catch Target to account for expected discards)	9,177

Alternative 1b. 3-Year Rebuilding based on P* with no risk policy change.

With Alternative 1b, the Council would begin a 3-year rebuilding program based on the Council's current "P*" risk policy, which coincidentally happens to be projected[4] to rebuild mackerel in 3 years (by June 2021). Table 3 on the next page summarizes the various specifications, which are determined by a series of decisions described next. Rebuilding projections indicate that this alternative would be expected to rebuild mackerel to slightly above the SSBmsyproxy as defined in the recent mackerel assessment (196,894 MT) within 3 years.

For a species with a quantitative assessment, the Council has charged its SSC with providing catch advice (the Total ABC) that has a certain probability of overfishing based on stock size, the species life history, and the SSC's judgement of the uncertainty involved in calculating the overfishing level (OFL). Applying this to mackerel, the SSC noted the recent and predicted stock sizes, determined mackerel has a typical life history, and increased the measures of uncertainty to a 100% coefficient of variation (C.V.) on the overfishing level (the SSC determined the C.V. coming directly out of the model does not account for some sources of uncertainty).

As part of the Council's risk policy, the Council has a sliding scale of acceptable probability of overfishing for a species with a typical life history where lower stock sizes trigger a lower probability of overfishing. For a typical rebuilt stock, the Council uses a 40% probability of overfishing. For mackerel, with its low but projected increasing stock size, the required probabilities of overfishing are 24% (F=0.14) for 2019, 29% (F=0.19) for 2020, and 34%[5] (F=0.18) for 2021. All projected Fs would be below the overfishing threshold.

To calculate the various specifications Canadian catch must be deducted. Of the two approaches considered for Canada (a 10,000 MT deduction or a 50% deduction), this approach is the most conservative by using whichever deducts the most in each year, in this case 10,000 MT from the ABC for 2019 and 50% from 2020 and 2021. This is not modifying the FMP's requirements to account for Canadian catch, only operationalizing the requirement for this particular set of specifications (i.e. it can be changed in future specifications). There has been discussion about undocumented Canadian catch, speculated previously to possibly be around 5,000 MT. The 2018 benchmark assessment considered this question and decided it was not appropriate to tack on some extra unknown catch to the time series. This is also consistent with previous recent evaluations by the SSC and MSB Monitoring Committee that it was not appropriate to add in and then deduct out an unknown amount of undocumented Canadian catch (MAFMC 2015a, MAFMC 2015b).

The Commercial/Recreational allocation must also be addressed to calculate the specifications. Currently the recreational fishery is allocated 6.2%. The total median recreational catch 2013-2017 has been 1,209 MT (range of 767 MT to 1,611 MT). However only 8%-26% of recreational catch comes from federal waters and can be impacted by federal regulations. There is also no

[4] All rebuilding projections in this document utilize the final assessment model that found mackerel to be overfished, and assume that the ABC is caught for future years, typical recruitment (i.e. similar to 1975-2016 median) occurs, and natural mortality remains constant (same as the assessment model).

[5] The previous year's stock size determines the acceptable percentage of overfishing, in this case 2020 stock size for the 2021 ABC. This is why the 2021 percentage is only 34% and not 40% even though under this alternative mackerel is predicted to rebuild in 2021 (it's not quite rebuilt in 2020).

long-term recreational total catch trend (see Figure 9). Closing federal waters could drive more recreational catch into state waters, with no impact on total catch. Given the current lack of control over this fishery, this alternative moves away from a percentage allocation to a deduction of 1,209 MT for total recreational catch to avoid substantial ACL overages under all specification options.

Currently there is a 10% management uncertainty buffer set aside to create a reduced Annual Catch Target (ACT) in case this high-volume fishery cannot be closed at the exact right time. Mackerel is a high volume fishery, which makes precise closures difficult. However, because the Council is recommending moving to a system of phased trip limits (see Alternative Set 2) that incorporate their own buffering system, a 3% management uncertainty is proposed for this alternative. The phased trip limits should slow the fishery so a 10% buffer will not be needed. Finally, the last step in calculating the commercial quota is accounting for discards. 2012-2016 discards accounted for 0.37% of catch in the recent benchmark, and is set aside similarly under all specification options.

Table 3. Specifications for a 3-year/P* rebuilding (1b)

Proposed Option 1b All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Overfishing Limit (OFL) (only available for 2019)	31,764	na	na
Total Acceptable Biological Catch (ABC) from SSC	19,025	26,183	33,001
Canadian Deduction (10,000 MT in 2019 and 50% in 2020-2021)	10,000	13,092	16,501
U.S. ABC = ACL (Canadian catch deducted)	9,025	13,092	16,501
Recreational Allocation	1,209	1,209	1,209
Commercial Allocation (rest of ACL)	7,816	11,883	15,292
Management Uncertainty Buffer = 3%	234	356	459
Commercial ACT (97% of ACL)	7,582	11,526	14,833
DAH (0.37% discards)	7,553	11,483	14,778

THIS SPACE INTENTIONALLY LEFT BLANK

Alternative 1c. 5-Year Rebuilding based on rebuilding projections with a 33,474 MT maximum ABC and risk policy adjustment. **(PREFERRED)**

With 1c, the Council would begin a 5-year[6] rebuilding program based on the catches that are projected to rebuild the mackerel stock within 5 years, by June 2023. The first three years' specifications would be set as described below. Because these catches are higher than the P* catches described in 1b, the Council would also adjust its risk policy for this rebuilding plan only. The Council's current risk policy states that the SSC should provide Acceptable Biological Catches (ABCs) that are the lesser of rebuilding ABCs or standard risk policy (P*) ABCs (1b follows the current P* approach). The P* catches in 1b are lower than 1c. In absence of a risk policy adjustment, ABCs prescribed under 1b would override those in 1c. So for this alternative, the Council would adjust its risk policy to indicate that in this, and only this, specific case of mackerel rebuilding initiation, the risk policy of the Council is adjusted to use this 5-year rebuilding timeline (thus limiting this adjustment both temporally and by species). This is the only way that the Council can consider a rebuilding plan longer than three years and allow the higher associated catches. As discussed in Section 4.4, flexibility to adjust the risk policy through specifications or a framework was explicitly anticipated and provided for in the Omnibus ACL/AM Amendment and implementing regulations.

The SSC has provided total ABCs to match this risk policy modification for 2019-2021 and certified them as the best available scientific information. Allowing a longer rebuilding timeline allows increased ABCs, and those increases affect many of the other specifications. Approaches for the Commercial/Recreational allocation, the management uncertainty buffer/ACT, and discards are identical to Alternative 1b and are not repeated here, but the resulting specifications are detailed in Table 4 below. For Canadian catch, the Council recommended deducting the current Canadian quota, 10,000 MT as endorsed by the Amendment's technical Fishery Management Action Team (FMAT). The specifications are reviewed each year by the SSC, Monitoring Committee, and Council, and the Council can modify future years' specifications and in particular, assumptions for Canadian catch, as appropriate.

The SSC recommended an ABC of 35,195 MT for 2021. However, the FMAT noted that some SSC rebuilding ABCs like this one are higher/riskier than the ABCs that would result from applying the Council's standard risk policy to a fully rebuilt stock. The standard risk policy ABC for a 100% rebuilt mackerel stock, assuming a 100% C.V. and typical life history, is 33,474 metric tons (MT), or 81% of the Maximum Sustainable Yield for a rebuilt stock (MSY=41,334 MT). Accordingly, the FMAT recommended and the Council adopted that no ABCs for 2019-2021 be initially set higher than 33,474 MT for the preferred alternative. Otherwise rebuilt ABCs might be lower than rebuilding ABCs. The table below uses 33,474 MT for 2021's ABC and the SSC-recommended ABCs for 2019 and 2020.

The base rebuilding fishing mortality rate for this alternative is 0.237 (which is below the overfishing threshold and projected to rebuild the stock within 5 years). There should be a

[6] It is anticipated that this plan will be implemented around March 15, 2019. The SSB rebuilding projections technically are for June biomass, so a "by June of 2023" rebuilding program is technically a 4 year and 3 month rebuilding timeline. Since it extends beyond 4 years it's being called a 5-year rebuilding program for sake of simplicity.

slightly greater than 50% chance that the stock would be rebuilt in 5 years because the 33,474 MT cap is lower than the 2021 35,195 MT catch actually used in the rebuilding projections.

Table 4. Specifications for a 5-year rebuilding (1c)

Proposed Option 1c All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Overfishing Limit (OFL) (only available for 2019)	31,764	na	na
Total Acceptable Biological Catch (ABC) from	29,184	32,480	33,474
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
U.S. ABC = ACL (Canadian catch deducted)	19,184	22,480	23,474
Recreational Allocation	1,209	1,209	1,209
Commercial Allocation (rest of ACL)	17,975	21,271	22,265
Management Uncertainty Buffer = 3%	539	638	668
Commercial ACT (97% of ACL)	17,436	20,633	21,597
DAH (0.37% discards)	17,371	20,557	21,517

THIS SPACE INTENTIONALLY LEFT BLANK

Alternative 1d. 7-Year Rebuilding based on rebuilding projections with risk policy adjustment.

With 1d, the Council would begin a 7-year[7] rebuilding program based on the catches that are projected to rebuild the mackerel stock within 7 years. The first three years' specifications would be set as described below. Because these catches are higher than the P* catches described in 1b, the Council would also adjust its risk policy for this rebuilding plan only. The Council's current risk policy states that the SSC should provide Acceptable Biological Catches (ABCs) that are the lesser of rebuilding ABCs or standard risk policy (P*) ABCs (1b follows the current P* approach). The P* catches in 1b are lower than 1d. In absence of a risk policy adjustment, ABCs prescribed under 1b would override those in 1d. So for this alternative, the Council would adjust its risk policy to indicate that in this, and only this, specific case of mackerel rebuilding initiation, the risk policy of the Council is adjusted to use this 7-year rebuilding timeline (thus limiting this adjustment both temporally and by species). This is the only way that the Council can consider a rebuilding plan longer than three years and allow the higher associated catches. As discussed in Section 4.4, flexibility to adjust the risk policy through specifications or a framework was explicitly anticipated and provided for in the Omnibus ACL/AM Amendment and implementing regulations.

The SSC has provided Total ABCs to match this risk policy modification for 2019-2021 and certified them as the best available scientific information. Allowing a longer rebuilding timeline allows increased ABCs, and those increases affect many of the other specifications. Approaches for the Commercial/Recreational allocation, the management uncertainty buffer/ACT, and discards are identical to Alternative 1b and are not repeated here, but the resulting specifications are detailed in the table below. For Canadian catch, this alternative would deduct the current Canadian quota, 10,000 MT, similar to Alternative 1c.

The base rebuilding fishing mortality rate for this alternative is 0.252 (which is below the overfishing threshold and projected to rebuild the stock within 7 years).

Table 5. Specifications for a 7-year rebuilding (1d)

Proposed Option 1d All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Overfishing Limit (OFL) (only available for 2019)	31,764	na	na
Total Acceptable Biological Catch (ABC) from SSC	30,868	34,016	36,551
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
U.S. ABC = ACL (Canadian catch deducted)	20,868	24,016	26,551
Recreational Allocation	1,209	1,209	1,209
Commercial Allocation (rest of ACL)	19,659	22,807	25,342
Management Uncertainty Buffer = 3%	590	684	760
Commercial ACT (97% of ACL)	19,069	22,123	24,582
DAH (0.37% discards)	18,999	22,041	24,491

[7] It is anticipated that this plan will be implemented around March 15, 2019. The SSB rebuilding projections technically are for June biomass, so a "by June of 2025" rebuilding program is technically a 6 year and 3 month rebuilding timeline. Since it extends beyond 6 years it's being called a 7-year rebuilding program for sake of simplicity.

5.2 ALTERNATIVE SET 2: In Season Management

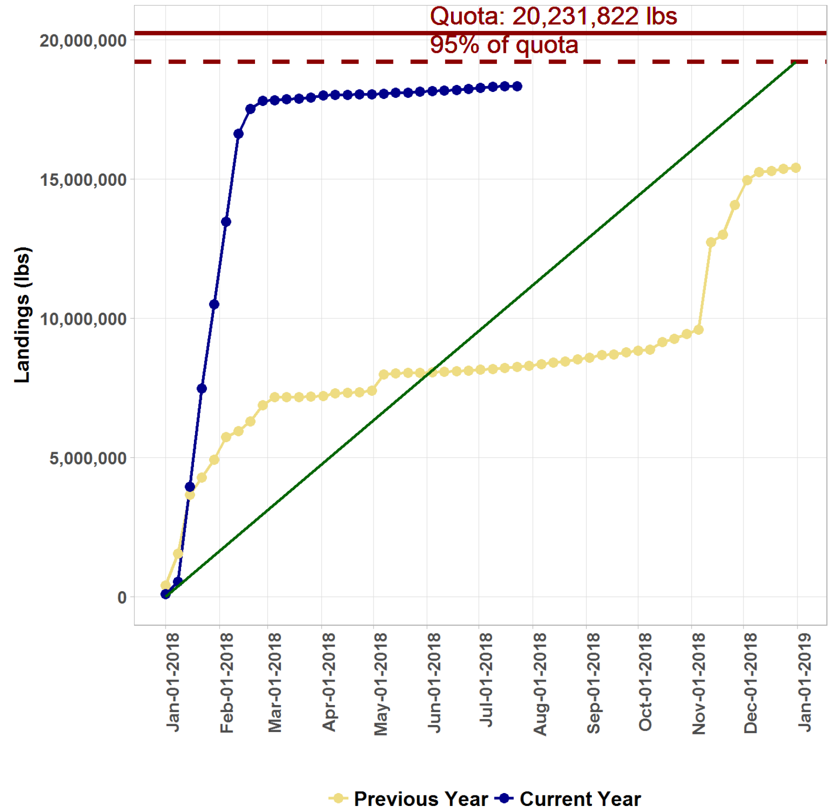
Introduction

There is limited information available to predict how the mackerel fishery will operate under any buffer/trigger/closure/trip limit combination. NMFS has never had to close this high-volume fishery due to mackerel landings, so it is unknown how effective NMFS will be at closing the fishery at any exact threshold. NMFS does have experience closing similar high volume fisheries (longfin squid, *Illex* squid, and Atlantic herring), and a number of reporting and monitoring provisions are in place to facilitate effective closures. There is also naturally high variation in the production of the mackerel fishery, especially given its mixed-fishery nature with Atlantic herring. Accordingly, either leaving a higher than expected amount of quota uncaught or exceeding an ACL is a possibility under all scenarios. Larger buffers and lower percentage catch triggers will be more likely to avoid ACL overages (which must be paid back) but also more likely to leave quota uncaught. Smaller buffers and higher percentage catch triggers will be more likely to catch the quota but also more likely to lead to ACL overages.

Staff has been able to examine mackerel landings under a 20,000 pound trip limit after the 2018 closure due to the RH/S cap. This is the first closure of the modern mackerel fishery. Landings under this trip limit after March 1, 2018 through July 25, 2018 averaged under 13 MT per week (Figure 1), or about 600 MT for a 10-month closure. Handgear auto-jig fishermen have been landing approximately 700-900 MT in the last three years, mostly in summer and later in the year so total post closure landings at a 20,000 pound trip limit for a 10-month closure might be expected to total roughly around 1,400 MT.

THIS SPACE INTENTIONALLY LEFT BLANK

Figure 1. 2018 Mackerel Landings (blue) for data reported through July 25, 2018 (91% of DAH)



The straight diagonal green line indicates the pace of landings from the beginning of the year that would avoid a closure

<u>Alternative 2a. No action/Status Quo (current closure measures roll over with no action)</u>

Incidental permits have a 20,000 pound trip limit regardless of fishery closure status. Limited access permits consist of 3 categories, Tier 1 with no initial trip limits, Tier 2 with a 135,000-pound initial trip limit, and Tier 3 with a 100,000-pound initial trip limit. To restrict Tier 3 participants to their historical participation levels, their trip limit falls to 20,000 pounds once they approach 7% of the DAH – this is a limit for them and not a set-aside. Additional details can be found at https://www.greateratlantic.fisheries.noaa.gov/sustainable/species/msb/index.html#el111022. When the fishery reaches 95% of the DAH, all permits have 20,000 pound trip limits. When the fishery reaches 100% of the DAH, all permits have 5,000 pound trip limits.

The RH/S cap can also close the directed fishery and implement a 20,000 pound trip limit for Tier 1-3 permits (see Alternative Set 3 for RH/S cap). Between the current (2018) 10% management uncertainty buffer (1,033 MT) and the 95% closure trigger (leaving 459 MT for after the closure), there is an effective reserve of 1,492 MT in place for the period after closure of the directed fishery.

In 2018 the gap between the 1st closure at 95% and the 2nd closure at 100% is 459 MT, which translates into about 51 trips at the existing 20,000 pound trip limit in this alternative. A run of

20,000 pound trips is not expected, but this information is provided to consider potential monitoring challenges and evaluation of impacts.

Alternative 2b. 80% of DAH Initial Trigger for directed fishery closure

When 80% of the DAH is projected to be landed, trip limits of 40,000 pounds would be implemented for Tier 1-3 directed permits and 5,000 pounds for incidental/open access permits. When 98% of the DAH is projected to be landed, a 5,000 pound trip limit would be implemented for all permits for the rest of the fishing year to cover remaining incidental catches. The initial Tier 2 and Tier 3 trip limits would remain the same, as would the Tier 3 7% limit. Recall from above (Alternative 1b) there is also an additional 3% management uncertainty buffer that can accommodate any catches beyond 100% of the DAH. The RH/S cap could also still close the directed fishery and implement a 20,000 pound trip limit for Tier 1-3 permits. Once the RH/S cap has been triggered, additional changes to trip limits are only reductions; for example, the trip limit would not increase to 40,000 pounds at 80% of the DAH if the RH/S cap has already been triggered. All possible combinations of triggers and DAHs are in Appendix 1. The triggers applicable for the committee-recommended rebuilding option DAHs (1c) combined with Alternative 2b are in a table below.

Table 6. Example of 2b closures combined with 1c rebuilding

Proposed Option 1c + 2b In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from	29,184	32,480	33,474
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
1st Close at 80% of DAH	13,897	16,445	17,214
Quota between 1st and 2nd close	3,127	3,700	3,873
2nd Close at 98% of DAH	17,024	20,145	21,087
Quota after 2nd close	347	411	430
Extra Management Uncertainty Buffer	539	638	668

To facilitate adaptive management, if in November and December of each year NMFS determines that keeping the mackerel fishery open longer than the set percentage triggers (in any phase of the fishery) is unlikely to cause a DAH overage, then NMFS shall have the discretion, based on a projection to not close (or not further close) the fishery so that optimum yield can be harvested. Predicting catch can be difficult, but this provision allows for some flexibility and further development of optimizing the closure process. NMFS might end up going slightly over the DAH in an effort to optimize catch, but that is the purpose of the ACT management uncertainty buffer.

For 2019, between the 3% management uncertainty buffer proposed in Alternative 1c (539 MT), and the 80% closure trigger (leaving 3,474 MT total for after the closure) under this Alternative 2b, there is an effective reserve of 4,013 MT in place for the period after closure of the directed fishery. Since the DAHs go up somewhat in 2020 and 2021, the effective reserve also increases somewhat in those years.

In 2019 the gap between the 1st closure at 80% and the 2nd closure at 98% is 3,127 MT, which translates into about 172 trips at the proposed 40,000 pound trip limit in this alternative. A run of 40,000 pound trips is not expected, but this information is provided to consider potential monitoring challenges. With the somewhat increasing DAHs in 2020 and 2021, the buffers get somewhat bigger and the landings from slightly more trips could be absorbed.

Alternative 2c. 85% of DAH Initial Trigger for directed fishery closure

When 85% of the DAH is projected to be landed, trip limits of 20,000 pounds would be implemented for Tier 1-3 directed permits and 5,000 pounds for incidental/open access permits. When 98% of the DAH is projected to be landed, a 5,000 pound trip limit would be implemented for all permits for the rest of the fishing year to cover remaining incidental catches. Recall from above (Alternative 1b) there is also an additional 3% management uncertainty buffer that can accommodate any catches beyond 100% of the DAH. The initial Tier 2 and Tier 3 trip limits would remain the same, as would the Tier 3 7% limit. The RH/S cap could also still close the directed fishery and implement a 20,000 pound trip limit for Tier 1-3 permits. Once the RH/S cap has been triggered, additional changes to trip limits would only be further reductions from 20,000 pounds. All possible combinations of triggers and DAHs are in Appendix 1. The triggers applicable for the committee-recommended rebuilding option DAHs (1c) combined with Alternative 2c are in a table below.

Table 7. Example of 2c closures combined with 1c rebuilding

Proposed Option 1c + 2c In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	29,184	32,480	33,474
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
1st Close at 85% of DAH	14,766	17,473	18,290
Quota between 1st and 2nd close	2,258	2,672	2,797
2nd Close at 98% of DAH	17,024	20,145	21,087
Quota after 2nd close	347	411	430
Extra Management Uncertainty Buffer	539	638	668

To facilitate adaptive management, if in November and December of each year NMFS determines that keeping the mackerel fishery open longer than the set percentage triggers (in any phase of the fishery) is unlikely to cause a DAH overage, then NMFS shall have the discretion, based on a projection to not close (or not further close) the fishery so that optimum yield can be harvested. Predicting catch can be difficult, but this provision allows for some flexibility and further development of optimizing the closure process. NMFS might end up going slightly over the DAH in an effort to optimize catch, but that is the purpose of the ACT management uncertainty buffer.

For 2019, between the 3% management uncertainty buffer proposed in Alternative 1c (539 MT), and the 85% closure trigger (leaving 2,605 MT total for after the closure) under this Alternative 2c, there is an effective reserve of 3,144 MT in place for the period after closure of the directed fishery. Since the DAHs go up somewhat in 2020 and 2021, the effective reserve also increases somewhat in those years.

In 2019 the gap between the 1st closure at 85% and the 2nd closure at 98% is 2,258 MT, which translates into about 249 trips at the proposed 20,000 pound trip limit in this alternative. A run of 20,000 pound trips is not expected, but this information is provided to consider potential monitoring challenges and evaluation of impacts. With the somewhat increasing DAHs in 2020 and 2021, the buffers get somewhat bigger and the landings from slightly more trips could be absorbed.

<u>Alternative 2d. 90% of DAH Initial Trigger for directed fishery closure **(PREFERRED)**</u>

When 90% of the DAH is projected to be landed, trip limits of 40,000 pounds would be implemented for Tier 1-3 directed permits and 5,000 pounds for incidental/open access permits. When 98% of the DAH is projected to be landed, a 5,000 pound trip limit would be implemented for all permits for the rest of the fishing year to cover remaining incidental catches. The initial Tier 2 and Tier 3 trip limits would remain the same, as would the Tier 3 7% limit. Recall from above (Alternative 1b) there is also an additional 3% management uncertainty buffer than can accommodate any catches beyond 100% of the DAH. The RH/S cap could also still close the directed fishery and implement a 20,000 pound trip limit for Tier 1-3 permits. Once the RH/S cap has been triggered, additional changes to trip limits are only reductions, for example the trip limit would not increase to 40,000 pounds at 90% of the DAH if the RH/S cap has already been triggered. All possible combinations of triggers and DAHs are in Appendix 1. The Triggers applicable for the committee-recommended rebuilding option DAHs (1c) combined with Alternative 2d are in a table below. Comparing the tables for Alternatives 2b and 2d shows the key difference is in how quickly the fishery moves to the initial lower trip limit, which affects the amount of quota available for fishing under the initial lower trip limit.

Table 8. Example of 2d closures combined with 1c rebuilding

Proposed Option 1c + 2e In-Season Measures			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	29,184	32,480	33,474
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
1st Close at 90% of DAH	15,634	18,501	19,365
Quota between 1st and 2nd close	1,390	1,645	1,721
2nd Close at 98% of DAH	17,024	20,145	21,087
Quota after 2nd close	347	411	430
Extra Management Uncertainty Buffer	539	638	668

To facilitate adaptive management, if in November and December of each year NMFS determines that keeping the mackerel fishery open longer than the set percentage triggers (in any phase of the fishery) is unlikely to cause a DAH overage, then NMFS shall have the discretion, based on a projection to not close (or not further close) the fishery so that optimum yield can be harvested. Predicting catch can be difficult, but this provision allows for some flexibility and further development of optimizing the closure process. NMFS might end up going slightly over the DAH in an effort to optimize catch, but that is the purpose of the ACT management uncertainty buffer.

For 2019, between the 3% management uncertainty buffer proposed in Alternative 1c (539 MT), and the 90% closure trigger (leaving 1,737 MT total for after the closure) under this Alternative 2c, there is an effective reserve of 2,276 MT in place for the period after closure of the directed fishery. Since the DAHs go up somewhat in 2020 and 2021, the effective reserve also increases somewhat in those years.

In 2019 the gap between the 1st closure at 90% and the 2nd closure at 98% is 1,390 MT, which translates into about 77 trips at the proposed 40,000 pound trip limit in this alternative. A run of 40,000 pound trips is not expected, but this information is provided to consider potential monitoring challenges and evaluation of impacts. With the somewhat increasing DAHs in 2020 and 2021, the buffers get somewhat bigger and the landings from slightly more trips could be absorbed.

Closing the directed fishery at 90% (sooner than the current 95%) should avoid substantial overruns by the directed fishery, which seems important in the context of rebuilding. The 40,000 pound post-closure trip limit is also likely to cover a few more incidental mackerel catches (but not all) in the Atlantic herring fishery based on recent landings data. Industry reports, which is really all we can use to predict behavior under a 40,000 pound trip limit, indicate that the directed fishery will mostly not operate with even a 40,000 pound trip limit but some smaller vessels may, especially late in the year. The universal 5,000 pound backstop trip limit at 98% of the DAH also further minimizes the chance of a DAH overage while allowing some incidental catch. The lowering of the open access/incidental trip limit to 5,000 pounds at the 90% threshold will also limit the rate of landings after the directed closure. And there is still a 3% overall management uncertainty buffer as a final reserve (and any ACL overages would have to be repaid).

The table below summarizes the closure options. Given the lack of data/experience with how the fishery will close during directed fishing and the limited data/experience after a closure in 2018, under any alternative the fishery will need to be closely monitored to determine the appropriateness of any closure system. The tradeoffs involved are two-fold. First, there's the issue of precaution about going over the DAH and possibly the ACL, and second there's the issue of maximizing catch for the early-season directed fishery versus preserving some quota for incidental or late-season directed fishing.

Table 9. Closure Options Summary

	2a (no action) with 2018 DAH of 9,177	2b with DAH of 17,371 (Alt 1c 2019)	2c with DAH of 17,371 (Alt 1c 2019)	2d with DAH of 17,371 (Alt 1c 2019)
1st closure directed	95% trigger, 20,000 pound trip limit	80% trigger, 40,000 pound trip limit	85% trigger, 20,000 pound trip limit	90% trigger, 40,000 pound trip limit
1st closure incidental	na, always 20,000 pound trip limit	5,000 pound trip limit	5,000 pound trip limit	5,000 pound trip limit
2nd closure directed	100%, 5000 pound trip limit	98% trigger, 5000 pound trip limit	98% trigger, 5000 pound trip limit	98% trigger, 5000 pound trip limit
2nd closure incidental	100%, 5000 pound trip limit	no change, 5,000 pound trip limit	no change, 5,000 pound trip limit	no change, 5,000 pound trip limit
Overall difference/reserve between commerical allocation and directed fishery closure	1,492 MT	4,013 MT	3,144 MT	2,276 MT
Trips supported at the trip limit proposed for each alterntaive between 1st and 2nd closure	51	172	249	77

5.3 ALTERNATIVE SET 3: River Herring and Shad (RH/S) Cap

Introduction

Before alternatives are considered, a history of the RH/S cap is presented. The caps are monitored based on observer data and landings data, and were set by examining historical catch estimates based on observer and landings data. Since the caps are not based on the biology of RH/S, if RH/S abundance increases it will be harder for the fishery to operate within the cap, and if RH/S abundance decreases it will be easier for the fishery to operate within the cap.

2014 was the first year of the cap. The cap was set at **236 MT** and the mackerel DAH was 33,821 MT. 236 MT was the median of the values generated when the annual RH/S catch to all retained catch ratios on mackerel trips 2005-2012 (from observer data) were applied to the quota (33,821 MT). The critical ratio of cap to mackerel was 0.70% and the ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) was 0.50%. This approach and the 236 MT cap was preferred because it created "a strong incentive for the fleet to avoid RH/S, allows for the possibility of the full mackerel quota to be caught if the fleet can avoid RH/S, and would likely reduce RH/S catches over time compared to what would occur without a cap" (MAMFC 2013a). The initial implementation of the cap rests on the assumption that a reduction of RH/S catch in the mackerel fishery, due either avoidance or a closure, might have a "potentially positive impact" on RH/S stocks, noting that the "connection between catch in the mackerel fishery (or other ocean fisheries) and RH/S populations is unknown (MAMFC 2013b)." Above those ratios the fishery would have had an early shut down. The estimated cap catch was 6 MT.

In 2015 there was a slight adjustment to identifying cap trips made, but the same basic procedure was used to generate a cap of **155 MT** for a mackerel DAH of 20,872 MT. The Council included a provision that the cap starts out lower, at **89 MT** (the median of actual RH/S catches by the mackerel fishery 2005-2012) until 10,000 MT of mackerel landings, so that there was still a strong incentive to avoid RH/S catches even at the low levels of mackerel catch then occurring. Until landings got above 10,000 MT the critical ratio of cap to mackerel was 0.89% and the ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) was 0.64%. To catch the full mackerel quota the critical ratio of cap to mackerel was 0.74% and the ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) was 0.53%. The estimated cap catch was 13 MT. If the 89 MT RH/S cap had been reached before 10,000 MT of mackerel had been landed, the fishery would be closed for the rest of the year, and based on past performance this would be expected to occur slightly less than 50% of years.

For 2016-2018 the mackerel DAH dipped below 10,000 MT to 9,177 MT. The Council applied the 0.89% ratio to that quota to get a cap of **82 MT**. The ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) would be 0.64%. The estimated cap catch was 13 MT in 2016 and 39 MT in 2017. In 2018, the directed fishery caught 109 MT of RH/S when it was shut down and 8,072 MT of mackerel, for a ratio of 1.35% cap to mackerel or about 0.90% cap to all catch. In 2018 the cap operated as designed – the fishery was closed early due to the relatively high RH/S ratio. The overage was not large relative to the pace of mackerel landings and the precision of RH/S estimates.

The tolerated ratio for 2016-2018 is higher than previous years, but because the mackerel quota is lower, the total RH/S that could be caught is lower in 2016-2018 (82 MT) than previous years.

The following discussion in this paragraph is consistent with the current cap, but NMFS quota-monitoring staff noted it was worth highlighting: The RH/S cap is estimated by extrapolating RH/S catch rates to **everything** kept on mackerel trips. If the proportion of herring:mackerel catch increases relative the RHS cap reference years (2005-2012), the cap could potentially be exceeded sooner than anticipated (ex. higher amounts of herring on mackerel trips increases the total kept, thereby increasing RH/S the extrapolation). This effect is due to anchoring the catch cap to mackerel DAH that uses a static RHS:mackerel rate. Alternatively, the inverse could be observed if the herring:mackerel catch ratio decreased. Since the mix of herring and mackerel was taken into account when setting the cap this effect is anticipated; operational issues would only arise if there was a substantial change in the proportions relative to historical performance.

Also, discussions between Council and NMFS quota-monitoring staff highlighted a concern that under low caps, monitoring is increasingly difficult due to data availability and the seasonality of the fishery. For example when the fishery closed in 2018 only four observed trips had occurred (though observer coverage also depends on the overall allocation of coverage).

Given the RH/S encounter rate during all but one of the five 2014-2018 cap years (2018) has been well below the median rate during the base years (2005-2012), it appears the cap has had the desired effect of encouraging avoidance behavior, though changing RH/S abundances can also drive the encounter rate. Setting the RH/S Cap really depends on how much pressure the Council wants to put on the mackerel fishery and how the Council evaluates the potential impacts. The alternatives considered by the Council are detailed below.

Alternative 3a. No action/Status Quo (current measures roll over with no action)

With no action, the current cap of 82 MT would roll over for whichever mackerel quotas are implemented. If the cap is fixed, then the critical ratio before a shutdown is likely to occur fluctuates with the mackerel DAH. The mackerel DAHs under the preferred alternative for 2019-2021 are 17,371 MT, 20,557 MT, and 21,517 MT. With an 82 MT fixed cap, the critical ratios of RH/S cap to the mackerel quota, with the approximate effective ratio of RH/S to all catch to account for mixed Atlantic herring catches in parentheses, would be 2019: 0.47% (0.34%), 2020: 0.40% (0.29%), and 2021: 0.38% (0.27%), substantially lower than the current ratio of 0.89% (0.64%). The directed fishery would close once 95% of the cap has been projected to be caught (incidental permits would stay at 20,000 pounds unless the mackerel fishery still reaches the mackerel closure thresholds as described in Alternative Set 2 that require lower trip limits).

Alternative 3b. Scale RH/S based on the 2015 ratio of 0.74% of mackerel DAH **(PREFERRED and combined with 3d)**

Under 3b the RH/S cap would scale with the mackerel DAH based on the 0.74% ratio used in 2015. The ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) would be about 0.53% (depends on how much Atl. Herring is caught – the more Atl. Herring that is landed on "mackerel trips" [above 20,000 pounds mackerel], the lower the ratio must be in any given year). All possible combinations of caps and DAHs are provided in Appendix 2. The caps for the preferred rebuilding option (1c) have been added in a table below, but can be calculated by multiplying any DAH by 0.0074. These are somewhat lower than the currently-tolerated ratio. The directed fishery would close once 95% of the cap has been projected to be caught (incidental permits would stay at 20,000 pounds unless the mackerel fishery still reaches the mackerel closure thresholds as described in Alternative Set 2 that require lower trip limits).

Table 10. Example Scaled RH/S Cap 0.74% ratio and 1c

Proposed Option 1c + 3b RH/S Cap Option All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
	Canada2	Canada2	Canada2
Total Acceptable Biological Catch (ABC) from	29,184	32,480	33,474
Canadian Deduction (1/2 of ABC or ABC-10,000)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
RH/S Cap	129	152	159

<u>Alternative 3c. Scale RH/S based on current ratio of 0.89% of mackerel DAH</u>

Under this alternative the RH/S cap would scale with the mackerel DAH based on the current 0.89% ratio. The ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) would be about 0.64% (depends on how much Atl. Herring is caught – the more Atl. Herring that is landed on "mackerel trips" [above 20,000 pounds mackerel], the lower the ratio must be in any given year). All possible combinations of caps and DAHs are provided in Appendix 2. The caps for the preferred rebuilding option (1c) have been added in a table below, but can be calculated by multiplying any DAH by 0.0089. The directed fishery would close once 95% of the cap has been projected to be caught (incidental permits would stay at 20,000 pounds unless the mackerel fishery still reaches the mackerel closure thresholds as described in Alternative Set 2 that require lower trip limits).

Table 11. Example Scaled RH/S Cap 0.89% ratio and 1c

Proposed Option 1c + 3c RH/S Cap Option All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
	Canada2	Canada2	Canada2
Total Acceptable Biological Catch (ABC) from	29,184	32,480	33,474
Canadian Deduction (1/2 of ABC or ABC-10,000)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
RH/S Cap	155	183	192

Alternative 3d (can be combined with 3b or 3c). Add a low-catch trigger to 3b or 3c as was done in 2015 **(PREFERRED and combined with 3b)**

Under this alternative, when mackerel quotas are above 10,000 MT and the associated RH/S cap is above 89 MT, the cap starts out lower, at 89 MT (the median of actual RH/S catches by the mackerel fishery 2005-2012) until 10,000 MT of mackerel landings so that there is still a strong incentive to avoid RH/S catches even at the low levels of mackerel catch. Once 10,000 MT of mackerel is landed, then the full cap becomes available. If the quota is at or above 10,000 MT, the cap will be at least 89 MT. Under this alternative the fishery would have to stay below a 0.89% cap to mackerel landings ratio (about 0.64% cap to all catch ratio) or the fishery will be shutdown before landing 10,000 MT (how much depends on how high the ratio is) and the fishery would then be closed for the rest of the year, except for incidental-level landings (20,000 pounds or less). The directed fishery would close once 95% of the cap has been projected to be caught (incidental permits would stay at 20,000 pounds unless the mackerel fishery still reaches the mackerel closure thresholds as described in Alternative Set 2 that require lower trip limits).

5.4 Considered But Rejected Alternatives

1. 10-year Rebuilding Plan. The MSA typically allows up to a 10-year rebuilding timeline. In this case, a 10-year plan only provides slightly more ABC (2% more in 2019) than the 7-year timeline, so it would be hard to justify that 7 years wouldn't be as short as possible after accounting for other considerations such as socioeconomic impacts, especially given the upward trend in possible catches. Accordingly, only timeframes up to 7 years were considered.

2. Closing the directed fishery at 95% of the DAH, at which point trip limits of 20,000 pounds would be implemented for Tier 1-3 directed permits and 5,000 pounds for incidental/open access permits. When 100% of the DAH is projected to be landed, a 5,000 pound trip limit would be implemented for all permits for the rest of the fishing year to cover remaining incidental catches, and the 3% management uncertainty buffer would cover any DAH overages. With only a 3% management uncertainty buffer, closing at 95% of the DAH would likely have a high risk of overages given the high volume nature of the mackerel fishery.

6.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT AND FISHERIES

This section identifies and describes the *valued ecosystem components* (VECs) (Beanlands and Duinker 1984) that comprise the affected environment and may be affected by the alternatives proposed in this document. The valued ecosystem components are identified and described here as a means of establishing the context for the impact analysis that will be presented in Section 7's "Analysis of Impacts." The significance of the various impacts of the proposed alternatives on the valued ecosystem components are also assessed from a cumulative effects perspective at the end of Section 7. The valued ecosystem components are:

1. Managed resources (Atlantic mackerel, longfin squid and *Illex* squid, and butterfish) and non-target species.
2. Habitat including EFH for the managed resources and non-target species
3. Endangered and other protected resources
4. Human communities

The affected environment consists of those physical, biological, and human components of the environment that are or will be meaningfully connected to mackerel fishing operations, and are described below. Overviews of the managed species in the FMP and of the physical environment are described first, to establish the context for the valued ecosystem components. While butterfish, longfin squid, and *Illex* squid should be negligibly affected by this action, summaries are provided since they are in the FMP. A summary for Atlantic herring is also included given the overlap with the mackerel and Atlantic herring fisheries. Impacts of the alternatives on the physical environment are addressed through analysis of impacts on habitat, as most of the impacted physical environment comprises EFH for various species.

6.1 Description of the Managed Resources and Non-target Fish Species

Mackerel

Unless otherwise indicated, the information in this section is taken from the mackerel EFH source document at http://www.nefsc.noaa.gov/nefsc/habitat/efh/ and the recent assessment at https://www.nefsc.noaa.gov/saw/reports.html.

Atlantic mackerel is a semi-pelagic/semi-demersal (may be found near the bottom or higher in the water column) schooling fish species primarily distributed between Labrador (Newfoundland, Canada) and North Carolina. Based on the work of Sette (1943, 1950) and confirmed in the recent assessment, the stock is considered to comprise two spawning contingents: a northern contingent spawning primarily in the southern Gulf of St. Lawrence and a southern contingent spawning in the Mid-Atlantic Bight, Southern New England and the western Gulf of Maine. The two contingents mix during winter months on the Northeast U.S. shelf; however, the degree of mixing and natal homing is unknown. Mackerel in the northwest Atlantic were modeled as one stock for the recent assessment. The Canadian fishery likely primarily catches the northern contingent while the U.S. fishery likely catches both contingents.

Mackerel spawning occurs during spring and summer and progresses from south to north as the surface waters warm. Atlantic mackerel are serial, or batch spawners. Eggs are pelagic. Post-larvae gradually transform from planktonic to swimming and schooling behavior at about 30-50 mm. Approximately 50% of fish are mature at age 2 and about 99% were mature at age 3 from 2007-2016 according to the recent benchmark assessment.

Atlantic mackerel are opportunistic feeders that can ingest prey either by individual selection of organisms or by passive filter feeding.

A wide variety of fish and other animals are predators of mackerel. Predator food habits on the Northeast US Shelf have been systematically sampled during the NEFSC bottom trawl surveys since 1973. In the recent benchmark assessment, these food habits data were evaluated for the top 17 mackerel predators based on the percent occurrence of mackerel in predator diets (NEFSC 2018, Appendix A4). The presence of Atlantic mackerel in fish stomachs was generally low from 1973-2016. A total of 1,284 out of 619,637 stomachs (~0.2%) contained mackerel, including unidentified mackerel Scombridae and Scomber spp. Spiny dogfish was the most dominant mackerel predator sampled by the trawl surveys, but the frequency of occurrence for mackerel in spiny dogfish diets only average 1%.

Additional potentially important predators of mackerel are not sampled in the NEFSC trawl surveys, including highly migratory species, marine mammals, and seabirds. Consumption from these predators is more difficult to estimate due to incomplete information on population levels and annual diet information. Furthermore, predator food habits were not available for the months the northern contingent was outside of the area sampled by the NEFSC trawl survey. Given this incomplete sampling, the low occurrence of mackerel in predator stomachs, and the resulting interannual variability in consumption estimates, the final model did not incorporate predator diets as an index of abundance. It should be noted though that observed temporal trends in consumption were consistent with trends from the range-wide egg index as well as abundance estimates.

Additional life history information is detailed in the Essential Fish Habitat (EFH) document for the species, located at: http://www.nefsc.noaa.gov/nefsc/habitat/efh/.

Based on this new assessment model (statistical catch-at-age model incorporating both fishery dependent and fishery independent data through 2016), the recommended status of Atlantic mackerel is overfished with overfishing occurring (NEFSC 2018), and the Council has initiated this rebuilding action. However, because of an estimated 2014 year class (eggs spawned in 2014) near the median and especially a relatively strong year-class in 2015, the stock was increasing at the end of the assessed time period and is projected to rebuild to target levels relatively quickly. Rebuilding projections also indicate there will likely be no overfishing in 2018 and that the stock should have climbed above the overfished threshold in 2018 (see projection figures in Section 7.1). These rebuilding projections, however, are critically dependent on the estimate of the 2015 year class, which was the most uncertain parameter from the assessment model (as is typical of all such assessments). Additional information on the mackerel fishery can be found in the EA for the 2016-2018 mackerel specifications, available at: https://www.greateratlantic.fisheries.noaa.gov/regs/2016/January/16msb2016specspr.html and in the recent assessment, available at https://www.nefsc.noaa.gov/publications/crd/crd1806/crd1806.pdf .

F40% was recommended as the proxy for FMSY (fishing mortality at "maximum sustainable yield") and was estimated to be 0.26. F40% was selected as a proxy for FMSY due to consistency with the Canadian reference point and ability to prevent stock collapse for stocks with similar life histories. F40% produces 40% of the "spawning stock biomass per recruit" (equivalent to lifetime egg production) relative to that produced by an unfished stock. Fishing mortality (F) in 2016 was estimated to be 0.47, so it was recommended that overfishing was occurring in 2016. The 2016 spawning stock biomass (SSB) was estimated to be 43,519 metric tons (MT), or 22% of the SSB target, so it was recommended that mackerel be considered "overfished" (below 50% of the target).

The biomass target is the SSB associated with the FMSY proxy or "SSBmsyproxy," and is estimated to be 196,894 MT. This is also the rebuilding biomass target. Once rebuilt, the MSYproxy (i.e. the proxy for maximum sustainable yield) is estimated to be 41,334 MT (total catch, U.S. plus Canada). Optimum yield is the landings that result from the Council's risk policy to rebuild the stock and avoid overfishing.

The terminal year recruitment estimates are generally among the most uncertain outputs of any assessment so the exact rebuilding path also involves some uncertainty. However this is typical for assessments and the recruitment estimates are part of the assessment that has been accepted as the best available scientific information. Some 2018 data on the likely ages of the 2018 catch are included in Appendix 3. An assessment update scheduled for 2020 will provide a relatively rapid indicator of rebuilding progress and indicate whether any adjustments should be considered by the Council.

Butterfish

Atlantic butterfish is a semi-pelagic schooling fish species primarily distributed between Nova Scotia, Canada and Florida. They are most abundant from the Gulf of Maine to Cape Hatteras, NC and are fast-growing, short-lived, and form loose schools. Additional life history information is detailed in the EFH document for the species, located at: http://www.nefsc.noaa.gov/nefsc/habitat/efh/.

The status of butterfish is not overfished (above target biomass) with no overfishing occurring according to a recent assessment update (NEFSC 2017a – available at http://www.mafmc.org/ssc-meetings/2017/may-17-18). The assessment update found that butterfish was at 141% of the target biomass in 2016. However, the update integrated recent trawl survey information that indicates recent recruitment has been poor, so biomass is expected to decline to below the SSBmsy target in 2017, but not below the overfished threshold ($SSB_{threshold}$ = 22,808 mt). Fishing mortality appears to have been very low in recent years, so the decline is not a result of overfishing but rather poor recruitment. If recruitment returns to average levels, then the stock is predicted to build above the SSBmsy target by 2020 (http://www.mafmc.org/s/butterfish_projections_2018-2020.xlsx). Butterfish recruitment is variable, and the terminal year recruitment was underestimated the last time the assessment model was run (2014), so it is not unreasonable to expect recruitment to be closer to average levels over the course of the projection.

Longfin Squid

Longfin squid is a neritic (from the shore to the edge of the continental shelf), semi-pelagic schooling cephalopod species primarily distributed between Georges Bank and Cape Hatteras, NC. The squid, and the fishery, generally occur offshore in the winter and inshore during the summer, with mixing and migrations from one to the other in spring and fall. Additional life history information is detailed in the EFH document for the species (Jacobson 2005), located at: http://www.nefsc.noaa.gov/nefsc/habitat/efh/. Information about the fishery, management and life history is presented in Arkhipkin et al. (2015). The current biomass reference point was developed during the 2010 stock assessment, however, no overfishing threshold was recommended. Longfin squid relative abundance and biomass indices from the NEFSC fall bottom trawl survey are highly variable, and are graphed in the "NEFSC Biological Update" that is created as part of the annual quota setting process. These are available at: http://www.mafmc.org/ssc-meeting-documents/ (see May 2016 Meeting Materials). Longfin had a stock assessment update in 2017, which found the stock biomass to be at 174% of the target in 2016, even higher than the 128% of target biomass in 2009 that was reported in the 2011 benchmark assessment. The assessment update is available at http://www.mafmc.org/ssc-meetings/2017/may-17-18. ABCs are set by the Council's SSC to avoid overfishing given the best available science. See http://www.mafmc.org/ssc for details on how ABCs are set for this species.

Illex squid

Illex squid is an oceanic, semi-pelagic schooling cephalopod species distributed between Newfoundland and the Florida Straits. Additional life history information is detailed in the EFH document for the species (Hendrickson and Holmes 2004), located at: http://www.nefsc.noaa.gov/nefsc/habitat/efh/. Information about the fishery, management and life history is presented in Arkhipkin et al. (2015). The status of *Illex* is unknown with respect to being overfished and is unknown with respect to overfishing. *Illex* squid relative abundance and biomass indices from the NEFSC fall bottom trawl surveys are highly variable and without trend, and are graphed in the "NEFSC Biological Update" that is created as part of the annual quota setting process. These are available at: http://www.mafmc.org/ssc-meeting-documents/ (see May 2016 Meeting Materials). According to the latest NEFSC "*Illex* Data Update" provided in April 2018 (available at http://www.mafmc.org/ssc-meetings/2018/may-8-9), relative abundance was near the long-term median during 2015-2017. ABCs are set by the Council's SSC to avoid overfishing given the best available science. See http://www.mafmc.org/ssc for details on how ABCs are set for this species. There has been a downward trend in *Illex* mean body weight in the survey since 1981, but squid size is likely highly influenced by environmental conditions.

Atlantic herring

Atlantic herring are migratory fish that live in large schools along the continental shelf from Labrador, Canada through Cape Hatteras, NC. Atlantic herring have supported an important commercial fishery since the late 19th century and play a very important role in the ecosystem as forage fish for many predators including marine mammals, larger fish, and seabirds, which support additional commercial, recreational, and ecotourism industries. Atlantic herring also provide effective and affordable bait to the lobster fishery, as well as other commercial and recreational fisheries. Finally, a smaller component of herring is landed and sold for human consumption, typically overseas. The status of herring is not overfished with overfishing not occurring in 2017, but a recent assessment indicates biomass declines due to low recruitment, and substantial quota reductions will be needed to avoid overfishing and/or becoming overfished. Additional life history information is detailed in the EFH document for the species (Reid et al 1999), located at: http://www.nefsc.noaa.gov/nefsc/habitat/efh/. Additional management and population status information can be found in the last herring specifications EA (NEFMC 2016).

THIS SPACE INTENTIONALLY LEFT BLANK

Non-Target Species

Non-target interactions in the longfin squid, *Illex* squid, and butterfish fisheries were recently described in the EA for the 2018-2020 specifications for those species (MAFMC 2017). Nothing in this action should affect the operation of those fisheries or their impact on non-target species.

Mackerel Non-Target Species

Various species are caught incidentally by the mackerel fishery. For non-target species that are managed under their own FMP, incidental catch/discards are also considered as part of the management of that fishery. Observers are deployed based on gear/area-based fleets via the standardized bycatch reporting methodology (SBRM), and for FMP species the NEFSC estimates discards of FMP species by those fleets - estimates may be found at https://www.nefsc.noaa.gov/fsb/SBRM/. However, those analyses are not fishery-specific and do not include several key species such as river herrings and shads (RH/S) so they have limited usefulness for making fishery-specific management decisions, and the SBRM is not intended to be the definitive document on the estimation methods nor is it a compendium of discard rates and total discards (Wigley et al. 2007). Accordingly, mackerel-specific analyses are presented below to obtain approximate information on incidental catch in the mackerel fishery. Since these analyses do not adhere to the stratification used to place observers, the approximate nature of these analyses is emphasized.

These species will be impacted to some degree by the prosecution of the mackerel fishery. Mackerel non-target interactions were described in the EA for 2016-2018 mackerel specifications (MAFMC 2016). As described in that document, non-target interactions constitute a relatively small part of the catch in the mackerel fishery – discards are less than 1% of catch, and mackerel, Atlantic herring, and butterfish account for 98% of all catch (retained plus discarded). The primary non-target species of current concern for mackerel are river herrings (alewife and blueback herring) and shads (American and hickory). Their populations are depleted in most river systems, and the RH/S cap limits catch of RH/S in the mackerel fishery. The text and table below update a similar analysis on incidental catch and discards in the mackerel fishery from the 2016-2018 EA with more recent data (2015-2017 now vs 2011-2013 then).

The primary database used to assess discarding is the NMFS Observer Program database, which includes data from trips that had trained observers onboard to document discards. One critical aspect of using this database to describe discards is to correctly define the trips that constitute a given directed fishery. Presumably some criteria of what captains initially intend to target, how they may adjust targeting over the course of a trip, and what they actually catch would be ideal. Thus to begin this process, staff first reviewed 2015-2017 trips in the dealer weighout database to see if a certain trip definition could account for most mackerel landed. The result of this review resulted in the following definition for mackerel trips using landings: All trips that had at least 50% mackerel by weight and all trips over 100,000 pounds of mackerel regardless of the ratio of other species. This definition results in capturing 90% of all mackerel landings in the dealer weighout database 2015-2017. The other trips with lower mackerel landings landed a variety of species, mostly Atlantic herring, silver hake, longfin squid, and scup. The set of trips in the observer database with the same mackerel criteria included 9 on average for each year 2015-2017. These trips made 124 hauls of which 89% were observed. Hauls may be unobserved for a variety of reasons, for example transfer to another vessel without an observer, observer not on station, haul slipped (dumped) in the water, etc…

Information on catch and discards is provided for observed hauls in the table below for species with at least 500 pounds of observed catch, with 500 pounds used as a proxy for catch that might be more than negligible. Since there were so few observed trips, extrapolations are not made but the total observed values are provided. Also, fishermen and processors on the Council's MSB Advisory Panel have also reported that mackerel caught in recent years are often caught incidental to Atl. herring fishing rather than during directed mackerel fishing because of the lack of fishable mackerel concentrations. This updated information is generally consistent with the previous analysis.

Table 12. Incidental catch in the mackerel fishery

NE Fisheries Science Center Common Name	Pounds Observed Caught	Pounds Observed Discarded	Of all discards observed, percent that comes from given species	Percent of given species that was discarded
MACKEREL, ATLANTIC	3,654,528	1,205	3%	0%
HERRING, ATLANTIC	1,294,838	1,577	4%	0%
BUTTERFISH	113,021	1,676	4%	1%
HAKE, SILVER (WHITING)	49,095	16,729	37%	34%
HERRING, NK	15,505	865	2%	6%
DOGFISH, SPINY	11,498	11,498	26%	100%
SQUID, ATL LONG-FIN	10,426	493	1%	5%
ALEWIFE	6,797	2,682	6%	39%
FISH, NK	3,567	3,567	8%	100%
HERRING, BLUEBACK	2,853	29	0%	1%
SHAD, AMERICAN	1,830	1,578	4%	86%
HADDOCK	899	323	1%	36%
HAKE, RED (LING)	575	324	1%	56%
SKATE, WINTER (BIG), WINGS	510	.	.	.
DORY, BUCKLER (JOHN)	506	481	1%	95%

A handline/auto-jig fishery has developed in recent years. This fishery, while lightly observed during 2015-2017 (13 trips targeting mackerel with handline or auto-jig handline), had minimal bycatch (primarily spiny dogfish).

For the mackerel fishery based on cap trips, from 2005-2012 (the base years for setting the cap) the average RH/S catch was 242 MT with a median of 89 MT. For the years when the cap has been in operation (2014-2018), the average was 36 MT of RH/S and the median was 13 MT. Overall mackerel and Atlantic herring effort, RH/S abundance and distribution, distribution and mixing of mackerel and Atlantic herring, and fishery behavior combine to result in the RH/S catch for any given year.

Atlantic herring are not non-target species since the directed fishery targets mackerel and Atlantic herring. Non-negligible non-target species therefore include silver hake, spiny dogfish, alewife, blueback herring, American shad, haddock, red hake, winter skate, and John Buckler Dory. Of these red hake is experiencing overfishing and is overfished (https://www.nefsc.noaa.gov/publications/crd/crd1802/crd1802.pdf), but catch was barely above the "more than negligible" threshold. There is no assessment for john dory buckler. Alewife, blueback herring, and American shad have been found to be depleted by the ASMFC, and assessment information is available at www.asmfc.org. Assessments for silver hake, spiny dogfish, haddock, and winter skate (not overfished, no overfishing) can be found at https://www.nefsc.noaa.gov/saw/.

6.2 Physical Environment and Habitat, Including EFH

Climate, physiographic, and hydrographic differences separate the Atlantic Ocean from Maine to Florida into the New England-Middle Atlantic Area and the South Atlantic Area (division/mixing at Cape Hatteras, NC). The MSB fisheries are prosecuted in the New England-Middle Atlantic Area. The inshore New England-Middle Atlantic area is relatively uniform physically, and is influenced by many large coastal rivers and estuarine areas. The continental shelf (characterized by water less than 650 ft. in depth) extends seaward approximately 120 miles off Cape Cod, narrows gradually to 70 miles off New Jersey, and is 20 miles wide at Cape Hatteras, NC. Surface circulation is generally southwesterly on the continental shelf during all seasons of the year, although this may be interrupted by coastal indrafting and some reversal of flow at the northern and southern extremities of the area. Water temperatures range from less than 33 ^{o}F in the New York Bight and north in the winter to over 80 ^{o}F off Cape Hatteras, NC in summer.

A number of distinct subsystems comprise the New-England-Middle-Atlantic Area (i.e. the Northeast U.S. Shelf). The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and fast-moving currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, NC. Detailed information on the affected physical and biological environments inhabited by the managed resources is available in Stevenson et al. (2006).

Ecosystem Considerations

The Council recently adopted an Ecosystem Approach to Fisheries Management (EAFM) Guidance Document, available at http://www.mafmc.org/eafm/. It is anticipated that the EAFM Guidance Document will serve through a transitional period where ecosystem considerations are introduced into Council management in an evolutionary fashion. Some highlights from the EAFM Guidance Document that could apply to MSB management include:

- It is 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.
- The Council could adopt biological reference points (overfishing levels or OFL) for forage stocks that are more conservative than the required MSA standard of F_{MSY}.
- The Council could modify the existing risk policy to accommodate ecosystem level concerns for forage species by reducing the maximum tolerance for risk of overfishing.
- The Council will promote the timely collection of data and development of analyses to support the biological, economic and social evaluation of ecosystem-level connections, tradeoffs, and risks, including those required to establish an optimal forage fish harvest policy.
- Habitat and climate change considerations will be more fully integrated into fishery management decisions.

The NEFSC also produces regular updates on conditions of the Northeast Shelf Ecosystem, which may be accessed via https://www.nefsc.noaa.gov/ecosys/. Highlights from the Spring 2018 Update include:

- Sea surface temperatures (SSTs) in the Northeast Shelf Large Marine Ecosystem during 2017 continue to be above average; however, they represent some moderation from the extremely warm conditions recorded in 2016.

- The 2017 spring phytoplankton bloom was poorly developed in most areas of the Northeast Shelf. The fall bloom tended to below average in intensity and duration. This reduced bloom activity was reflected in the 2017 mean annual chlorophyll concentration, which was the lowest in the time series.

- As seen in both surface and bottom water temperature time series, there appears to have been a regime shift in thermal conditions in the Gulf of Maine. The shift represent an increase in temperature on the order of 1.5°C.

- The variability of daily SST has increased over recent decades as indicated by the trends in standard deviation of daily temperature. There is an emerging pattern of cyclic variation in SST variability in the Middle Atlantic Bight.

- The combined occupancy habitat for the main species occurring on the Northeast Shelf has increased dramatically indicating greater niche overlap among species.

<u>Habitat, Including Essential Fish Habitat (EFH)</u>

Pursuant to the Magnuson-Stevens Act / EFH Provisions (50 CFR Part 600.815 (a)(1)), an FMP must describe EFH by life history stage for each of the managed species in the plan. This information was updated via Amendment 11 to the MSB FMP. EFH for the four species managed under this FMP is described using fundamental information on habitat requirements by life history stage that is summarized in a series of EFH source documents produced by NMFS and available at: http://www.nefsc.noaa.gov/nefsc/habitat/efh/ and in other published information sources which are identified in Amendments 9 and 11. The EFH maps are based on an analysis of average catch rates in ten minute squares of latitude and longitude in the historical time series of fall and spring bottom trawl survey data in the northeast region collected by the NEFSC. The updated EFH designations (text and maps) are available at http://www.habitat.noaa.gov/protection/efh/efhmapper/. In general, EFH for the MSB species is the water column itself, and the species have temperature and prey preferences/needs that determine the habitat suitability of any particular area/depth, thus fishing activity has minimal impacts. Longfin squid also use hard bottom, submerged vegetation, other natural or artificial structure, and sand or mud to attach/anchor eggs, but there are no known preferences for different types of substrates or indications that fishing activity may negatively impact longfin squid egg EFH. Impacts to EFH are separate from impacts to longfin squid eggs themselves, which are considered in the alternative impact analysis in Section 7.

There are other lifestages of federally-managed species that have designated EFH that may be susceptible to adverse impacts from bottom trawls used in MSB fisheries, depending on the geographic distribution of their essential habitats in relation to the footprint of MSB bottom trawl fishing activity. Most directed fishing for mackerel uses bottom trawl and mid-water trawl (with mid-water dominating in years of higher catch – NEFSC 2018), though there is a growing handline/auto-jig fishery (MAFMC 2018c). Mid-water trawl and the auto-jig fishery should not affect the bottom, but bottom trawling does. EFH for all the federally-managed species in the region that could potentially be affected by mackerel bottom trawling activity is described in the following table:

Table 13. EFH descriptions for species vulnerable to trawl gear

Species	**Life Stage**	**Geographic Area**	**Depth (meters)**	**Habitat Type and Description**
Acadian redfish	Juveniles	Gulf of Maine and the continental slope north of 37°38'N	50-200 in Gulf of Maine, to 600 on slope	Sub-tidal coastal and offshore rocky reef substrates with associated structure-forming epifauna (e.g., sponges, corals) , and soft sediments with cerianthid anemones
Acadian redfish	Adults	Gulf of Maine and the continental slope north of 37°38'N	140-300 in Gulf of Maine, to 600 on slope	Offshore benthic habitats on finer grained sediments and on variable deposits of gravel, silt, clay, and boulders
American plaice	Juveniles	Gulf of Maine and bays and estuaries from Passamaquoddy Bay to Saco Bay, Maine and from Massachusetts Bay to Cape Cod Bay, Massachusetts Bay	40-180	Sub-tidal benthic habitats on mud and sand, also found on gravel and sandy substrates bordering bedrock
American plaice	Adults	Gulf of Maine, Georges Bank and bays and estuaries from Passamaquoddy Bay to Saco Bay, Maine and from Massachusetts Bay to Cape Cod Bay, Massachusetts Bay	40-300	Sub-tidal benthic habitats on mud and sand, also gravel and sandy substrates bordering bedrock
Atlantic cod	Juveniles	Gulf of Maine, Georges Bank, and Southern New England,	Mean high water-120	Structurally-complex intertidal and sub-tidal habitats, including

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
		including nearshore waters from eastern Maine to Rhode Island and the following estuaries: Passamaquoddy Bay to Saco Bay; Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay		eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulder) with and without attached macroalgae and emergent epifauna
Atlantic cod	Adults	Gulf of Maine, Georges Bank, Southern New England, and the Mid-Atlantic to Delaware Bay, including the following estuaries: Passamaquoddy Bay to Saco Bay; Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	30-160	Structurally complex sub-tidal hard bottom habitats with gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae, also sandy substrates and along deeper slopes of ledges
Atlantic halibut	Juveniles & Adults	Gulf of Maine, Georges Bank, and continental slope south of Georges Bank	60-140 and 400-700 on slope	Benthic habitats on sand, gravel, or clay substrates
Atlantic herring	Eggs	Coastal Gulf of Maine, Georges Bank, and Southern New England	5-90	Sub-tidal benthic habitats on coarse sand, pebbles, cobbles, and boulders and/or macroalgae
Atlantic sea scallop	Eggs	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Inshore and offshore benthic habitats (see adults)
Atlantic sea scallop	Larvae	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Massachusetts Bay, and Cape Cod Bay	No information	Inshore and offshore pelagic and benthic habitats: pelagic larvae ("spat"), settle on variety of hard surfaces, including shells, pebbles, and gravel and to macroalgae and other benthic organisms such as hydroids
Atlantic sea scallop	Juveniles	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Benthic habitats initially attached to shells, gravel, and small rocks (pebble, cobble), later free-swimming juveniles found in same habitats as adults
Atlantic sea scallop	Adults	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Benthic habitats with sand and gravel substrates
Atlantic surfclams	Juveniles and adults	Continental shelf from southwestern Gulf of Maine to Cape Hatteras, North Carolina	Surf zone to about 61, abundance low >38	In substrate to depth of 3 ft
Atlantic wolffish	Eggs	U.S. waters north of 41˚N latitude and east of 71˚W longitude	<100	Sub-tidal benthic habitats under rocks and boulders in nests
Atlantic wolffish	Juveniles	U.S. waters north of 41˚N latitude and east of 71˚W longitude	70-184	Sub-tidal benthic habitats

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Atlantic wolffish	Adults	U.S. waters north of 41˚N latitude and east of 71˚W longitude	<173	A wide variety of sub-tidal sand and gravel substrates once they leave rocky spawning habitats, but not on muddy bottom
Barndoor skate	Juveniles and adults	Primarily on Georges Bank and in Southern New England and on the continental slope	40-400 on shelf and to 750 on slope	Sub-tidal benthic habitats on mud, sand, and gravel substrates
Black sea bass	Juveniles and adults	Continental shelf and estuarine waters from the southwestern Gulf of Maine and Cape Hatteras, North Carolina	Inshore in summer and spring	Benthic habitats with rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, also offshore clam beds and shell patches in winter
Clearnose skate	Juveniles	Inner continental shelf from New Jersey to the St. Johns River in Florida and certain bays and certain estuaries including Raritan Bay, inland New Jersey bays, Chesapeake Bay, and Delaware Bays	0-30	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
Clearnose skate	Adults	Inner continental shelf from New Jersey to the St. Johns River in Florida and certain bays and certain estuaries including Raritan Bay, inland New Jersey bays, Chesapeake Bay, and Delaware Bays	0-40	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
Deep-sea red crab	Eggs	Outer continental shelf and slope throughout the region, including two seamounts	320-640	Benthic habitats attached to female crabs
Deep-sea red crab	Juveniles	Outer continental shelf and slope throughout the region, including two seamounts	320-1300 on slope and to 2000 on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments
Deep-sea red crab	Adults	Outer continental shelf and slope throughout the region, including two seamounts	320-900 on slope and up to 2000 on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments
Golden tilefish	Juveniles and adults	Outer continental shelf and slope from U.S.-Canada boundary to the Virginia-North Carolina boundary	100-300	Burrows in semi-lithified clay substrate, may also utilize rocks, boulders, scour depressions beneath boulders, and exposed rock ledges as shelter
Haddock	Juveniles	Inshore and offshore waters in the Gulf of Maine, on Georges Bank, and on the continental shelf in the Mid-Atlantic region	40-140 and as shallow as 20 in coastal Gulf of Maine	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel
Haddock	Adults	Offshore waters in the Gulf of Maine, on Georges Bank, and on the continental shelf in Southern New England	50-160	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel and adjacent to boulders and cobbles along the margins of rocky reefs
Little skate	Juveniles	Coastal waters in the Gulf of Maine, Georges Bank, and the continental shelf in the Mid-Atlantic region as far south as Delaware Bay, including certain	Mean high water-80	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
		bays and estuaries in the Gulf of Maine		
Little skate	Adults	Coastal waters in the Gulf of Maine, Georges Bank, and the continental shelf in the Mid-Atlantic region as far south as Delaware Bay, including certain bays and estuaries in the Gulf of Maine	Mean high water-100	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud
Longfin inshore squid	Eggs	Inshore and offshore waters from Georges Bank southward to Cape Hatteras	Generally <50	Bottom habitats attached to variety of hard bottom types, macroalgae, sand, and mud
Monkfish	Juveniles	Gulf of Maine, outer continental shelf in the Mid-Atlantic, and the continental slope	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Sub-tidal benthic habitats on a variety of habitats, including hard sand, pebbles, gravel, broken shells, and soft mud, also seek shelter among rocks with attached algae
Monkfish	Adults	Gulf of Maine, outer continental shelf in the Mid-Atlantic, and the continental slope	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Sub-tidal benthic habitats on hard sand, pebbles, gravel, broken shells, and soft mud, but seem to prefer soft sediments, and, like juveniles, utilize the edges of rocky areas for feeding
Ocean pout	Eggs	Georges Bank, Gulf of Maine, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	<100	Sub-tidal hard bottom habitats in sheltered nests, holes, or rocky crevices
Ocean pout	Juveniles	Gulf of Maine, on the continental shelf north of Cape May, New Jersey, on the southern portion of Georges Bank, and including certain bays and estuaries in the Gulf of Maine	Mean high water-120	Intertidal and sub-tidal benthic habitats on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel
Ocean pout	Adults	Gulf of Maine, Georges Bank, on the continental shelf north of Cape May, New Jersey, and including certain bays and estuaries in the Gulf of Maine	20-140	Sub-tidal benthic habitats on mud and sand, particularly in association with structure forming habitat types; i.e. shells, gravel, or boulders
Ocean quahogs	Juveniles and adults	Continental shelf from southern New England and Georges Bank to Virginia	9-244	In substrate to depth of 3 ft
Offshore hake	Juveniles	Outer continental shelf and slope from Georges Bank to 34° 40’N	160-750	Pelagic and benthic habitats
Offshore hake	Adults	Outer continental shelf and slope from Georges Bank to 34° 40’N	200-750	Pelagic and benthic habitats
Pollock	Juveniles	Inshore and offshore waters in the Gulf of Maine (including bays and estuaries in the Gulf of Maine), the Great South Channel, Long Island Sound, and Narragansett Bay, Rhode Island	Mean high water-180 in Gulf of Maine, Long Island Sound, and Narragansett Bay; 40-180 on Georges Bank	Intertidal and sub-tidal pelagic and benthic rocky bottom habitats with attached macroalgae, small juveniles in eelgrass beds, older juveniles move into deeper water habitats also occupied by adults
Pollock	Adults	Offshore Gulf of Maine waters, Massachusetts Bay and Cape Cod Bay, on the southern edge of Georges Bank, and in Long Island Sound	80-300 in Gulf of Maine and on Georges Bank; <80 in Long Island Sound, Cape Cod	Pelagic and benthic habitats on the tops and edges of offshore banks and shoals with mixed rocky substrates, often with attached macro algae

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
			Bay, and Narragansett Bay	
Red hake	Juveniles	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including Passamaquoddy Bay to Cape Cod Bay in the Gulf of Maine, Buzzards Bay and Narragansett Bay, Long Island Sound, Raritan Bay and the Hudson River, and lower Chesapeake Bay	Mean high water-80	Intertidal and sub-tidal soft bottom habitats, esp those that that provide shelter, such as depressions in muddy substrates, eelgrass, macroalgae, shells, anemone and polychaete tubes, on artificial reefs, and in live bivalves (e.g., scallops)
Red hake	Adults	In the Gulf of Maine, the Great South Channel, and on the outer continental shelf and slope from Georges Bank to North Carolina , including inshore bays and estuaries as far south as Chesapeake Bay	50-750 on shelf and slope, as shallow as 20 inshore	Sub-tidal benthic habitats in shell beds, on soft sediments (usually in depressions), also found on gravel and hard bottom and artificial reefs
Rosette skate	Juveniles and adults	Outer continental shelf from approximately 40˚N to Cape Hatteras, North Carolina	80-400	Benthic habitats with mud and sand substrates
Scup	Juveniles	Continental shelf between southwestern Gulf of Maine and Cape Hatteras, North Carolina and in nearshore and estuarine waters between Massachusetts and Virginia	No information	Benthic habitats, in association with inshore sand and mud substrates, mussel and eelgrass beds
Scup	Adults	Continental shelf and nearshore and estuarine waters between southwestern Gulf of Maine and Cape Hatteras, North Carolina	No information, generally overwinter offshore	Benthic habitats
Silver hake	Juveniles	Gulf of Maine, including certain bays and estuaries, and on the continental shelf as far south as Cape May, New Jersey	40-400 in Gulf of Maine, >10 in Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats in association with sand-waves, flat sand with amphipod tubes, shells, and in biogenic depressions
Silver hake	Adults	Gulf of Maine, including certain bays and estuaries, the southern portion of Georges Bank, and the outer continental shelf and some shallower coastal locations in the Mid-Atlantic	>35 in Gulf of Maine, 70-400 on Georges Bank and in the Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats, often in bottom depressions or in association with sand waves and shell fragments, also in mud habitats bordering deep boulder reefs, on over deep boulder reefs in the southwest Gulf of Maine
Smooth skate	Juveniles	Offshore Gulf of Maine, some coastal bays in Maine and New Hampshire, and on the continental slope from Georges Bank to North Carolina	100-400 offshore Gulf of Maine, <100 inshore Gulf of Maine, to 900 on slope	Benthic habitats, mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks in the Gulf of Maine
Smooth skate	Adults	Offshore Gulf of Maine and the continental slope from Georges Bank to North Carolina	100-400 offshore Gulf of Maine, to 900 on slope	Benthic habitats, mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks in the Gulf of Maine
Summer flounder	Juveniles	Continental shelf and estuaries from Cape Cod, Massachusetts, to Cape Canaveral, Florida	To maximum 152	Benthic habitats, including inshore estuaries, salt marsh creeks, seagrass beds, mudflats, and open bay areas
Summer flounder	Adults	Continental shelf from Cape Cod, Massachusetts, to Cape Canaveral, Florida, including	To maximum 152 in colder months	Benthic habitats

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
		shallow coastal and estuarine waters during warmer months		
Spiny dogfish	Juveniles	Primarily the outer continental shelf and slope between Cape Hatteras and Georges Bank and in the Gulf of Maine	Deep water	Pelagic and epibenthic habitats
Spiny dogfish	Female sub-adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Male sub-adults	Primarily in the Gulf of Maine and on the outer continental shelf from Georges Bank to Cape Hatteras	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Female adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Male adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
Thorny skate	Juveniles	Offshore Gulf of Maine, some coastal bays in the Gulf of Maine, and on the continental slope from Georges Bank to North Carolina	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 om slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
Thorny skate	Adults	Offshore Gulf of Maine and on the continental slope from Georges Bank to North Carolina	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 om slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
White hake	Juveniles	Gulf of Maine, Georges Bank, and Southern New England, including bays and estuaries in the Gulf of Maine	Mean high water - 300	Intertidal and sub-tidal estuarine and marine habitats on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats
White hake	Adults	Gulf of Maine, including coastal bays and estuaries, and the outer continental shelf and slope	100-400 offshore Gulf of Maine, >25 inshore Gulf of Maine, to 900 on slope	Sub-tidal benthic habitats on fine-grained, muddy substrates and in mixed soft and rocky habitats
Windowpane flounder	Juveniles	Estuarine, coastal, and continental shelf waters from the Gulf of Maine to northern Florida, including bays and estuaries from Maine to Maryland	Mean high water - 60	Intertidal and sub-tidal benthic habitats on mud and sand substrates
Windowpane flounder	Adults	Estuarine, coastal, and continental shelf waters from the Gulf of Maine to Cape Hatteras, North Carolina, including bays and estuaries from Maine to Maryland	Mean high water - 70	Intertidal and sub-tidal benthic habitats on mud and sand substrates
Winter flounder	Eggs	Eastern Maine to Absecon Inlet, New Jersey (39° 22´N) and Georges Bank	0-5 south of Cape Cod, 0-70 Gulf of Maine and Georges Bank	Sub-tidal estuarine and coastal benthic habitats on mud, muddy sand, sand, gravel, submerged aquatic vegetation, and macroalgae
Winter flounder	Juveniles	Coastal Gulf of Maine, Georges Bank, and continental shelf in Southern New England and Mid-Atlantic to Absecon Inlet, New Jersey, including bays and estuaries from eastern Maine to northern New Jersey	Mean high water - 60	Intertidal and sub-tidal benthic habitats on a variety of bottom types, such as mud, sand, rocky substrates with attached macro algae, tidal wetlands, and eelgrass; young-of-the-year juveniles on muddy and sandy sediments in and adjacent to eelgrass and macroalgae,

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
				in bottom debris, and in marsh creeks
Winter flounder	Adults	Coastal Gulf of Maine, Georges Bank, and continental shelf in Southern New England and Mid-Atlantic to Absecon Inlet, New Jersey, including bays and estuaries from eastern Maine to northern New Jersey	Mean high water - 70	Intertidal and sub-tidal benthic habitats on muddy and sandy substrates, and on hard bottom on offshore banks; for spawning adults, also see eggs
Winter skate	Juveniles	Coastal waters from eastern Maine to Delaware Bay, including certain bays and estuaries from eastern Maine to Chincoteague Bay, Virginia, and on Georges Bank and the continental shelf in Southern New England and the Mid-Atlantic	0-90	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud
Winter skate	Adults	Coastal waters from eastern Maine to Delaware Bay, including certain bays and estuaries in Maine and New Hampshire, and on Georges Bank and the continental shelf in Southern New England and the Mid-Atlantic	0-80	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud
Witch flounder	Juveniles	Gulf of Maine and outer continental shelf and slope	50-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
Witch flounder	Adults	Gulf of Maine and outer continental shelf and slope	35-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
Yellowtail flounder	Juveniles	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	20-80	Sub-tidal benthic habitats on sand and muddy sand
Yellowtail flounder	Adults	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	25-90	Sub-tidal benthic habitats on sand and sand with mud, shell hash, gravel, and rocks

Fishery Impact Considerations

Actions implemented that affect species with overlapping EFH were assessed in Amendment 9 to the MSB FMP in 2008 (http://www.mafmc.org/fmp/history/smb-hist.htm). Amendment 9 summarized Stevenson et al. 2004's findings on bottom-trawling's habitat impacts as:

"In studies examining the effect of bottom otter trawling on a variety of substrate types, it was demonstrated that the physical effects of trawl doors contacting the bottom produced furrows and some shifts in surface sediment composition, although there is a large variation in the duration of these impacts. Typically the more dynamic environment and less structured bottom composition, the shorter the duration of impact. This type of fishing was demonstrated to have some effects on composition and biomass of benthic species in the affected areas, but the directionality and duration of these effects varied by study and substrate types."

Some mackerel fishing does use bottom-tending trawl gear. Industry contacts report that MSB effort is generally over sand/mud bottoms that will not damage nets and that "hangs" or areas with structure have been mapped over the years and are avoided. Amendment 9 included an analysis of the adverse impacts of the MSB fisheries on EFH (per section 303(a)(7) of the MSA). In Amendment 9 the Council determined that bottom trawls used in MSB fisheries do have the potential to adversely affect EFH for some federally-managed fisheries in the region and closed portions of two offshore canyons (Lydonia and Oceanographer) to squid trawling. Subsequent closures were implemented in these and two other canyons (Veatch and Norfolk) to protect tilefish EFH by prohibiting all bottom trawling activity. The Council has also taken action for protections for deep-sea corals on the outer continental shelf and slope via Amendment 16 to the MSB FMP.

Because there have been no significant changes to the manner in which the MSB fisheries are prosecuted, and because none of the alternatives being considered in this document should have more than a minimal and/or temporary adverse impact (see section 7.0), no additional alternatives to minimize adverse effects on EFH are considered as part of this management action.

THIS SPACE INTENTIONALLY LEFT BLANK

6.3 Human Communities and Economic Environment

This section describes the performance of the mackerel fishery to allow the reader to understand the socio-economic importance of the mackerel fishery. The recent squid and butterfish specifications EA (MAFMC 2017) can be consulted for information on those species, but those fisheries are not expected to be impacted by this action. Recent Amendments to the MSB FMP contain additional information about the MSB fisheries, especially demographic information on ports that land MSB species. See Amendments 11 and 14 at http://www.mafmc.org/msb/ for more information or visit NMFS' communities page at: http://www.nefsc.noaa.gov/read/socialsci/community_profiles/. In general, the MSB fisheries saw high foreign landings in the 1970s followed by a domestication of the fishery, and domestic landings have been variable, but lower than the peak foreign landings. The current regulations for the MSB fisheries are summarized by NMFS at https://www.greateratlantic.fisheries.noaa.gov/regs/info.html, and detailed in the Federal Register at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=1e9802ffddb05d0243d9c657fade956c&rgn=div5&view=text&node=50:12.0.1.1.5&idno=50.

The most obvious way that human communities are affected by the MSB fisheries are from the revenues generated by the fisheries, and the jobs created. The affected communities include both individuals directly involved in harvesting and processing as well as indirect support services (e.g. vessel maintenance, insurance, ice, etc.). While the direct data points that are most available are landings and revenues, it is important to keep in mind that by contributing to the overall functioning of and employment in coastal communities, the MSB fisheries have indirect social impacts as well. Social impacts are strongly aligned with changes to fishing opportunities and while difficult to measure can include impacts to families from income changes/volatility, safety-at-sea (related to changes in fishery operations due to regulation changes), job satisfaction, and general frustration by individuals due to management's impacts especially if they perceive management actions to be unreasonable or ill-informed.

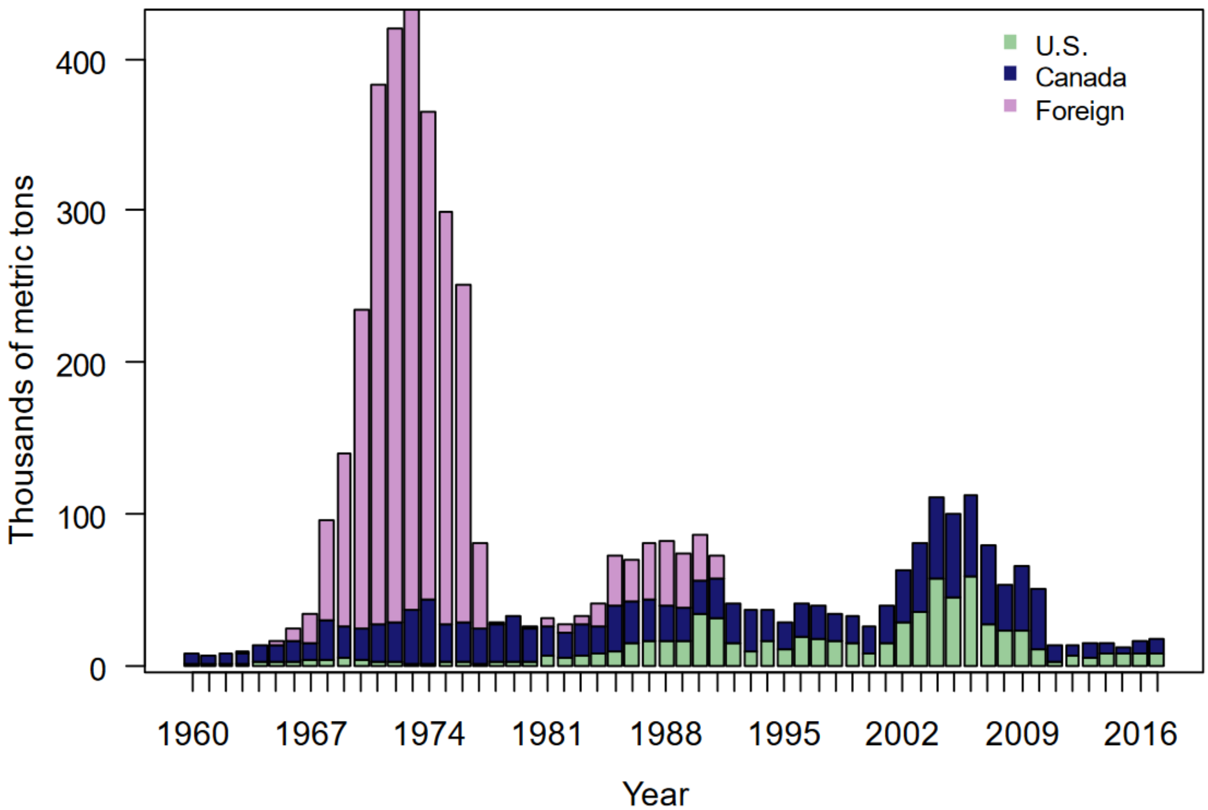
Descriptive information on the fisheries is included, and where possible, quantitative commercial fishery and economic information is presented. This section establishes a descriptive baseline for the fishery with which to compare actual and predicted future socio-economic changes that result from management actions.

6.3.1 Atlantic Mackerel

The figure below (next page) illustrates that foreign catches dominated the fishery during the 1960s and 1970s, with total catch peaking at over 430,000 MT in 1973. Foreign catches declined and then were eliminated by the MSA, though there was also some joint venture activity from the mid-1980s through 1991. From 1992 through 2001, total catches averaged only 35,222 MT before increasing to peaks of just over 110,000 MT in 2004 and 2006. Total catch then declined and since 2011 has averaged 14,122 MT per year. Preliminary estimated 2017 total catch was the highest since 2010 and equaled 17,508 MT. U.S. commercial discards represented an average of 4.2% of U.S. commercial catch over the time series, and 1.7% of U.S. commercial catch since 2000. U.S. recreational catch represented an average of 26.4% of total U.S. catch in the 1980's, decreased to an average of 5.2% during the 1990's and 2000's, and has averaged 17.0% since 2010.

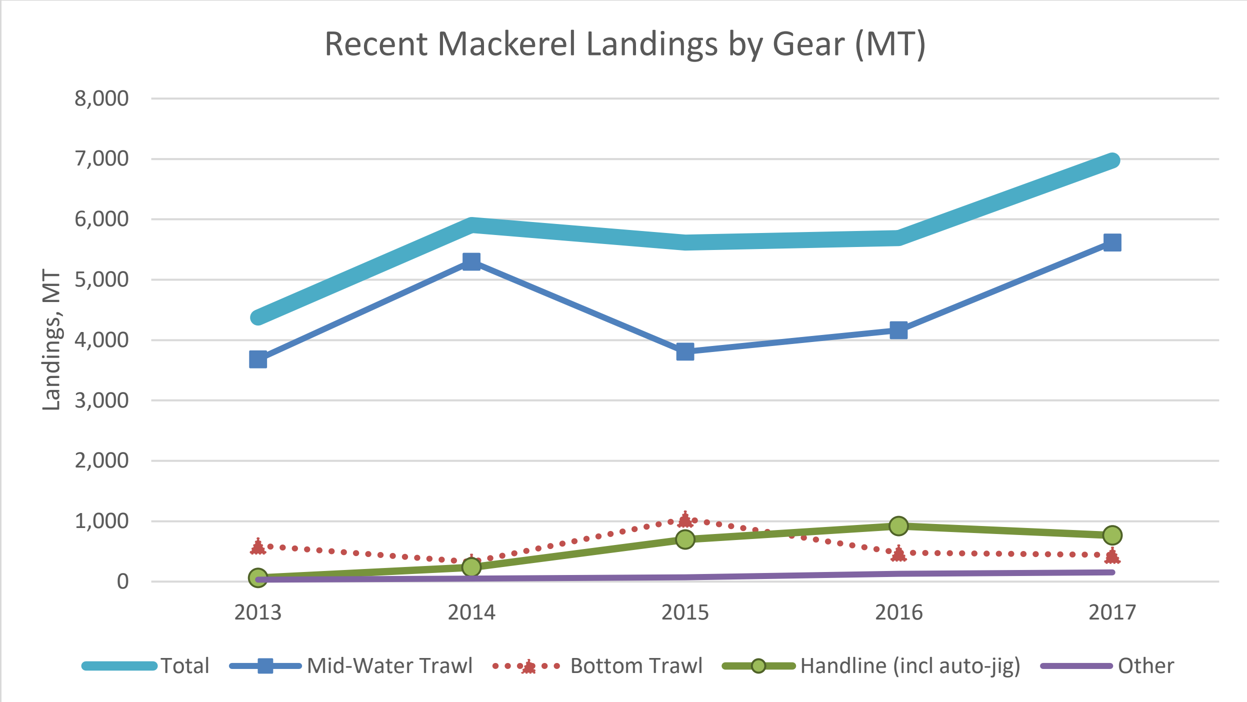
Most landings in recent years are from mid-water trawl gear, with lower levels from bottom trawl, handline (including auto-jig), and other (see figure next page). A substantial portion of mackerel landings in recent years have come incidental to Atlantic herring fishing.

Figure 2. Total annual mackerel catch (mt) by the U.S., Canada and other countries for 1960-2017.



THIS SPACE INTENTIONALLY LEFT BLANK

Figure 3. Recent U.S. Mackerel Landings By Gear.



THIS SPACE INTENTIONALLY LEFT BLANK

For almost the entire time series, catches have been well below the limits placed on the fishery, as summarized in the table below.

Table 14. Annual stock-wide ABCs (mt), total catch from all sources (mt) and the proportion of the annual ABC caught.

Year	Stock ABC	Total Catch	Proportion
1995	850,000	28,418	0.03
1996	1,175,500	40,322	0.03
1997	1,178,000	38,920	0.03
1998	382,000	34,376	0.09
1999	383,000	31,998	0.08
2000	369,000	25,338	0.07
2001	369,000	39,364	0.11
2002	369,000	62,962	0.17
2003	369,000	80,311	0.22
2004	369,000	111,377	0.30
2005	335,000	99,603	0.30
2006	335,000	112,425	0.34
2007	238,000	79,733	0.34
2008	211,000	53,008	0.25
2009	211,000	65,676	0.31
2010	211,000	49,648	0.24
2011	80,000	13,147	0.16
2012	80,000	12,601	0.16
2013	80,000	14,360	0.18
2014	80,000	13,971	0.18
2015	40,165	11,950	0.30
2016	19,898	15,316	0.77
2017	19,898	17,508	0.88

The figures below show ex-vessel revenues (nominal) and ex-vessel prices (inflation adjusted) for mackerel from 1982-2017 based on dealer data from the Northeast Commercial Fisheries Database.

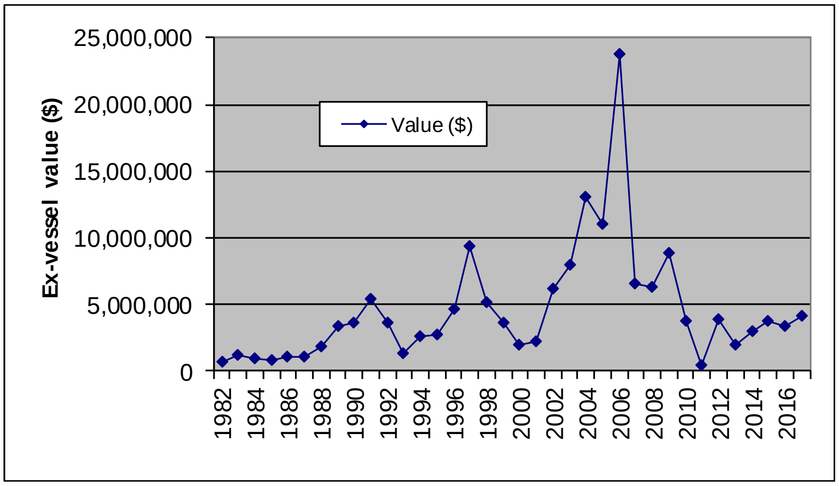


Figure 4. Nominal Ex-Vessel Revenues for mackerel landings during 1982-2017.

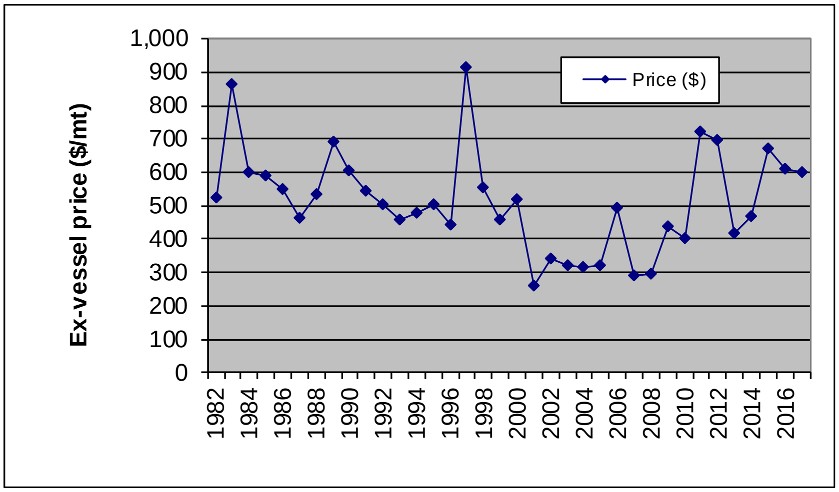


Figure 5. Inflation-adjusted ex-vessel Prices for mackerel landings during 1982-2017.

The mackerel fishery takes place in shelf waters as described in the figures below. Landings for all gears other than paired midwater trawl were reported via dealer reports matched to a vessel trip report (VTR) when possible (only VTR for 2017). Landings for paired midwater trawl vessels were reported via VTRs. From 2007-2011 80% of landings had location data, from 2012-2016 84% of landings had location information, and in 2017 99% of VTR reports had location information.

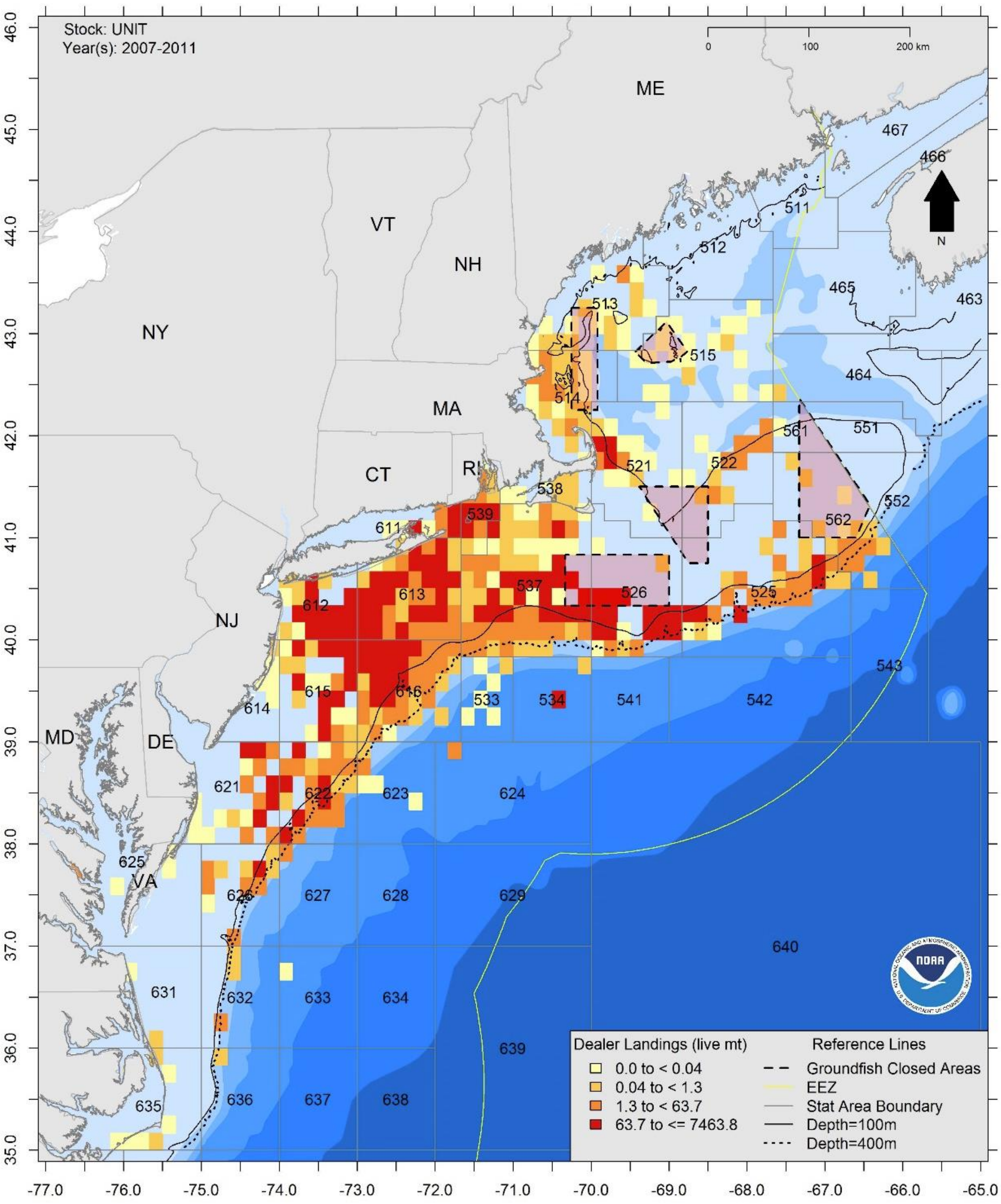


Figure 6. Spatial distribution of landings (mt) by ten-minute square, during 2007-2011.

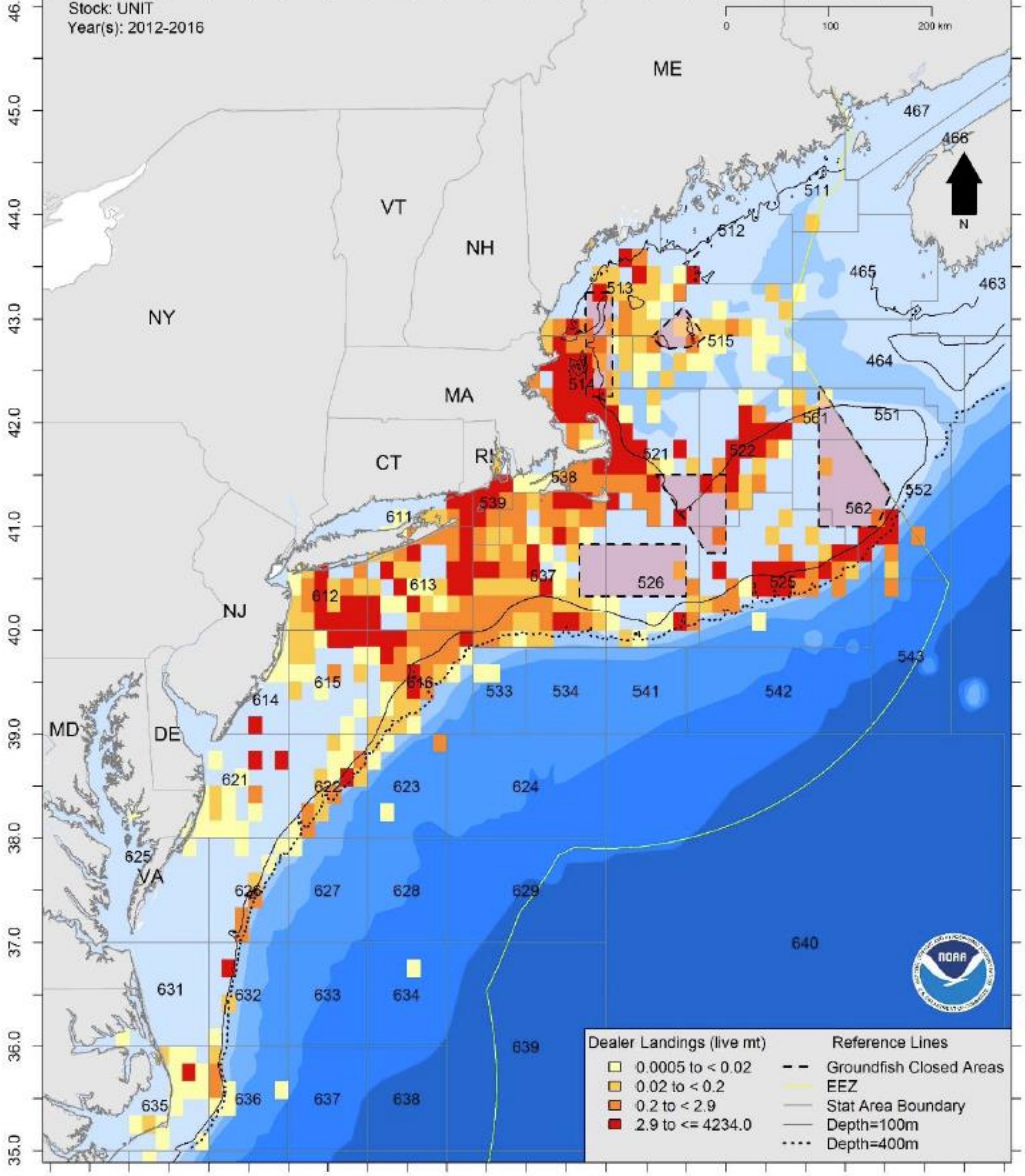


Figure 7. Spatial distribution of landings (mt) by ten-minute square, during 2012-2016.

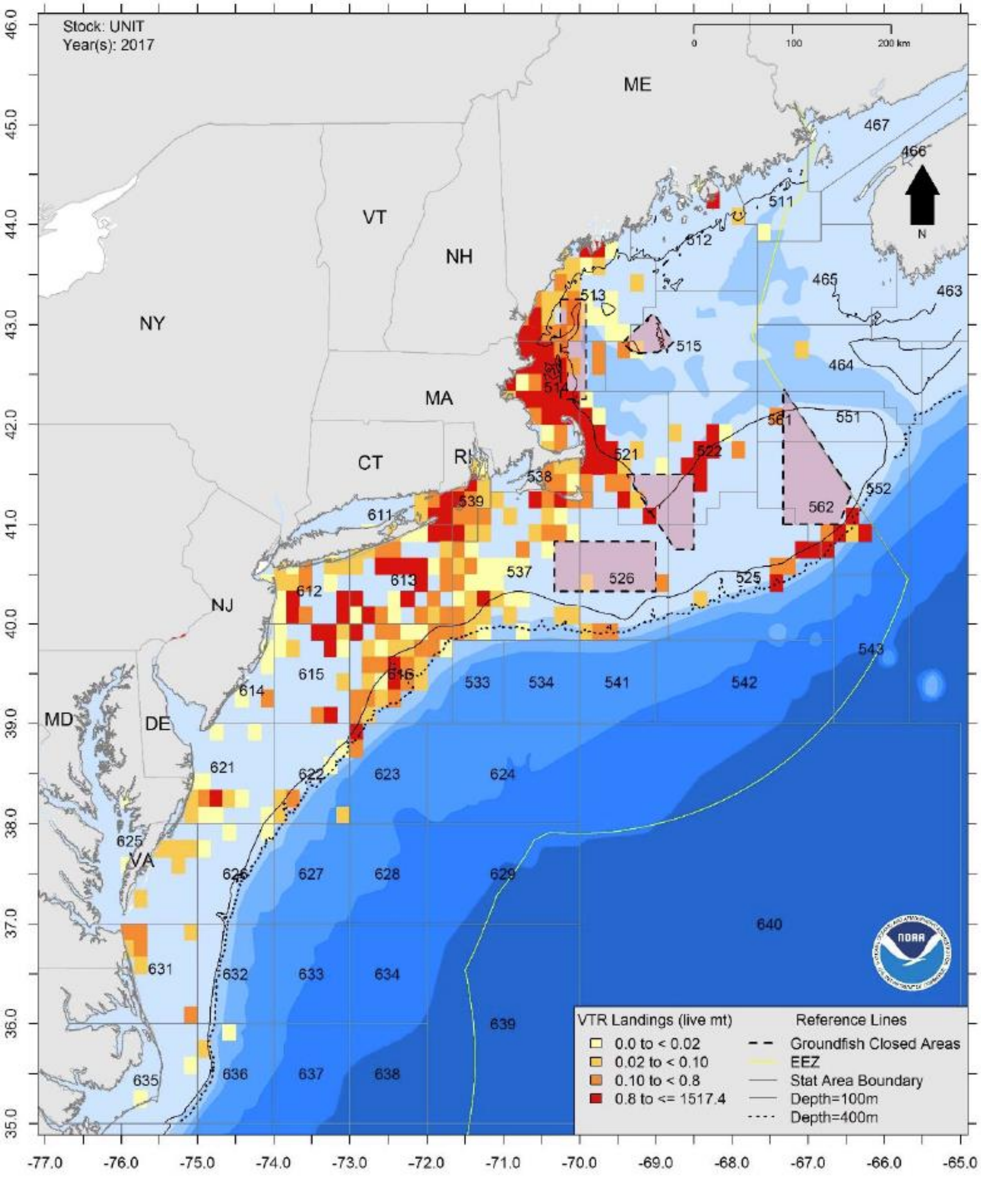


Figure 8. Spatial distribution of landings (mt) by ten-minute square, during 2017.

In recent years most mackerel landings have occurred in Massachusetts and New Jersey (see table below). Further breakdowns by port may violate the spirit of data confidentiality rules. The subsequent table describes the numbers of vessels that have fished for mackerel over time, which also provides perspective on the numbers of jobs supported by the fishery

Table 15. Recent Mackerel Landings by State (mt)

YEAR	MA	NJ	RI	ME	NY	Other	Total
2015	3,175	1,006	865	510	35	26	5,591
2016	4,833	139	519	169	21	7	5,681
2017	4,710	1,275	315	633	28	13	6,962

Table 16. Numbers of vessels that actively fished for mackerel, by landings (lbs) category, during 1982-2017.

YEAR	Vessels 1 mil +	Vessels 100,000 - 1mil	Vessels 50,000 - 100,000	Vessels 10,000 - 50,000	Total
1982	0	10	10	43	63
1983	0	10	5	26	41
1984	0	11	14	29	54
1985	0	12	10	28	50
1986	1	10	5	37	53
1987	1	15	8	31	55
1988	2	20	8	40	70
1989	6	17	8	27	58
1990	6	16	7	39	68
1991	13	18	1	38	70
1992	9	17	13	48	87
1993	0	16	11	55	82
1994	2	27	14	44	87
1995	4	24	11	50	89
1996	7	45	15	53	120
1997	6	30	20	46	102
1998	9	16	6	39	70
1999	6	15	9	36	66
2000	5	3	0	26	34
2001	5	3	2	20	30
2002	12	3	1	22	38
2003	14	6	5	23	48
2004	18	6	1	14	39
2005	16	12	4	15	47
2006	21	12	5	10	48
2007	16	12	2	20	50
2008	15	5	1	17	38
2009	15	6	6	18	45
2010	10	9	2	13	34
2011	0	3	3	17	23
2012	3	9	1	9	22
2013	4	3	3	13	23
2014	6	5	1	13	25
2015	5	9	10	12	36
2016	3	16	7	26	52
2017	6	7	14	28	55

There are four categories of mackerel permits. When the fishery starts each year, the various commercial mackerel permit categories start with different trip limits. Tier 1 has an unlimited trip limit, Tier 2 has a 135,000 pound trip limit, and Tier 3 has a 100,000 pound trip limit. An open access/incidental permit has a 20,000 pound trip limit. When the fishery reaches 95% of the DAH, all permits have 20,000 pound trip limits. When the fishery reaches 100% of the DAH, all permits have 5,000 pound trip limits. When Tier 3 catches 7% of the overall commercial quota its trip limit goes to 20,000 pounds. In 2017 there were about 34 Tier 1 permits, 24 Tier 2 permits, 87 Tier 3 permits, and approximately 2000 open access/incidental permits.

Recreational Fishery

Recreational harvest has been variable without much trend over the 1981-2017 Marine Recreational Information Program (MRIP) time series (see figure below). In recent years most fish have been caught in New England states' waters (primarily Massachusetts, Maine, and New Hampshire) in May-October. Pending revisions to this time series will likely be incorporated into the next assessment update. There are no recreational regulations except for license/registry requirements.

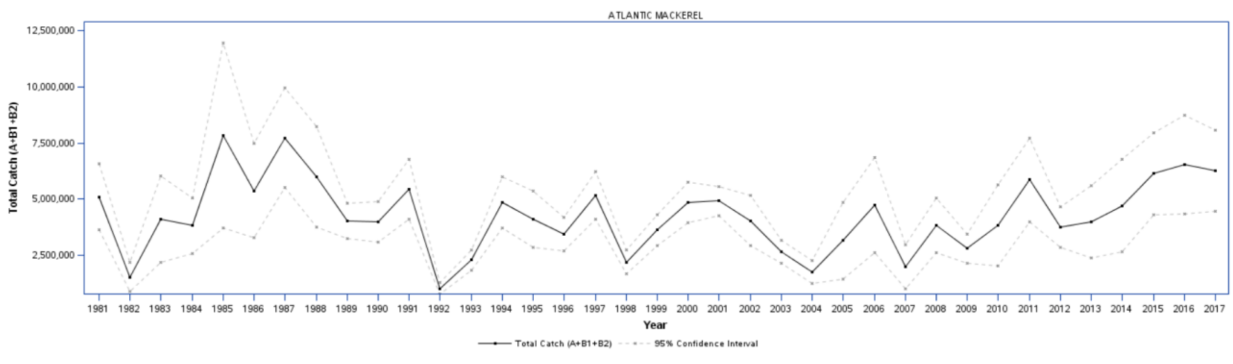


Figure 9. MRIP mackerel time series 1981-2017, total catch, numbers of fish.

6.3.2 Atlantic Herring

Detailed information on the herring fishery can be found in the most recent specifications Environmental Assessment (NEFMC 2016). Atlantic herring landings have been variable in the last decade, averaging about 90,000 mt, with the highest amount in 2009 (about 104,000 mt) and lowest in 2017 (about 50,000 mt). The herring fishery uses predominantly single and paired mid water trawl, bottom trawl, purse seine, and to a lesser extent, gillnet gear. Most landings are by midwater trawl gear (about 70%), followed by purse seine gear used exclusively in the Gulf of Maine (about 25%), and then bottom trawl gear (5-10%). The average dockside price of herring increased over the last decade, from $238 per mt in 2007 to $552 per mt in 2017. Total revenues for the fishery have been above $20 million dollars per year for some time, peaking above $30 million in 2013. 40 vessels landed over 10,000 pounds of herring in 2017.

6.4 Protected Species

Protected species are those afforded protections under the Endangered Species Act (ESA; species listed as threatened or endangered under the ESA) and/or the Marine Mammal Protection Act (MMPA). The table below provides a list of protected species that occur in the affected environment of the MSB fisheries and the potential for the fishery to impact the species, specifically via interactions with gear types primarily used to prosecute the MSB fishery (i.e., mid-water trawl and bottom trawl gear). Marine mammal species (cetaceans and pinnipeds) italicized and in bold are considered MMPA strategic stocks. Shaded rows indicate species who prefer continental shelf edge/slope waters (i.e., >200 meters).

Table 17. Species Protected Under the ESA and/or MMPA that May Occur in the Affected Environment of the MSB FMP

Species	**Status**[2]	***Observed/documented interactions with bottom trawl and/or mid-water trawl gear?***
Cetaceans		
North Atlantic right whale (Eubalaena glacialis)	***Endangered***	***No***
Humpback whale, West Indies DPS, (Megaptera novaeangliae)	***Protected (MMPA)***	***No***
Fin whale (Balaenoptera physalus)	***Endangered***	***No***
Sei whale (Balaenoptera borealis)	***Endangered***	***No***
Blue whale (Balaenoptera musculus)	***Endangered***	***No***
Sperm whale (Physeter macrocephalus	***Endangered***	***No***
Minke whale (*Balaenoptera acutorostrata*)	Protected (MMPA)	Yes
Pilot whale (Globicephala spp.)[3]	***Protected (MMPA)***	***Yes***
Pygmy sperm whale (*Kogia breviceps*)	Protected (MMPA)	No
Dwarf sperm whale (*Kogia sima*)	Protected (MMPA)	No
Risso's dolphin (*Grampus griseus*)	Protected (MMPA)	Yes
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Protected (MMPA)	Yes
Short Beaked Common dolphin (*Delphinus delphis*)	Protected (MMPA)	Yes
Atlantic Spotted dolphin (*Stenella frontalis*)	Protected (MMPA)	No
Striped dolphin (*Stenella coeruleoalba*)	Protected (MMPA)	No
Beaked whales (*Ziphius and Mesoplodon spp*)[4]	Protected (MMPA)	No
Bottlenose dolphin (Tursiops truncatus)[5]	***Protected (MMPA)***	***Yes***
Harbor porpoise (*Phocoena phocoena*)	Protected (MMPA)	Yes
Pinnipeds		
Harbor seal (*Phoca vitulina*)	Protected (MMPA)	Yes
Gray seal (*Halichoerus grypus*)	Protected (MMPA)	Yes

Species	Status[2]	*Observed/documented interactions with bottom trawl and/or mid-water trawl gear?*
Harp seal (*Phoca groenlandicus*)	Protected (MMPA)	Yes
Hooded seal (*Cystophora cristata*)	Protected (MMPA)	No
Sea Turtles		
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Yes
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Yes
Green sea turtle, North Atlantic DPS (*Chelonia mydas*)	Threatened	Yes
Loggerhead sea turtle (*Caretta caretta*), Northwest Atlantic Ocean DPS	Threatened	Yes
Hawksbill sea turtle (*Eretmochelys imbricate*)	Endangered	No
Fish		
Atlantic salmon	Endangered	Yes
Atlantic sturgeon *(Acipenser oxyrinchus)*		
Gulf of Maine DPS	Threatened	Yes
New York Bight DPS, Chesapeake Bay DPS, Carolina DPS & South Atlantic DPS	Endangered	Yes
Cusk *(Brosme brosme)*	Candidate	Yes
Alewife *(Alosa pseudoharengus)*	Candidate	Yes
Blueback herring *(Alosa aestivalis)*	Candidate	Yes
Critical Habitat		
Northwest Atlantic DPS of Loggerhead Sea Turtle	ESA (Protected)	No
North Atlantic Right Whale Critical Habitat	ESA (Protected)	No

Notes:

[1] A strategic stock is defined under the MMPA as a marine mammal stock for which: (1) the level of direct human-caused mortality exceeds the potential biological removal level; (2) based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; and/or (3) is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA (Section 3 of the MMPA of 1972).

[2] Status is defined by whether the species is listed under the ESA as endangered (i.e. at risk of extinction) or threatened (i.e. at risk of endangerment), or protected under the MMPA. Marine mammals listed under the ESA are also protected under the MMPA. Candidate species are those species for which ESA listing may be warranted.

[3] There are 2 species of pilot whales: short finned (*G. melas melas*) and long finned (*G. macrorhynchus*). Due to the difficulties in identifying the species at sea, they are often referred to as *Globicephala spp*.

[4] There are multiple species of beaked whales in the Northwest Atlantic. They include the cuvier's (*Ziphius cavirostris*), blainville's (*Mesoplodon densirostris*), gervais' (*Mesoplodon europaeus*), sowerbys' (*Mesoplodon bidens*), and trues' (*Mesoplodon mirus*) beaked whales. Species of *Mesoplodon* are difficult to identify at sea, therefore, much of the available characterization for beaked whales is to the genus level only.

[5] This includes the Western North Atlantic Offshore, Northern Migratory Coastal, and Southern Migratory Coastal Stocks of Bottlenose Dolphins.

Cusk, alewife, and blueback herring are NMFS "candidate species" under the ESA. Candidate species are those petitioned species for which NMFS has determined that listing may be warranted under the ESA and those species for which NMFS has initiated an ESA status review through an announcement in the Federal Register. If a species is proposed for listing the conference provisions under Section 7 of the ESA apply (see 50 CFR 402.10); however, candidate species receive no substantive or procedural protection under the ESA. As a result, these species will not be discussed further in this and the following sections; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on candidate species from any proposed action. Additional information on cusk, alewife, and blueback herring can be found at: https://www.fisheries.noaa.gov/endangered-species-conservation/candidate-species-under-endangered-species-act.

6.4.1. Protected Species and Critical Habitat Not Likely to be Affected (via interactions with gear or destruction of essential features of critical habitat) by the MSB fisheries

Based on available information, it has been determined that this action is not likely to affect (via interactions with gear or destruction of essential features of critical habitat) some ESA listed and/or marine mammal protected species or their designated critical habitat (see Table 17). This determination has been made because either the occurrence of the species is not known to overlap with the area primarily affected by the action and/or there have never been documented interactions between the species and the primary gear type used to prosecute the MSB fisheries (i.e., bottom otter and mid-water trawls); https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region;NMFS NEFSC FSB 2015, 2016, 2017, 2018; http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html). In the case of critical habitat, this determination has been made because operation of the MSB fisheries will not affect the essential physical and biological features of North Atlantic right whale or loggerhead (NWA DPS) critical habitat and therefore, will not result in the destruction or adverse modification of any species critical habitat (NMFS 2014; NMFS 2015a,b).

THIS SPACE INTENTIONALLY LEFT BLANK

6.4.2. Protected Species Potentially Affected by the Proposed Action

Table 17 also provides a list of protected species of sea turtle, marine mammal, and fish species present in the affected environment of the MSB fishery, and that may also be affected by the operation of this fishery; that is, have the potential to become entangled or bycaught in the fishing gear used to prosecute the fishery. To aid in the identification of MMPA protected species potentially affected by the action, the MMPA List of Fisheries and marine mammal stock assessment reports for the Atlantic Region were referenced (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries). To aid in identifying ESA listed species potentially affected by the action, the 2013 Biological Opinion issued by NMFS on the operation of seven commercial fisheries, including the MSB FMP, and its impact on ESA listed species was referenced (NMFS 2013) was referenced. The 2013 Opinion, which considered the best available information on ESA listed species and observed or documented ESA listed species interactions with gear types used to prosecute the 7 FMPs (e.g., gillnet, bottom trawl, and pot/trap), concluded that the seven fisheries may adversely affect, but was not likely to jeopardize the continued existence of any ESA listed species. The Opinion included an incidental take statement (ITS) authorizing the take of specific numbers of ESA listed species of sea turtles, Atlantic salmon, and Atlantic sturgeon. Reasonable and prudent measures and terms and conditions were also issued with the ITS to minimize impacts of any incidental take.

Up until recently, the 2013 Opinion remained in effect; however, new information on North Atlantic right whales has been made available that may reveal effects of the fisheries analyzed in the 2013 Opinion that may not have been previously considered. As a result, per an October 17, 2017, ESA 7(a)(2)/7(d) memo issued by NMFS, the 2013 Opinion has been reinitiated. However, the October 17, 2017, memo concludes that allowing these fisheries to continue during the reinitiation period will not increase the likelihood of interactions with ESA listed species above the amount that would otherwise occur if consultation had not been reinitiated, and therefore, the continuation of these fisheries during the reinitiation period would not be likely to jeopardize the continued existence of any ESA listed species. Until replaced, the MSB FMP is currently covered by the incidental take statement authorized in NMFS 2013 Opinion.

As the primary concern for both MMPA protected and ESA listed species is the potential for the fishery to interact (e.g., bycatch, entanglement) with these species it is necessary to consider (1) species occurrence in the affected environment of the fishery and how the fishery will overlap in time and space with this occurrence; and (2) data and observed records of protected species interaction with particular fishing gear types, in order to understand the potential risk of an interaction. Information on species occurrence in the affected environment of the MSB FMP is provided below, while information on protected species interactions with specific fishery gear is provided in section 6.4.3.

6.4.2.1. Sea Turtles

This section contains a brief summary of the occurrence and distribution of sea turtles in the affected environment of the MSB fisheries. Additional background information on the range-wide status of affected sea turtles species, as well as a description and life history of each of these species, can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; TEWG 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b; Conant et al. 2009; NMFS and USFWS 2013), and recovery plans for the loggerhead sea turtle (Northwest Atlantic DPS; NMFS and USFWS 2008), leatherback sea turtle (NMFS and USFWS 1992, 1998a), Kemp's ridley sea turtle (NMFS et al. 2011), and green sea turtle (NMFS and USFWS 1991, 1998b).

Hard-shelled sea turtles: In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, MA, although their presence varies with the seasons due to changes in water temperature (Braun-McNeill et al. 2008; Braun & Epperly 1996; Epperly et al. 1995a,b; Mitchell et al. 2003; Shoop & Kenney 1992; TEWG 2009; Blumenthal et al. 2006; Braun-McNeill & Epperly 2004; Griffin et al. 2013; Hawkes et al. 2006; Hawkes et al. 2011; Mansfield et al. 2009; McClellan & Read 2007; Mitchell et al. 2003; Morreale & Standora 2005). As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States and also move up the Atlantic Coast (Braun-McNeill & Epperly 2004; Epperly et al. 1995a,b,c; Griffin et al. 2013; Morreale & Standora 2005), occurring in Virginia foraging areas as early as late April and on the most northern foraging grounds in the Gulf of Maine (GOM) in June (Shoop & Kenney 1992). The trend is reversed in the fall as water temperatures cool. The majority leave the Gulf of Maine by September, but some remain in Mid-Atlantic and Northeast areas until November. By December, sea turtles have migrated south to waters offshore of North Carolina, particularly south of Cape Hatteras, NC and further south, although hard-shelled sea turtles can occur year-round in waters off Cape Hatteras, NC, and south (Epperly et al. 1995b; Griffin et al. 2013; Hawkes et al. 2011; Shoop & Kenney 1992).

Leatherback sea turtles: Leatherbacks, a pelagic species, are known to use coastal waters of the U.S. continental shelf and to have a greater tolerance for colder water than hard-shelled sea turtles (James et al. 2005; Eckert et al. 2006; Murphy et al. 2006; NMFS and USFWS 2013; Dodge et al. 2014). Leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992; James et al. 2005; James et al. 2006; Dodge et al. 2014). They are found in more northern waters (i.e., Gulf of Maine) later in the year (i.e., similar time frame as hard-shelled sea turtles), with most leaving the Northwest Atlantic shelves by mid-November (James et al. 2005; James et al. 2006; Dodge et al. 2014).

6.4.2.2. Large Whales

Multiple species of whales occur in the Northwest Atlantic, with the minke whale being the only whale species potentially affected by the proposed action. In general, large whales, such as minke whales, follow an annual pattern of migration between low latitude (south of 35oN) wintering/calving grounds and high latitude spring/summer foraging grounds (primarily north of 41oN; Hayes et al. 2018; NMFS 1991, 2005, 2010b, 2011a, 2012b). This, however, is a simplification of whale movements, particularly as it relates to winter movements. It remains unknown if all individuals of a population migrate to low latitudes in the winter, although, increasing evidence suggests that for some species (e.g. right and humpback whales), some portion of the population remains in higher latitudes throughout the winter (Hayes et al. 2017; Khan et al. 2009, 2010, 2011, 2012; Brown et al. 2002; NOAA 2008; Cole et al. 2013; Clapham et al. 1993; Swingle et al. 1993; Vu et al. 2012). Although further research is needed to provide a clearer understanding of large whale movements and distribution in the winter, the distribution and movements of large whales to foraging grounds in the spring/summer is well understood. Movements of whales into higher latitudes coincide with peak productivity in these waters. As a result, the distribution of large whales in higher latitudes is strongly governed by prey availability and distribution, with large numbers of whales coinciding with dense patches of preferred forage (Mayo and Marx 1990; Kenney et al. 1986, 1995; Baumgartner et al. 2003; Baumgartner and Mate 2003; Payne et al.1986, 1990; Brown et al. 2002; Kenney and Hartley 2001; Schilling et al. 1992). For additional information on the biology, status, and range wide distribution of whale species, such as the minke whale, please refer to marine mammal stock assessment reports provided at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.

6.4.2.3. Small Cetaceans and Pinnipeds

Table 13 lists the small cetaceans and pinnipeds that may occur in the affected environment of the MSB fisheries. Small cetaceans can be found throughout the year in the Northwest Atlantic Ocean; however, within this range, there are seasonal shifts in species distribution and abundance. Pinnipeds are primarily found throughout the year or seasonally from New Jersey to Maine; however, increasing evidence indicates that some species (e.g., harbor seals) may be extending their range seasonally into waters as far south as Cape Hatteras, NC (35oN). For additional information on the biology and range wide distribution of each species of small cetacean and pinniped provided in Table 18 please refer to the marine mammal stock assessment reports provided at: http://www.nmfs.noaa.gov/pr/sars/region.htm.

6.4.2.4. Atlantic Sturgeon

The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. All five DPSs of Atlantic sturgeon have the potential to be located anywhere in this marine range (ASSRT 2007; Dovel and Berggren 1983; Dadswell et al. 1984; Kynard et al. 2000; Stein et al. 2004a; Dadswell 2006; Laney et al. 2007; Dunton et al. 2010, 2015; Erickson et al. 2011; Wirgin et al. 2012; Waldman et al. 2013; O'Leary et al. 2014; Wirgin et al. 2015a,b; ASMFC 2017). Based on fishery-independent and dependent data, as well as data collected from tracking and tagging studies, in the marine environment, Atlantic sturgeon appear to primarily occur inshore of the 50 meter depth contour (Stein et al. 2004 a,b; Erickson et al. 2011; Dunton et al. 2010); however, Atlantic sturgeon are not restricted to these depths, as excursions into deeper continental shelf waters have been documented (Timoshkin 1968; Collins and Smith 1997; Stein et al. 2004a,b; Dunton et al. 2010; Erickson et al. 2011). Data from fishery-independent surveys and tagging and tracking studies also indicate that Atlantic sturgeon may undertake seasonal movements along the coast (Dunton et al. 2010; Erickson et al. 2011; Wipplehauser 2012); however, there is no evidence to date that all Atlantic sturgeon make these seasonal movements and therefore, may be present throughout the marine environment throughout the year. For additional information on the biology, status, and range wide distribution of each distinct population segment (DPS) of Atlantic sturgeon please refer to 77 FR 5880 and 77 FR 5914, as well as the Atlantic Sturgeon Status Review Team's (ASSRT) 2007 status review of Atlantic sturgeon (ASSRT 2007) and the Atlantic States Marine Fisheries Commission 2017 Atlantic Sturgeon Benchmark Stock Assessment and Peer Review Report (ASMFC 2017).

6.4.2.5 Atlantic Salmon

The wild populations of Atlantic salmon are listed as endangered under the ESA. Their freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, while the marine range of the Gulf of Maine DPS extends from the Gulf of Maine (primarily northern portion of the Gulf of Maine) to the coast of Greenland (NMFS and USFWS 2005, 2016; Fay et al. 2006). In general, smolts, post-smolts, and adult Atlantic salmon may be present in the Gulf of Maine and coastal waters of Maine in the spring (beginning in April), and adults may be present throughout the summer and fall months (Baum 1997; Fay et al. 2006; USASAC 2004; Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004, 2005; Reddin 1985; Reddin and Short 1991; Reddin and Friedland 1993, Sheehan et al. 2012; NMFS and USFWS 2005, 2016; Fay et al. 2006). For additional information on the on the biology, status, and range-wide distribution of the Gulf of Maine DPS of Atlantic salmon please refer to NMFS and USFWS 2005, 2016; Fay et al. 2006.

6.4.3. Gear Interactions with Protected Species

Several protected species are vulnerable to interactions with various types of fishing gear. Interaction risks vary by gear type, quantity, and soak or tow time. Available information on gear interactions with a given protected species (or species group) is provided in the sections below. These sections are not a comprehensive review of all fishing gear types known to interact with a given species; focus is placed on interaction risks associated with bottom trawls or midwater trawls, the primary gear types used in the MSB fisheries.

6.4.3.1. Gear Interactions with Sea Turtles

Bottom Otter Trawl

Sea turtle interactions with bottom trawl gear have been observed on Georges Bank, and in the Mid-Atlantic; however, most of the observed interactions have occurred in the Mid-Atlantic (Warden 2011a,b; Murray 2015). As no sea turtle interactions with bottom trawl gear have been observed in the Gulf of Maine, and few sea turtle interactions have been observed on Georges Bank, there is insufficient data available to conduct a robust model-based analysis on sea turtle interactions with bottom trawl gear in these regions or produce a bycatch estimate for these regions. As a result, the bycatch estimates and discussion below are for bottom trawl gear in the Mid-Atlantic.

Bottom trawl gear poses an injury and mortality risk to sea turtles, specifically due to forced submergence (Sasso and Epperly 2006). Green, Kemp's ridley, leatherback, loggerhead, and unidentified sea turtles have been documented interacting (e.g., bycaught) with bottom trawl gear. However, estimates are available only for loggerhead sea turtles. Warden (2011a,b) estimated that from 2005-2008, the average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic[8] was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls, but released through a Turtle Excluder Device (TED).[9] The 292 average annual observable loggerhead interactions equates to approximately 44 adult equivalents (Warden 2011a,b). Most recently, Murray (2015) estimated that from 2009-2013, the total average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic[10] was 231 (CV=0.13, 95% CI=182-298); this equates to approximately 33 adult equivalents (Murray 2015). Bycatch estimates provided in Warden (2011a) and Murray (2015) are a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-

[8] Warden (2011a) defined the Mid-Atlantic as south of Cape Cod, Massachusetts, to approximately the North Carolina/South Carolina border.

[9] TEDs allow sea turtles to escape the trawl net, reducing injury and mortality resulting from capture in the net. Approved TEDs are required in the shrimp and summer trawl fishery. For further information on TEDs see 50 CFR 223.206 and 68 FR 8456 (February 21, 2003).

[10] Murray 2015b defined the Mid-Atlantic as the boundaries of the Mid-Atlantic Ecological Production; roughly waters west of 71°W to the North Carolina/South Carolina border)

2004, which Murray (2008) estimated at 616 sea turtles (CV=0.23, 95% CI over the nine-year period: 367-890). This decrease is likely due to decreased fishing effort in high-interaction areas (Warden 2011a, b).

Mid-Water Trawl

NEFOP and ASM observer data from 1989 to 2016 show five leatherback sea turtle interactions with mid-water trawl gear; the primary species landed during these interactions was tuna (NMFS NEFSC FSB 2015, 2016, 2017, 2018). These takes were in the early 1990s in an experimental HMS fishery that no longer operates. No takes have been documented in other mid-water trawl fisheries operating in the Greater Atlantic Region. Based on this and the best available information, sea turtle interactions in mid-water trawl gear in the Greater Atlantic Region are expected to be rare.

6.4.3.2. Gear Interactions with Atlantic Sturgeon

Bottom Otter Trawl

Atlantic sturgeon interactions (i.e., bycatch) with bottom trawl gear have been observed since 1989; these interactions have the potential to result in the injury or mortality of Atlantic sturgeon (NMFS NEFSC FSB 2015, 2016, 2017, 2018). Three documents, covering three time periods, that use data collected by the Northeast Fisheries Observer Program to describe bycatch of Atlantic sturgeon in bottom trawl gear: Stein et al. (2004b) for 1989-2000; ASMFC (2007b) for 2001-2006; and Miller and Shepard (2011) for 2006-2010; none of these documents provide estimates of Atlantic sturgeon bycatch by Distinct Population Segment. Miller and Shepard (2011), the most recent of the three documents, analyzed fishery observer data and VTR data in order to estimate the average annual number of Atlantic sturgeon interactions in otter trawl in the Northeast Atlantic that occurred from 2006 to 2010. This timeframe included the most recent, complete data and as a result, Miller and Shepard (2011) is considered to represent the most accurate predictor of annual Atlantic sturgeon interactions in the Northeast bottom trawl fisheries (NMFS 2013).

Based on the findings of Miller and Shepard (2011), NMFS (2013) estimated that the annual bycatch of Atlantic sturgeon in bottom trawl gear to be 1,342 sturgeon. Miller and Shepard (2011) reported observed Atlantic sturgeon interactions in trawl gear with small (< 5.5 inches) and large (≥ 5.5 inches) mesh sizes and concluded that, based on NEFOP observed sturgeon mortalities, relative to gillnet gear, bottom trawl gear posed less risk of mortality to Atlantic sturgeon. Estimated mortality rates in gillnet gear were 20.0%, while those in otter trawl gear were 5.0% (Miller and Shepard 2011; NMFS 2013). Similar conclusions were reached in Stein *et al*. (2004b) and ASMFC (2007b) reports; after review of observer data from 1989-2000 and 2001-2006, both studies concluded that observed mortality is much higher in gillnet gear than in trawl gear. However, an important consideration to these findings is that observed mortality is considered a minimum of what actually occurs and therefore, the conclusions reached by Stein *et al*. (2004b), ASMFC (2007b), and Miller and Shepard (2011) are not reflective of the total mortality associated with either gear type. To date, total Atlantic sturgeon mortality associated with gillnet or trawl gear remains uncertain.

Mid-Water Trawl

To date, there have been no observed/documented interactions with Atlantic sturgeon in mid-water trawl gear (NMFS NEFSC FSB 2015, 2016, 2017, 2018). Based on this information, mid-water trawl gear is not expected to pose an interaction risk to any Atlantic sturgeon and therefore, is not expected to be source of injury or mortality to this species.

6.4.3.3. Gear Interaction with Atlantic Salmon

Bottom Otter Trawl

Atlantic salmon interactions (i.e., bycatch) with bottom trawl have been observed since 1989; in many instances, these interactions have resulted in the injury and mortality of Atlantic salmon (NMFS NEFSC FSB 2015, 2016, 2017, 2018). According to the Biological Opinion issued by NMFS Greater Atlantic Regional Fisheries Office on December 16, 2013, NMFS Northeast Fisheries Science Center's (NEFSC) Northeast Fisheries Observer and At-Sea Monitoring Programs documented a total of 15 individual salmon incidentally caught on more than 60,000 observed commercial fishing trips from 1989 through August 2013 (NMFS 2013; Kocik *et al*. 2014); of those 15 salmon, four were observed caught in bottom trawl gear (Kocik (NEFSC), pers. comm (February 11, 2013) in NMFS 2013).The genetic identity of these captured salmon is unknown; however, the NMFS 2013 Biological Opinion considers all 15 fish to be part of the Gulf of Maine Distinct Population Segment, although some may have originated from the Connecticut River restocking program (i.e., those caught south of Cape Cod, Massachusetts). Since 2013, no additional Atlantic salmon have been observed in bottom trawl gear (NMFS NEFSC FSB 2015, 2016, 2017, 2018). Based on the above information, bottom trawl interactions with Atlantic salmon are likely rare (NMFS 2013; Kocik *et al*. 2014).

Mid-Water Trawl

To date, there have been no observed/documented interactions with Atlantic salmon and mid-water trawl gear (NMFS NEFSC FSB 2015, 2016, 2017, 2018). Based on this information, mid-water trawls or purse seines are not expected to pose an interaction risk to any Atlantic salmon and therefore, are not expected to be source of injury or mortality to this species.

6.4.3.4. Gear Interactions with Marine Mammals

Depending on species, marine mammal interactions have been observed in bottom trawl, purse seine, and/or mid-water trawl gear. Pursuant to the MMPA, NMFS publishes a List of Fisheries (LOF) annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injuries and/or mortalities of marine mammals in each fishery (i.e., Category I=frequent; Category II=occasional; Category III=remote likelihood or no known interactions). In the Northwest Atlantic, the 2018 LOF (83 FR 5349 (February 7, 2018)) categorizes the commercial MSB fisheries, which are primarily prosecuted with bottom and mid-water trawl gears, as a Category II bottom trawl (Northeast and Mid-Atlantic) or Category II mi-water (Northeast and Mid-Atlantic) fishery.

Large Whales

Bottom Otter and Mid-Water Trawls

With the exception of one species, there have been no observed interactions with large whales and trawl (bottom or mid-water) gear. The one exception is minke whales, which have been observed seriously injured and killed in both types of trawl gear. Over the past10 years, there have been two (2) observed minke whales incidentally taken in mid-water trawl gear. These occurred in 2009 and 2013, with the 2009 incident resulting from entanglement in NOAA research mid-water trawl gear (whale released alive, but seriously injured), and the 2013 incident resulting from entanglement in a Northeast mid-water trawl (including pair trawl) fishery (whale was dead, moderately decomposed) (see http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html; Waring *et al*. 2016; Henry *et al*. 2015). Based on the latter incident, as provided in Waring *et al*. (2016), the estimated annual average minke whale mortality and serious injury from the Northeast mid-water trawl (including pair trawl) fishery from 2009 to 2013 is 0.2. Most recently, based on information provided by Henry et al. (2017) and Hayes *et al*. (2018) the estimated annual average minke whale mortality and serious injury from the Northeast mid-water trawl (including pair trawl) fishery from 2011 to 2015 was zero.

In bottom trawl gear, to date, interactions have only been observed in the northeast bottom trawl fisheries. From the period of 2008-2012, the estimated annual mortality attributed to this fishery was 7.8 minke whales for 2008 and zero minke whales from 2009-2012; no serious injuries were reported during this time (Waring et al. 2015). Based on this information, from 2008-2012, the estimated annual average minke whale mortality and serious injury attributed to the northeast bottom trawl fishery was 1.6 (CV=0.69) whales (Waring et al. 2015). Lyssikatos (2015) estimated that from 2008-2013, mean annual serious injuries and mortalities from the northeast bottom trawl fishery were 1.40 (CV=0.58) minke whales. Serious injury and mortality records for minke whales in U.S. waters from 2010-2015 showed zero interactions with bottom trawl (northeast or Mid-Atlantic) gear (Henry et al. 2016; Henry et al. 2017; Hayes et al. 2017; Hayes et al. 2018).

Based on above information, trawl gear is likely to pose a low interaction risk to any large whale species. Should an interaction occur, serious injury or mortality to any large whale is possible;

however, relative to other gear types, such as fixed gear, trawl gear represents a low source serious injury or mortality to any large whale (Henry et al. 2016; Henry et al. 2017; Hayes et al. 2017; Hayes et al. 2018).

Small Cetaceans and Pinnipeds

Bottom and Mid-Water Trawl Gear

Small cetaceans and pinnipeds are vulnerable to interactions with bottom and/or mid-water trawl gear (Read et al. 2006; Lyssikatos 2015; Chavez-Rosales et al. 2017; Waring et al. 2014a; Waring et al. 2015; Waring et al. 2016; Hayes et al. 2017; Hayes et al. 2018; 83 FR 5349 (February 7, 2018)). Based on the most recent Marine Mammal List of Fisheries (LOF) issued on February 7, 2018 (83 FR 5349), Table 18 provides a list of species that have been observed (incidentally) seriously injured and/or killed by List of Fisheries Category II trawl fisheries that operate in the affected environment of the MSB fisheries (83 FR 5349 (February 7, 2018)).

Table 18. Small cetacean and pinniped species observed seriously injured and/or killed by Category II trawl fisheries in the affected environment of the MSB fisheries.

Fishery	Category	Species Observed or reported Injured/Killed
Mid-Atlantic Mid-Water trawl (including pair trawl)	II	Gray seal
		Harbor seal
Northeast Midwater Trawl- Including Pair Trawl	II	Short-beaked common dolphin
		Long-finned pilot whales
		Gray seal
		Harbor seal
Northeast Bottom Trawl	II	Harp, Harbor, Gray seals
		Long-finned pilot whales
		Short-beaked common dolphin
		White-sided dolphin
		Harbor porpoise
		Bottlenose dolphin (offshore)
		Risso’s dolphin
Mid-Atlantic Bottom Trawl	II	White-sided dolphin
		Short-beaked common dolphin
		Risso’s dolphin
		Bottlenose dolphin (offshore)
		Gray, Harbor seals
Sources: MMPA LOF 83 FR 5349 (February 7, 2018).		

In 2006, based on observed mid-water trawl interactions with long-finned pilot whales, short - finned pilot whales, common dolphins, and white sided dolphins, the Atlantic Trawl Gear Take Reduction Team (ATGTRT) was convened to address the incidental mortality and serious injury of these species incidental to bottom and mid-water trawl fisheries operating in both the New England and Mid-Atlantic regions. Because none of the marine mammal stocks of concern to the ATGTRT are classified as a “strategic stock”, nor do they currently interact with a Category I fishery,[11] it was determined that development of a take reduction plan was not necessary. In lieu of a take reduction plan, the ATGTRT agreed to develop an Atlantic Trawl Gear Take Reduction Strategy (ATGTRS). The ATGTRS identifies informational and research tasks, as well as education and outreach needs the ATGTRT believes are necessary to provide the basis for decreasing mortalities and serious injuries of marine mammals to insignificant levels approaching zero. The ATGTRS also identifies several voluntary measures that can be adopted by certain trawl fishing sectors to potentially reduce the incidental capture of marine mammals.[12]

THIS SPACE INTENTIONALLY LEFT BLANK

[11] Category I fisheries have frequent incidental mortality and serious injury of marine mammals.

[12] For additional details on the ATGTRS, visit: http://www.greateratlantic.fisheries.noaa.gov/Protected/mmp/atgtrp/

7.0 Biological and Human Community Impacts

The alternatives considered are fully described in section 5 and summarized below.

For habitat, protected resource, and non-target species impacts, the key determinant is not so much the catch itself but the amount and character of the related effort. A decrease in effort may result in positive impacts (+) as a result of fewer encounters and/or fewer habitat impacts from fishing gear, while an increase in effort may result in a negative impact (-). Similar effort likely results in neutral impacts (0). The table immediately below illustrates that the availability of the target species can drive effort as much as any quota change, and as effort changes so would impacts on habitat, protected resources, and non-target species. This is noted for the habitat, protected resource, and non-target species sections since the MSB fisheries often experience large swings in availability and therefore effort, independent of any regulatory changes. Since limits on catch do cap effort, catch limits are a factor related to effort and impacts but many other factors are at least somewhat beyond the control of the Council (such as fish abundance, availability of other opportunities, weather, climate, fish movements/ availability, variable productivity, etc.).

National Oceanic and Atmospheric Administration Administrative Order 216-6A and the Companion Manual contains criteria for determining the significance of the impacts of a proposed action and it includes the possibility of introducing or spreading a nonindigenous species. This potential impact does not fit into the sections below so it is addressed in this introduction. There is no evidence or indication that these fisheries have ever resulted or would ever result in the introduction or spread of nonindigenous species.

THIS SPACE INTENTIONALLY LEFT BLANK

Table 19. Changes in effort as a result of adjustments to quota and/or fish availability.

Change in quota	Fish abundance/availability		
	Decrease in availability	**No change in availability**	**Increase in availability**
Decrease in quota	Fishing effort may decrease, increase, or stay the same depending on a combination of factors[13].	Effort likely to decrease or stay the same. If per trip catch stays the same, the fishery will be closed earlier with fewer trips taken (reducing effort). However managers may reduce trip limits or adjust regulations that extend the fishing season (keeping effort the same).	Effort likely to decrease or stay the same. A lower quota plus higher catch per unit of effort (CPUE) from higher availability should decrease effort. However, managers may reduce trip limits or adjust regulations that extend the fishing season which may keep effort relatively even.
No change in quota	Effort may increase or decrease. Even with no change, fishermen may take more trips to catch the same amount of fish (increasing effort) or may stop targeting a stock of fish if availability is low enough to decrease profitability (decreasing effort).	Fishing effort may remain the same given the quota has not changed and availability is expected to be similar.	Effort should decrease. While the quota has not changed, fishermen should be able to take fewer trips to catch the same amount of fish (decreasing effort).
Increase in quota	Fishing effort likely to increase or stay the same. A higher quota plus lower catch per unit of effort from lower availability should increase effort. However, managers may increase trip limits or adjust regulations to allow more efficient fishing (keeping effort the same).	Effort likely to increase or stay the same. If per trip catch stays the same, the fishery will be closed later with more trips taken (increasing effort). However managers may increase trip limits or adjust regulations to allow more efficient fishing (keeping effort the same).	Fishing effort may decrease, increase, or stay the same depending on a combination of factors.

[13] Factors affecting fishing effort include other species abundance, availability of other opportunities, weather, climate, fish movements/availability, variable productivity, and market forces/price changes.

Environmental impacts are described both in terms of their direction (negative, positive, or no impact) and their magnitude (slight, moderate, or high). The table below summarizes the guidelines used for each VEC to determine the magnitude and direction of the impacts described in this section.

Table 20. General definitions for impacts and qualifiers relative to resource condition (i.e., baselines)

General Definitions				
VEC	Resource Condition	Impact of Action		
		Positive (+)	Negative (-)	No Impact (0)
Target and non-target Species	Overfished status defined by the MSA	Alternatives that maintain or are projected to result in a stock status above an overfished condition*	Alternatives that maintain or are projected to result in a stock status below an overfished condition*	Alternatives that do not impact stock / populations
ESA-listed protected species (endangered or threatened)	Populations at risk of extinction (endangered) or endangerment (threatened)	Alternatives that contain specific measures to ensure no interactions with protected species (i.e., no take)	Alternatives that result in interactions/take of listed species, including actions that reduce interactions	Alternatives that do not impact ESA listed species
MMPA protected species (not also ESA listed)	Stock health may vary but populations remain impacted	Alternatives that maintain takes below PBR and approaching the Zero Mortality Rate Goal	Alternatives that result in interactions with/take of marine mammals that could result in takes above PBR	Alternatives that do not impact MMPA protected species
Physical environment / habitat / EFH	Many habitats degraded from historical effort and slow recovery time (see condition of the resources table)	Alternatives that improve the quality or quantity of habitat or allow for recovery	Alternatives that degrade the quality/quantity or increase disturbance of habitat	Alternatives that do not impact habitat quality
Human communities (socioeconomic)	Highly variable but generally stable in recent years (see condition of the resources table for details)	Alternatives that increase revenue and social well-being of fishermen and/or communities	Alternatives that decrease revenue and social well-being of fishermen and/or communities	Alternatives that do not impact revenue and social well-being of fishermen and/or communities
	Impact Qualifiers			
A range of impact qualifiers is used to indicate any existing uncertainty	Negligible		To such a small degree to be indistinguishable from no impact	
	Slight (sl), as in slight positive or slight negative		To a lesser degree / minor	
	Moderate (M) positive or negative		To an average degree (i.e., more than "slight", but not "high")	
	High (H), as in high positive or high negative		To a substantial degree (not significant unless stated)	
	Significant (in the case of an EIS)		Affecting the resource condition to a great degree, see 40 CFR 1508.27.	
	Likely		Some degree of uncertainty associated with the impact	
*Actions that will substantially increase or decrease stock size, but do not change a stock status may have different impacts depending on the particular action and stock. Meaningful differences between alternatives may be illustrated by using another resource attribute aside from the MSA status, but this must be justified within the impact analysis.				

The table below summarizes the baseline conditions of the VECs considered in this action, as described in Section 6.

Table 21. Summary Baseline conditions of VECs considered in this action

VEC		**Baseline Condition**	
		Status/Trends, Overfishing?	**Status/Trends, Overfished?**
Target stocks (section 6.1)	**Atl. mackerel**	Yes through 2016, projected to be below overfishing threshold in 2017 and beyond.	Yes in 2016. Projected to be above overfished threshold in 2018 and beyond. A rebuilding program is being proposed in this action.
	Butterfish	No	No
	Longfin Squid	Unknown, believed lightly exploited.	No
	***Illex* Squid**	Unknown	Unknown, NEFSC fall bottom trawl surveys are highly variable and without trend
Non-target species (principal species listed in section 6.1)	silver hake	no	No
	spiny dogfish	no	No
	alewife	Unknown	depleted
	blueback herring	Unknown	depleted
	American shad	Unknown	depleted
	haddock	no	No
	red hake	yes	yes
	winter (big) skate	no	No
	john dory buckler	Unknown	Unknown
Habitat (section 6.2)		Commercial fishing impacts are complex and variable and typically adverse; Recreational fishing impacts are typically minimal. Non-fishing activities had historically negative but site-specific effects on habitat quality.	
Protected resources (section 6.4)	**Sea turtles**	Leatherback and Kemp's ridley sea turtles are classified as endangered under the ESA; loggerhead (NW Atlantic DPS) and green (North Atlantic DPS) sea turtles are classified as threatened.	
	Fish	Atlantic salmon, shortnose sturgeon, and the New York Bight, Chesapeake, Carolina, and South Atlantic DPSs of Atlantic sturgeon are classified as endangered under the ESA; the Atlantic sturgeon Gulf of Maine DPS is listed as threatened; cusk, alewife, and blueback herring are candidate species	
	Large whales	All large whales in the Northwest Atlantic are protected under the MMPA. North Atlantic right, fin, blue, sei, and sperm whales are also listed as endangered under the ESA. Pursuant to section 118 of the MMPA, the Large Whale Take Reduction Plan was implemented to reduce humpback, North Atlantic right, and fin	

		whale entanglement in vertical lines associated with fixed fishing gear (sink gillnet and trap/pot) and sinking groundlines.
	Small cetaceans	Pilot whales, dolphins, and harbor porpoise are all protected under the MMPA. Pursuant to section 118 of the MMPA, the HPTRP and BDTRP was implemented to reduce bycatch of harbor porpoise and bottlenose dolphin stocks, respectively, in gillnet gear.
	Pinnipeds	Gray, harbor, hooded, and harp seals are protected under the MMPA.
Human communities (section 6.3)		The MSB stocks support substantial fisheries and related support services.

The table below provides a summary of the alternatives for ease of reference in this Section. See Section 5 for details.

Table 22. Alternatives Summary

Alt. Set 1	1a	No action on ABCs or other specifications. 3-year or less rebuilding. Lowest catches.
	1b	P* ABCs, no adjustment to risk policy, 3-year rebuilding. Medium-low catches.
	1c (preferred)	5-year rebuilding ABCs, adjustment to risk policy. Medium-high catches.
	1d	7-year rebuilding ABCs, adjustment to risk policy. Highest catches.
Alt. Set 2	2a	No action on in-season commercial closure measures (directed fishery closes at 95%, 20,000-pound trip limit for incidental permits and all permits after directed fishery closure. 5000-pound trip limit at 100% of DAH.
	2b	At 80% of the DAH, 40,000-pound trip limit for directed permits and 5,000 pounds for incidental permits (who start at 20,000 pounds). At 98% of the DAH, 5,000-pound trip limit for all permits.
	2c	At 85% of the DAH, 20,000-pound trip limit for directed permits and 5,000 pounds for incidental permits (who start at 20,000 pounds). At 98% of the DAH, 5,000-pound trip limit for all permits.
	2d (preferred)	At 90% of the DAH, 40,000-pound trip limit for directed permits and 5,000 pounds for incidental permits (who start at 20,000 pounds). At 98% of the DAH, 5,000-pound trip limit for all permits.
Alt. Set 3	3a	No action on RH/S Cap absolute value; lowest cap and tolerated encounter ratio.
	3b (preferred)	Scale RH/S based on the 2015 ratio of 0.74% of mackerel DAH. Medium cap and encounter ratio.
	3c	Scale RH/S based on the current ratio of 0.89% of mackerel DAH. Highest cap and encounter ratio.
	3d (preferred)	Add a low mackerel catch trigger to 3b or 3c as was done in 2015.

7.1 Managed Resources

7.1.1 Impacts on Mackerel

Current resource condition: mackerel are overfished with overfishing occurring in 2016 (see NOAA "FSSI and Non-FSSI Stock Status Table" at https://www.fisheries.noaa.gov/national/population-assessments/fishery-stock-status-updates). The impacts of Alternative Set 1, which sets the mackerel catch limits, are relatively more substantial than Alternative Sets 2 and 3, which more affect how the fishery operates within the catch limits considered in Alternative Set 1.

Alternative Set 1- Rebuilding

Overview

Any of the proposed alternatives or alternative combinations (including no action) are projected to rebuild mackerel in 7 years or less. As such, they should all have a positive impact on the mackerel stock. Alternatives that result in lower catches and therefore lower fishing mortality will have a faster positive impact (1a fastest, then 1b, then 1c, then 1d slowest). No specific projections were run for 1a, but it involves substantially less catch over 3 years than any other alternative so would likely rebuild fastest.

While it may seem unusual that catches can increase initially during the rebuilding period, there is also the context that catch limits (or their historical equivalent) were reduced 82% from 1997-2009 and then an additional 91% from 2009-2016, for a total reduction of more than 98% between 1997 and 2018. The 2014 and especially 2015 year classes in the recent benchmark assessment drive the rebuilding projections and allow the catch increases from the already substantially lowered catch limits. As is normal for terminal years in an assessment, recruitment estimates in the last couple of years are relatively uncertain and the 2016 recruitment (2015 year class) is the most uncertain estimate of the model, but no consistent retrospective trends are apparent. The resulting stock size under all options is very similar after three years, i.e. all are more than 90% of the SSBmsyproxy target after three years (by 2021).

Once the stock is rebuilt then the ABCs would return to the standard P* approach. The table below provides estimates for SSB over 10-years for 1b-1d based on the rebuilding projections through the rebuilding time period and then approximates biomass based on the standard P* approach once rebuilt. Once rebuilt, biomass under all alternatives converges to around 240,000 MT if the P* approach with a 100% C.V. is used once the stock is rebuilt (about 9 years for 1b, 13 years for 1c, and 15 years for 1d). 1a would be similar to 1b but very slightly lower biomass in 2019 and higher biomasses in later years.

Table 23. Estimated 10-year Biomasses Based on Projections

	Projected Biomass Each Year (MT)										
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
1b, P*, 3-year	138,947	167,103	190,164	204,307	213,576	220,923	226,164	232,437	236,224	238,775	240,254
1c, 5-year	138,968	162,796	176,538	184,399	190,926	196,922	200,307	209,576	216,923	222,164	228,437
1d, 7-year	138,968	162,034	174,076	180,452	185,866	190,978	194,255	197,292	198,650	207,919	215,266

Specific Alternatives

1a. No specific rebuilding projections were run for the no-action alternative, but since 1a involves 24% less catch than even 1b over 3 years and is very similar in 2019, (19,898 MT in all years for 1a) it would be expected to lead to the fastest 3-year increases in the mackerel stock and rebuild it within 3 years since 1b, with higher catches, would rebuild the stock within 3 years. As such, no action would have the most positive impact on mackerel of all the rebuilding alternatives, even though the current condition of mackerel is overfished.

1b. The projection methodology reviewed and approved during the most recent mackerel benchmark assessment indicates 1b should rebuild the mackerel stock in three years, i.e. the stock would be slightly above 100% of the SSBmsyproxy target in three years. The figure below shows the rebuilding trajectory for 1b over 2019-2021 in the context of historical catches and recruitment. 1b would have less of a positive impact than no action (1a) but more positive than 1c or 1d. The focus is on 2019-2021 because an expected assessment update in 2020 will likely result in new biomass estimates and suggest different catches in 2021 and beyond.

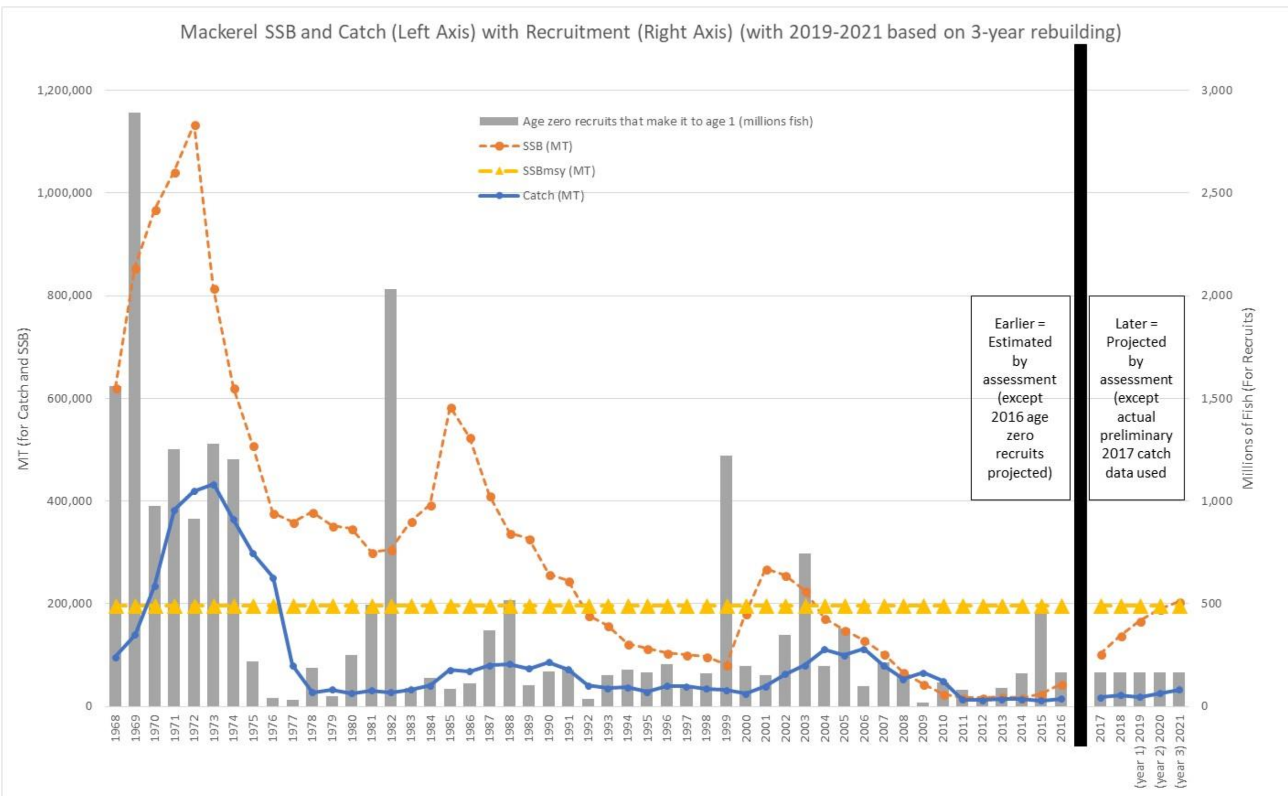


Figure 10. Mackerel SSB and catch including 2019-2021 P* projections under 1b (3-year rebuilding)

1c. (PREFERRED) The projection methodology reviewed and approved during the most recent mackerel benchmark assessment indicates 1c should rebuild the mackerel stock in five years, i.e. the stock would be slightly above 100% of the SSBmsyproxy target in five years. In three years it would be at 94% of the SSBmsyproxy target. The figure below shows the rebuilding trajectory for 1c over 2019-2021 in the context of historical catches and recruitment. From 2022-2023 biomass would continue to increase slightly up to the SSBmsyproxy target under a 5-year rebuilding plan. 1c would have less of a positive impact than no action (1a) or 1b, but more positive than 1d. The focus is on 2019-2021 because an expected assessment update in 2020 will likely result in new biomass estimates and suggest different catches in 2021 and beyond.

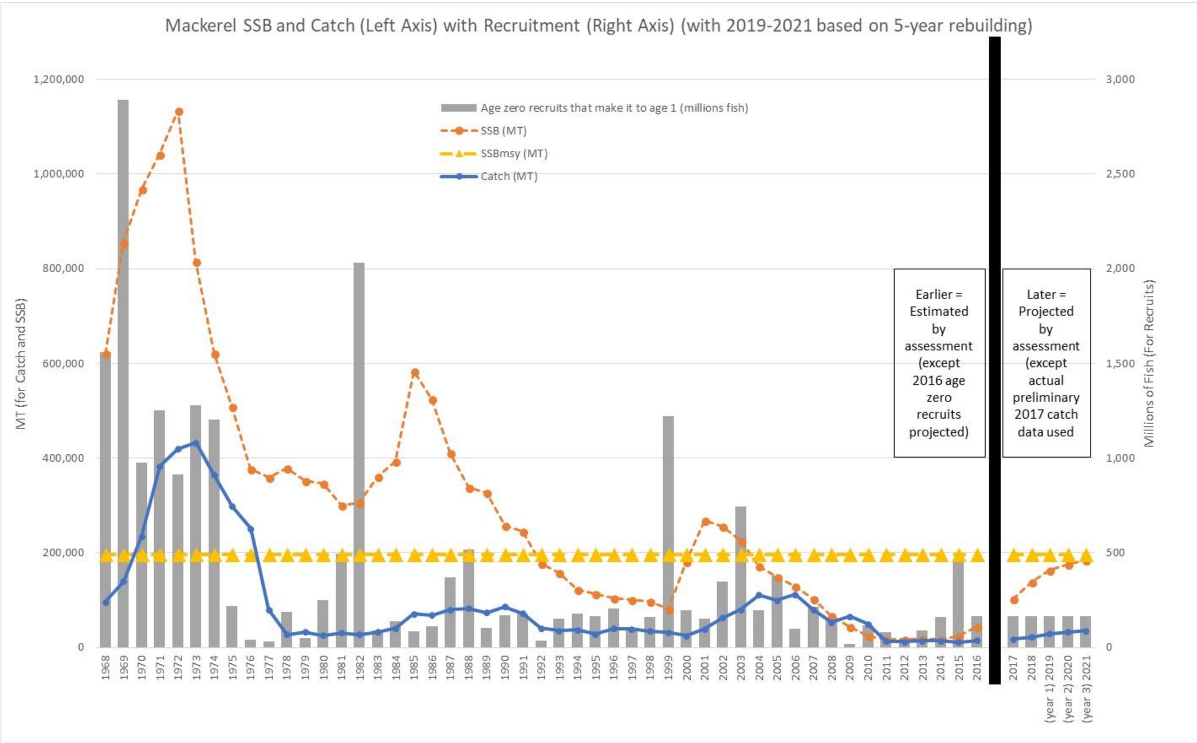


Figure 11. Mackerel SSB and catch including 2019-2021 rebuilding projections under 1c (5-year rebuilding)

1d. The projection methodology reviewed and approved during the most recent mackerel benchmark assessment indicates 1d should rebuild the mackerel stock in seven years, i.e. the stock would be slightly above 100% of the SSBmsyproxy target in seven years. In three years it would be at 92% of the SSBmsyproxy target. The figure below shows the rebuilding trajectory for 1d over 2019-2021 in the context of historical catches and recruitment. From 2022-2025 biomass would continue to increase slightly up to the SSBmsyproxy target under a 7-year rebuilding plan. 1d would have the least positive impact of all the rebuilding alternatives, but still is projected to rebuild within 7 years. The focus is on 2019-2021 because an expected assessment update in 2020 will likely result in new biomass estimates and suggest different catches in 2021 and beyond.

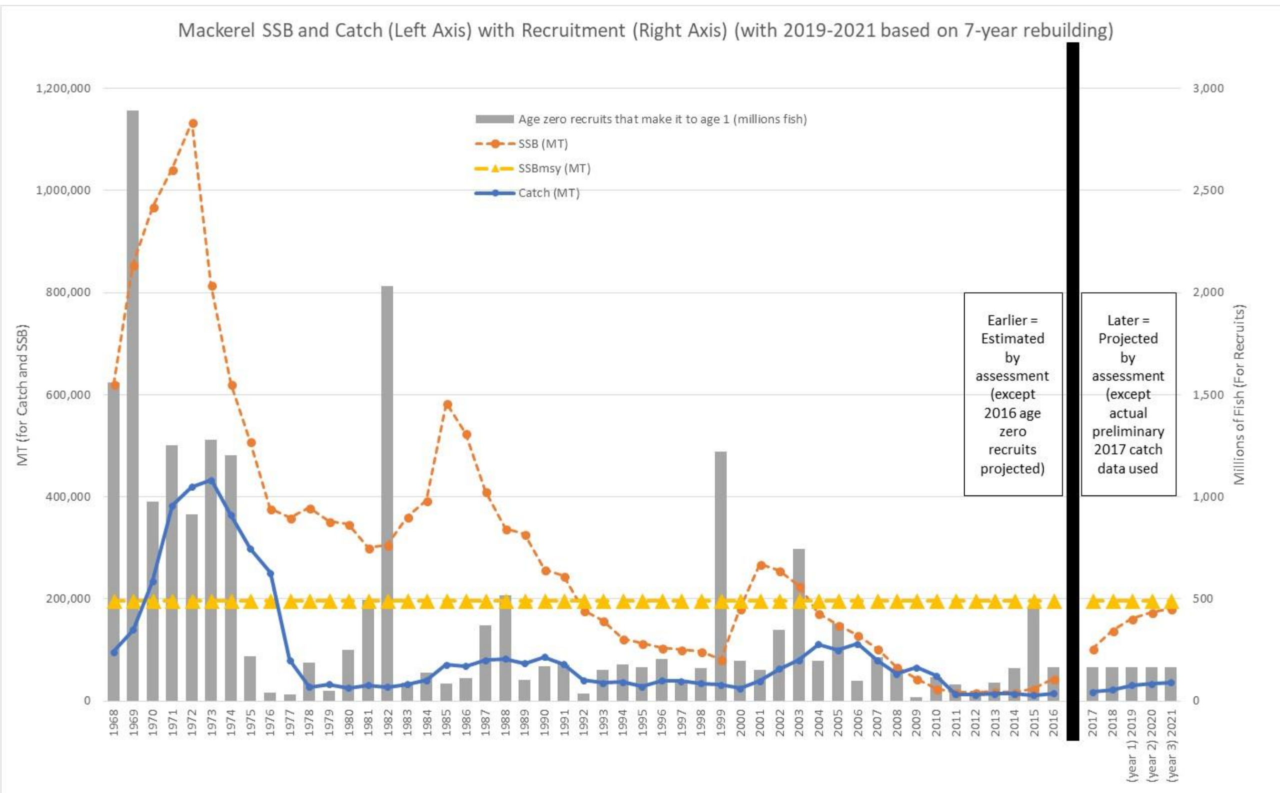


Figure 12. Mackerel SSB and catch including 2019-2021 rebuilding projections under 1d (7-year rebuilding)

THIS SPACE INTENTIONALLY LEFT BLANK

Alternative Set 2- Closure Alternatives

The closure alternatives are expected to provide for efficient operation of the fishery with negligible biological impacts. All of the closure options should result in roughly the same outcome – most of the DAH will be caught without a high risk of substantially exceeding the ACL. Larger buffers may reduce the risk of exceeding ACLs, but there should not be ACL overages with any of the options based on recent operation of the fishery, especially since they all have a backstop trip limit of 5,000 pounds once all or most of the DAH has been landed. 2a has the smallest closure buffer but would be paired with a larger ACT buffer in 1a so is still approximately equivalent to 2b-2d in terms of avoiding ACL overages. For action alternatives, 2d has the smallest closure buffer, then 2c, then 2b but all should slow the fishery sufficiently to avoid substantial quota overages, so compared to each other including the no action all should have negligible biological impacts other than indirectly supporting the mackerel rebuilding measures in Alternative Set 1.

Alternative Set 3- RH/S Cap

If the RH/S cap closes the mackerel fishery, the stock may rebuild faster than anticipated due to lower fishing mortality (less harvest would occur than assumed in the projections). Lower caps may therefore slightly benefit the mackerel stock. Accordingly, the no action would have the most benefit, followed by 3b and then 3c having the least potential for benefit because caps would be higher and there would be less possibility of an early closure. Adding 3d onto 3b or 3c would slightly increase the benefit because with 3d the mackerel fishery may close earlier than without 3d. Overall these impacts should be minor for the mackerel stock.

7.1.2 Impacts on Butterfish

Current resource condition: butterfish are not overfished (141% of target biomass in 2016), overfishing is not occurring, and catches are limited to maintain a sustainable fishery. Recent stock projections suggest a short-term decline in biomass due to low recruitment, but not to an overfished condition. Butterfish are relatively short-lived and recruitment is variable so substantial year to year population changes are expected. In general, the Council will seek management that achieves OY, which should be sustainable and maintain the butterfish stock at a non-overfished level. Since catch of butterfish in the mackerel fishery is relatively low, none of the alternatives in this action should affect butterfish catches, which are separately and directly controlled. As such, existing management measures will ensure that catch stays at or below the ABC, maintaining stock size above an overfished condition. While there is some butterfish catch in mackerel fishing, the levels of catch are not substantial enough relative to the butterfish ABC and other catches to impact the butterfish stock. Therefore, the impacts on butterfish from any alternatives in this action are similarly negligible.

7.1.3 Impacts on Longfin Squid

Current resource condition: longfin squid are not overfished (174% of target biomass in 2016). Overfishing status is unknown but likely low according to the most recent assessment, and catches are limited to maintain a sustainable fishery. In general, the Council will seek management that achieves OY, which should be sustainable and maintain the longfin squid stock at a non-overfished level. None of the alternatives in this action should affect longfin squid catches, which are separately and directly controlled. As such, existing management measures will ensure that catch stays at or below the ABC, maintaining stock size above an overfished condition. While there is some longfin squid catch in mackerel fishing, the levels of catch are not substantial enough relative to the longfin squid ABC to impact the longfin squid stock. Therefore, the impacts on longfin squid from any alternatives in this action are similarly negligible.

7.1.4 Impacts on *Illex* Squid

Current resource condition: while there is no assessment for *Illex* squid, catches have been limited to an amount deemed sustainable by the SSC based on the best available scientific information. In general, the Council will seek management that achieves OY, which should be sustainable and maintain the *Illex* squid stock at a non-overfished level. None of the alternatives in this action should affect *Illex* squid catches, which are separately and directly controlled. As such, existing management measures will ensure that catch stays at or below the ABC, maintaining stock size above an overfished condition. Therefore, the impacts on longfin squid from any alternatives in this action are similarly negligible.

7.1.5 Impacts on Atlantic herring.

Current resource condition: while Atlantic herring were not overfished and did not have overfishing occurring in 2016, due to low recruitment the resource is in substantial decline (NEFSC 2018b). While mackerel and Atlantic herring are co-targeted and co-caught, separate management measures in the Atlantic Herring Fishery Management Plan (FMP) should ensure the sustainability of that resource under all alternatives in this action. [14] Theoretically higher mackerel DAHs could lead to higher herring catch and potentially herring discards depending on the status of herring quotas. Again, this will be tracked and addressed within the Atlantic herring FMP to ensure sustainability regardless.

Alternative Set 1- Rebuilding

Depending on fleet behavior, higher mackerel catch may lead to higher Atlantic herring catch. Depending on the then-current Atlantic herring regulations, this could lead to higher Atlantic herring landings or discards. Landings will be controlled to ensure sustainability. Depending on how Atlantic herring discards are addressed, higher discards, should they occur, could potentially negatively impact the Atlantic herring stock. While an indirect and only potential impact, the greatest potential for a negative impact is from the highest mackerel catches, so the order from

[14] Future restrictions on Atlantic herring fishing may make it difficult to catch the proposed mackerel quotas depending on the availability of both species, but those impacts are being evaluated within the Atlantic Herring FMP and associated environmental analyses and may or may not impact mackerel landings. See also discussion in Cumulative Impacts Section.

most negative potential impact to least is 1d, 1c, 1b, then 1a. Given the indirect nature of impacts and requirements in the Atlantic herring plan to account for all catch, impacts should be slight for all alternatives.

Alternative Set 2- Closure Alternatives

The closure alternatives are expected to provide for efficient operation of the mackerel fishery with negligible biological impacts. All of the closure options should result in roughly the same outcome – most of the mackerel DAH will be caught without a high risk of substantially exceeding the ACL so Atlantic herring catches and impacts under all options would be similar (including the no action) and all should have similarly negligible Atlantic herring impacts other than indirectly supporting the measures in Alternative Set 1.

Alternative Set 3- RH/S Cap

If the RH/S cap closes the mackerel fishery, less Atlantic herring catch may occur. Lower caps may therefore slightly benefit the Atlantic herring stock. Accordingly, the no action would have the most benefit, followed by 3b and then 3c having the least potential for benefit because caps would be higher and there would be less possibility of an early closure. Adding 3d onto 3b or 3c would slightly increase the benefit because with 3d the mackerel fishery may close earlier than without 3d. Overall these impacts should be minor.

7.2 Habitat

Current resource condition: In general, fishing and non-fishing activities have likely degraded habitat to some degree. See Section 6.2 for additional details on how the MSB fisheries may be impacting habitat and actions that have been taken to mitigate impacts on habitat from operation of the MSB fisheries. As discussed at the start of Section 7, the availability of the targeted species may drive effort (and habitat impacts) as much as quotas and other regulations. Impacts on the habitat for the managed species (7.2.1) and other species (7.2.2) are addressed separately. The word "habitat" encompasses essential fish habitat (EFH) for the purposes of this analysis. The Council has already minimized to the extent practicable impacts to habitat from the MSB fisheries through closure of several canyon areas in MSB Amendment 9 (http://www.mafmc.org/fmp/history/smb-hist.htm) and Tilefish Amendment 1 (http://www.mafmc.org/fmp/history/tilefish.htm), and protections for Deep Sea Corals via Amendment 16 (http://www.mafmc.org/fmp/history/smb-hist.htm). As an overall current resource condition, many habitats in the area of operation of the MSB fisheries are degraded from historical fishing effort (both MSB and other) and from non-fishing activities (Stevenson et al. 2004). Ongoing fishing, and ongoing and new non-fishing activities may also hinder recovery.

7.2.1 Impacts on Managed Species Habitat

As described in Section 6.2, most MSB fishing takes place with bottom otter trawling on sand/mud substrate or with mid-water trawl for mackerel. Habitat for the MSB species generally consists of the water column, which is not significantly impacted by fishing activity. The exception to the habitat location being the water column is longfin squid eggs, which are attached to sand, mud, or bottom structure (manmade or natural). However, as determined in Amendment 9, there is no indication that squid eggs are preferentially attached to substrates that are vulnerable to disturbance from fishing/bottom trawling, so no impacts on habitat for longfin squid eggs are expected from any increase or decrease in fishing effort by bottom trawls. Bottom trawling or mid-water trawling won't impact the water column itself and there is no information to suggest that MSB bottom trawling impacts on substrate will degrade it for purposes of longfin squid egg laying or survival. Therefore, the impacts on the managed species habitat from any alternatives in this action are similarly negligible.

7.2.2 Impacts on Other Federally Managed Species Habitat

Alternative Set 1- Rebuilding

Most of the rebuilding plan/specifications alternatives allow an increase in mackerel landings/effort in each year and all allow an increase by 2020. The amount of DAH is the primary influence on potential commercial effort for mackerel, which is the key determinant of impacts. The no action DAH is 9,177 MT. The action alternatives would change the DAH under Alternative 1b to 7,553 MT for 2019, 11,483 MT for 2020, and 14,778 MT for 2021. Under Alternative 1c the DAHs would be 17,371 MT for 2019, 20,557 MT for 2020, and 21,517 MT for 2021. Under Alternative 1d the DAHs would be 18,999 MT for 2019, 22,041 MT for 2020, and 24,491 MT for 2021 (see also tables in Section 5.1). So the largest potential increase in any year is 24,491 MT-9,177MT = 15,314 MT of potential extra DAH. In Jan/Feb of 2018 when there was directed mackerel fishing, 31 trips landed slightly over 80% of the mackerel that were landed through July of 2018, with average landings of 217 MT per trip. These are the kinds of trips that would be likely to take advantage of additional mackerel quota. At 217 MT per trip, an extra 15,314 MT of DAH might therefore translate into around an extra 71 directed trips (a mix of bottom trawl and mid-water trawl). This is likely negligible compared just to the 15,071 total bottom trawl trips in 2017 in NMFS dealer data and 262 mid-water trawl trips in 2017 in NMFS VTR data (pers com Kiersten Curti, NEFSC, also MAFMC 2018b).

Thus expanded quota/opportunities for mackerel could lead to a small increase in bottom trawling activity for mackerel (mid-water trawling and hook and line [including auto-jigging] should not impact habitat) relative to total trawling activity. The proposed quotas are somewhat more than current, similar to 2015, and less than quotas that existed prior to 2015. Existing restrictions on trawling in sensitive areas (e.g. New-England EFH restrictions, Tilefish and deep-water coral closures) would remain in place. All of the higher quotas are also substantially lower than historical quotas. Also, most MSB fishing with bottom-trawl gear takes place on sand/mud substrate with limited vulnerable hard bottom to avoid net damage. These areas are also subject to substantial bottom trawl fishing already from other fisheries. Taking these factors into consideration, the limited increase in bottom trawling that could result from any options that increase quotas should not have adverse effects on habitat that are more than minimal and/or temporary in nature. While minimal and/or temporary in nature, impacts in order of least negative to slightly more negative would be 1a, 1b, 1c, and then 1d (following the increase in quotas among these alternatives).

Alternative Set 2- Closure Alternatives

The closure alternatives are expected provide for efficient operation of the mackerel fishery. All of the closure options should result in roughly the same outcome – most of the mackerel DAH will be caught without a high risk of substantially exceeding the ACL. So habitat impacts under all options would be similar (including the no action) and all should have similarly negligible habitat impacts other than indirectly supporting the measures in Alternative Set 1.

Alternative Set 3- RH/S Cap

If the RH/S cap closes the mackerel fishery early, effort may be reduced. Lower caps may therefore slightly indirectly benefit habitat, in that effort may be reduced. Accordingly, the no action would have the most benefit, followed by 3b and then 3c having the least potential for benefits to habitat. Adding 3d onto 3b or 3c would slightly increase the benefit in an additive fashion because mackerel effort would be more likely to be reduced. Overall these impacts should all be indirect and slight.

THIS SPACE INTENTIONALLY LEFT BLANK

7.3 Protected Resources

7.3.1 Introduction

Current resource condition: Affected ESA listed species and MMPA protected species are described in Section 6.4. How the current MSB fisheries impact these species can be considered as if the no action alternatives were selected for all alternatives (because no action will continue the current regulations) and is further described below. The impacts on protected resources may vary between ESA-listed and MMPA-protected species. For ESA-listed species, any action that has the risk to result in take (including ongoing take) of ESA-listed species is expected to have negative impacts, including actions that reduce interactions (because some take is still occurring and the population is at a critical level). Under the MMPA, the impacts from an action vary based on the stock condition of each marine mammal species and the potential for an action to impact fishing effort. For marine mammal stocks/species that have their potential biological removal (PBR) level reached or exceeded, negative impacts would be expected from any action that has the potential to interact with these species or stocks. For marine mammal stocks/species that are at more sustainable levels (i.e., PBR levels have not been exceeded), any action not expected to change fishing behavior or effort such that interaction risks increase relative to what has been in the fishery previously, may have positive impacts by maintaining takes below the PBR level and approaching the Zero Mortality Rate Goal. Taking the latter into consideration, the overall impacts on the protected resources VEC account for impacts on ESA-listed species, impacts on marine mammal stocks in good condition (i.e., PBR level has not been exceeded), and marine mammal stocks that have reached or exceeded their PBR level.

For no-action and similar to Section 6.4, impacts reference both bottom and mid-water trawl gear since Atlantic mackerel are targeted primarily with these gear types.

7.3.1 General No-Action Impacts

General No-action: MMPA (Non-ESA Listed) Species Impacts

The MSB FMP fisheries do overlap with the distribution of non-ESA listed species of marine mammals (cetaceans and pinnipeds). As a result, marine mammal (non-ESA listed species) interactions with bottom or mid-water trawl gear are possible (see section 6.4); however, ascertaining the risk of an interaction and the resultant potential impacts of the No Action on cetaceans and pinnipeds (marine mammals) are difficult and somewhat uncertain, as quantitative analysis has not been performed.

However, we have considered, to the best of our ability, the most recent (2010-2015) information on marine mammal interactions with commercial fisheries, of which, the MSB FMP is a component (Hayes *et al*. 2017, Hayes et al. 2018). Aside from humpback whales, pilot whales and several stocks of bottlenose dolphin, there has been no indication that takes of non-ESA listed species of marine mammals in commercial fisheries has gone above and beyond levels which would result in the inability of each species population to sustain itself (Hayes *et al*. 2017, Hayes et al. 2018). Specifically, aside from humpback whales, pilot whales, and several stocks of bottlenose dolphin, potential biological removal (PBR) has not been exceeded for any of the non-ESA listed marine mammal species identified in section 6.4 (Hayes *et al*. 2017). Although humpback whales, pilot whales and several stocks of bottlenose dolphin have experienced levels of take that have resulted in the exceedance of each species PBR, take reduction strategies and/or plans have been implemented and are currently in place to reduce bycatch in the fisheries affecting these species (Atlantic Trawl Gear Take Reduction Strategy, Pelagic Longline Take Reduction Plan effective May 19, 2009 (74 FR 23349); Bottlenose Dolphin Take Reduction Plan (BDTRP), effective April 26, 2006 (71 FR 24776)). Although the most recent information presented in Hayes et al. (2017) and Hayes et al. 2018 is a collective representation of commercial fisheries interactions with non-ESA listed species of marine mammals, and does not address the effects of the MSB FMP specifically, the information does demonstrate that thus far, current management measures are keeping most non-ESA listed marine mammal species below their PBR levels; exceptions include non-ESA listed marine mammal strategic stocks of humpback whales, pilot whales, and bottlenose dolphin stocks (Hayes et al. 2017; Hayes et al. 2018).

Taking into consideration the above information, and the fact that there are non-listed marine mammal stocks/species whose populations may or may not be at optimum sustainable levels, impacts of the No Action on non-ESA listed species of marine mammals are likely to range from slight negative to slight positive. As noted above, humpback whales, pilot whales, and stocks of bottlenose dolphins are experiencing levels of interactions that have resulted in exceedance of their PBR levels. These stocks/populations are not at an optimum sustainable level and therefore, the continued existence of these stocks/species is at risk. As a result, any potential for an interaction is a detriment to the species/stocks ability to recover from this condition. As the potential risk of interacting with gear types used in the mackerel fishery varies between these marine mammal species (e.g., interactions between humpback whales and bottom or mid-water trawl gear have never been observed or documented; pilot whales and bottlenose dolphins have been observed or documented in bottom and mid-water trawl gear (see section 6.4)), depending on the marine mammal species/stocks, the No Action is likely to result in negligible to slight negative impacts to these non-listed marine mammal stocks/species in poor condition.

Alternatively, there are also many non-ESA listed marine mammals that, even with continued fishery interactions, are maintaining an optimum sustainable level (i.e., PBR levels have not been exceeded) over the last several years. For these stocks/species, it appears that the fishery management measures that have been in place over this timeframe have resulted in levels of effort that equate to interaction levels that are not expected to impair the stocks/species ability to remain at an optimum sustainable level. These fishery management measures, therefore, have resulted in indirect slight positive impacts to these non-ESA listed marine mammal species/stocks. Should future fishery management actions maintain similar operating condition as they have over the past several years, it is expected that these slight positive impacts would remain. Thus, given that the No Action will not substantially change fishing effort, the impacts of the No Action on these non-ESA listed species of marine mammals in good condition (i.e., PBR levels have not been exceeded) are expected to be slight positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level).

General No-action: ESA Listed Species Impacts

The MSB fishery is primarily prosecuted with bottom and mid-water trawl gear. As provided in section 6.4, these gear types are known to interact with ESA listed species of sea turtles, Atlantic sturgeon, and Atlantic salmon, with interactions often resulting in the serious injury or mortality to the species; large whale (ESA listed) interactions with bottom trawl or mid-water trawl have never been observed or documented. The risk of an interaction; however, is strongly associated with the amount of gear in the water, the time the gear is in the water (e.g., soak time, tow time), and the presence of listed species in the same area and time as the gear, with risk of an interaction increasing with increases in of any or all of these factors. Based on this, the MSB fishery is likely to result in some level some level of negative impacts to ESA listed species. Taking into consideration fishing behavior/effort under the No Action, as well as the factors that affect the risk of an interaction with a listed species, we determined the level of negative impacts to ESA listed species to be slight. Below, we provide support for this determination.

Under the No Action, fishing behavior and effort in the MSB fishery is expected to remain similar to what has been observed in the fishery over the last 5 or more years. Specifically, the amount of trawl gear, tow times, and area fished are not expected change significantly from current operating conditions. As provided above, interactions risks with ESA listed species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and listed species, with vulnerability of an interaction increasing with increases in any of these factors. Continuation of "status quo" fishing behavior/effort is not expected to change any of these operating conditions and therefore, relative to current conditions, new or elevated (e.g., more gear, longer tow times) interaction risks to listed species are not expected. Based on this, impacts of the No Action on ESA listed species is expected to be slight negative.

7.3.2 Impacts from Specific Alternatives

The impacts of Alternative Set 1, which sets the mackerel catch limits, are relatively more substantial than Alternative Sets 2 and 3, which more affect how the fishery operates within the catch limits considered in Alternative Set 1.

Alternative Set 1- Rebuilding

Expanded quota/opportunities for mackerel could lead to a small increase in trawling activity (bottom and mid-water, the primary mackerel gear types) relative to overall fishing activity. The proposed quotas are somewhat more than current, similar to 2015, and less than quotas that existed prior to 2015.

Most of the rebuilding plan/specifications alternatives allow an increase in mackerel landings/effort in each year and all allow an increase by 2020. The amount of DAH is the primary influence on potential commercial effort for mackerel, which is the key determinant of impacts. The no action DAH is 9,177 MT. The action alternatives would change the DAH under Alternative 1b to 7,553 MT for 2019, 11,483 MT for 2020, and 14,778 MT for 2021. Under Alternative 1c the DAHs would be 17,371 MT for 2019, 20,557 MT for 2020, and 21,517 MT for 2021. Under Alternative 1d the DAHs would be 18,999 MT for 2019, 22,041 MT for 2020, and 24,491 MT for 2021. So the largest potential increase in any year is 24,491 MT-9,177MT = 15,314 MT of potential extra DAH. In Jan/Feb of 2018 when there was directed mackerel fishing, 31 trips landed slightly over 80% of the mackerel that were landed through July of 2018, with average landings of 217 MT per trip. These are the kinds of trips that would be likely to take advantage of additional mackerel quota. At 217 MT per trip, an extra 15,314 MT of DAH might therefore translate into around an extra 71 directed trips (a mix of bottom trawl and mid-water trawl). This is likely negligible compared just to the 15,071 total bottom trawl trips in 2017 in NMFS dealer data and 262 mid-water trawl trips in 2017 in NMFS VTR data (pers com Kiersten Curti, NEFSC, also MAFMC 2018b).

Based on the above, relative to current operating conditions, the potential increase in effort is not expected to be significant. Further, it is not expected that the area fished, the amount of trawl gear in the water, or the tow times to greatly change under any of the action alternatives. For these reasons, and given the existing Atlantic Trawl Gear Take Reduction Strategy, impacts to protected species from any of the action alternatives are expected to be range from negligible to moderately negative, with impacts to ESA listed species ranging from neutral to moderately negative, and impacts to non-ESA listed marine mammals ranging from slight positive to moderately negative (MMPA species in good condition: slight positive to slight negative; MMPA species in poor condition: slight to moderately negative). Relative to the no action, any of the action alternatives are expected to result in negligible to moderately negative impacts given the slight potential increase in effort. Relative to each other, differential impacts of any action alternative compared to another are expected to be negligible.

Alternative Set 2- Closure Alternatives

The in-season management alternatives are unlikely to substantially affect overall fishing effort or the nature of that effort. As such, under the no action or all action alternatives within this alternative set, impacts to protected resources would remain as described under the general no action impact description above, as modified by alternatives in other alternative sets, primarily Alternative Set 1. There may be slightly less directed fishing effort if the directed fishery is closed earlier (Alternative 2b closes earliest, then 2c, then 2d, then 2a) but any differences in effort would be expected to be negligible compared to the changes that could occur with Alternative Set 1 related to the overall specifications/quotas. Thus the impacts of all alternatives in Alternative Set 2 are essentially the same – and the resource condition of protected resources would be expected to persist. For MMPA species experiencing levels of interactions that have resulted in exceedance of their PBR levels (humpback whales, pilot whales, and stocks of bottlenose dolphins) impacts would continue slight negative. For MMPA species below PBR, impacts would be slight positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level). Continuation of “status quo” fishing behavior/effort is not expected to change interaction risks to listed ESA species so impacts to them would be slight negative.

Alternative Set 3- RH/S Cap

If the RH/S cap closes the mackerel fishery effort may be reduced. Lower caps may therefore slightly indirectly benefit protected resources, in that effort may be reduced. Higher caps are less likely to constrain the fishery. If the fishery is not constrained by the RH/S Cap, then the impacts to protected resources are just those described under Alternative Set 1.

For this alternative set, the Council had the option of choosing one alternative from 3a-3c and then 3d, if combined with 3a-3c and implemented, has impacts additive to 3a-3c.

Scaling the RH/S cap with the quota based on the current RH/S ratio (3c) would maintain the current probability of closures due to the RH/S cap – a slightly early closure occurred in 2018, the first time in 5 years of the cap. So under 3c, the impacts to protected resources are the same as those described under the no action and Alternative Set 1 due to the apparent low probability of effects on effort. For MMPA species experiencing levels of interactions that have resulted in exceedance of their PBR levels (humpback whales, pilot whales, and stocks of bottlenose dolphins) impacts would continue slight negative. For MMPA species below PBR, impacts would be slight positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level). Continuation of "status quo" fishing behavior/effort is not expected to change interaction risks to listed ESA species so impacts to them would be slight negative.

Lowering the tolerated ratio increases the probability of closures, so no action (3a) would actually have the most potential for lowering effort compared to 3a-3c, followed by 3b between 3a and 3c. However, among all of these overall effort is unlikely to change substantially, so changes to ongoing impacts would be only slight. Accordingly, for MMPA species experiencing levels of interactions that have resulted in exceedance of their PBR levels (humpback whales, pilot whales, and stocks of bottlenose dolphins) impacts would continue slight negative. For MMPA species below PBR, impacts would be slight positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level). Continuation of "status quo" fishing behavior/effort is not expected to change interaction risks to listed ESA species so impacts to them would be slight negative.

Adding 3d, by adding a trigger at low catches, further increases the possibility of an early closure. This is an additive effect combined with 3a-3c. Since the effects are indirect, they are best thought of as potentially mitigating any of the possibly negative effects if effort increases due to alternatives in Alternative Set 1. In other words, making early closures more likely by selection of 3d could dampen increases in effort that might otherwise occur under some alternatives in Alternative Set 1. However, overall effort is unlikely to change substantially, so changes to ongoing impacts would be only slight. Accordingly, for MMPA species experiencing levels of interactions that have resulted in exceedance of their PBR levels (humpback whales, pilot whales, and stocks of bottlenose dolphins) impacts would continue slight negative. For MMPA species below PBR, impacts would be slight positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level). Continuation of "status quo" fishing behavior/effort is not expected to change interaction risks to listed ESA species so impacts to them would be slight negative.

7.4 Non-Target Resources

Current Resource Condition:

Bycatch in the mackerel fishery is described in Section 6.1 and is relatively low, less than 1%. Atlantic herring are not non-target species since the directed fishery targets mackerel and Atlantic herring. Non-negligible non-target species therefore include silver hake, spiny dogfish, alewife, blueback herring, American shad, haddock, red hake, winter skate, and John Buckler Dory. Of these red hake is experiencing overfishing and is overfished (https://www.nefsc.noaa.gov/publications/crd/crd1802/crd1802.pdf). There is no assessment for John Dory Buckler. Alewife, blueback herring, and American shad have been found to be depleted by the ASMFC, and assessment information is available at www.asmfc.org. Assessments for silver hake, spiny dogfish, haddock, and winter skate (not overfished, no overfishing) can be found at https://www.nefsc.noaa.gov/saw/. Mortality from bycatch is accounted for with species that are managed under a fishery management plan. For unmanaged species, we have no data to indicate the impact that these measures would have on them. RH/S catch is controlled via the RH/S catch cap.

The impacts of Alternative Set 1, which sets the mackerel catch limits, are relatively more substantial than Alternative Sets 2 and 3, which more affect how the fishery operates within the catch limits considered in Alternative Set 1.

Alternative Set 1- Rebuilding

Expanded quota/opportunities for mackerel could lead to a small increase in trawling activity (bottom and mid-water, the primary mackerel gear types) relative to overall fishing activity. The proposed quotas are somewhat more than current, similar to 2015, and less than quotas that existed prior to 2015.

Most of the rebuilding plan/specifications alternatives allow an increase in mackerel landings/effort in each year and all allow an increase by 2020. The amount of DAH is the primary influence on potential commercial effort for mackerel, which is the key determinant of impacts. The no action DAH is 9,177 MT. The action alternatives would change the DAH under Alternative 1b to 7,553 MT for 2019, 11,483 MT for 2020, and 14,778 MT for 2021. Under Alternative 1c the DAHs would be 17,371 MT for 2019, 20,557 MT for 2020, and 21,517 MT for 2021. Under Alternative 1d the DAHs would be 18,999 MT for 2019, 22,041 MT for 2020, and 24,491 MT for 2021. So the largest potential increase in any year is 24,491 MT-9,177MT = 15,314 MT of potential extra DAH. In Jan/Feb of 2018 when there was directed mackerel fishing, 31 trips landed slightly over 80% of the mackerel that were landed through July of 2018, with average landings of 217 MT per trip. These are the kinds of trips that would be likely to take advantage of additional mackerel quota. At 217 MT per trip, an extra 15,314 MT of DAH might therefore translate into around an extra 71 directed trips (a mix of bottom trawl and mid-water trawl). This is likely negligible compared just to the 15,071 total bottom trawl trips in 2017 in NMFS dealer data and 262 mid-water trawl trips in 2017 in NMFS VTR data (pers com Kiersten Curti, NEFSC, also MAFMC 2018b). Also, RH/S catch would continue to be controlled via the RH/S catch cap regardless of effort changes.

Based on the above, relative to current operating conditions, the potential increase in effort is not expected to be significant. Further, it is not expected that the area fished, the amount of trawl gear in the water, or the tow times to change under any of the action alternatives. As such, a moderate increase in mackerel effort is unlikely to appreciably change the total type, amount, or time that fishing gear is in the water, especially since additional mackerel effort may mean that somewhat less effort will be expended in some other fishery. The mackerel fishery also has relatively low bycatch and the primary bycatch of concern is controlled through the RH/S cap. Taking these factors into consideration, the limited increase in mackerel fishing effort that could result from any options that increase quotas should only have at most a slight negative impact on non-target species compared to no action that maintains the impacts described above, and would not be likely to change the status of any non-target species. While red hake is overfished, most red hake discards are in the small mesh bottom trawl SBRM fleet, which is not the fleet that would be expected to increase effort in pursuit of mackerel since most mackerel are currently caught via MWT (see SBRM estimates for 2015-2017 at https://www.nefsc.noaa.gov/fsb/SBRM/). The New England Fishery Management Council will also have to develop a rebuilding plan specifically for red hake that will take all catch into consideration. Relative to each other, differential impacts of any action alternative compared to another are expected to be negligible.

Alternative Set 2- Closure Alternatives

The in-season management alternatives are unlikely to substantially affect overall fishing effort or the nature of that effort, so they should all have negligible impacts to non-target resources. As such, under the no action or action alternatives within this alternative set, impacts to non-target resources would remain as described under the general no action impact description above, as modified by alternatives in other alternative sets.

Alternative Set 3- RH/S Cap

Note: For this alternative set, the Council had the option of choosing one alternative from 3a-3c and then 3d, if combined with 3a-3c and implemented, has impacts additive to 3a-3c.

Non-target resources besides RH/S:

If the RH/S cap closes the mackerel fishery effort may be reduced. Lower caps may therefore slightly indirectly benefit non-target resources, in that effort may be reduced. Accordingly, no action would have the most benefit, followed by 3b and then 3c having the least potential for benefits to non-target resources. Adding 3d onto 3b or 3c would slightly increase the benefit in an additive fashion. Overall these impacts should all be indirect and relatively slight for non-target resources, especially since non-target interactions in the mackerel fishery are generally low.

RH/S:

The RH/S cap directly affects RH/S catch in the mackerel fishery. The degree of impact of the mackerel fishery on RH/S populations is unknown, but RH/S populations are depleted, as discussed previously. Accordingly, only qualitative directional impacts of different RH/S caps can be assessed. Accordingly, the no action would have the most benefit, followed by 3b and then 3c having the least potential for benefits to RH/S as the cap increases. Adding 3d onto 3b or 3c would slightly increase the benefit for 3b or 3c.

7.5 Socioeconomic Impacts

Current Condition: This action would primarily affect the mackerel fishery. As discussed above, the availability of the targeted species may drive effort (and catch and revenues) as much as any regulations.

Mackerel fishery Current Condition: Due to the year to year variation in catch and effort in the fishery, it is difficult to fully quantify human community impacts but the current fishery supports a number of vessels, as described in Section 6.3, and provides a variety of jobs related directly to fishing and also in associated support services. 55 vessels landed over 10,000 pounds of mackerel in 2017, with total mackerel landings valued at $4.1 million. The current conditions of the fishery should generally be maintained in the short and long run since the ABCs and catch should be sustainable given the Council's risk policy and implementation of that risk policy in specifications. While a rebuilding plan is being developed, it is not expected to result in negative economic impacts relative to recent fleet operations.

The following section is focused on the quantitative evaluation and analysis of direct data points for each action alternative, using landings and revenues data, and describes the qualitative directional impacts of the alternative analyses on the affected communities. It is important to keep in mind that by contributing to the overall functioning of and employment in coastal communities, the MSB fisheries have indirect social impacts as well. Social impacts are strongly aligned with changes to fishing opportunities and while difficult to measure can include impacts to families from income changes/volatility, safety-at-sea (related to changes in fishery operations due to regulation changes), job satisfaction and stability, and general frustration by individuals due to management's impacts especially if they perceive the management actions to be unreasonable or ill-informed. Unless otherwise noted, expanded fishing opportunities or less burdensome regulations that result in increased revenue for more individuals will have concomitant (i.e. naturally accompanying) positive social impacts. Likewise, reduced fishing opportunities or more burdensome regulations that result in lower revenue to fewer individuals will have concomitant negative social impacts. This relationship is not repeated for every alternative but should be kept in mind by the reader.

Mackerel Fishery-Related Impacts

<u>Alternative Set 1- Rebuilding</u>

Rebuilding Alternatives: Most of the action rebuilding alternatives allow increases in landings and so should have positive long-term socioeconomic benefits compared to no action depending on the amount of increased landings and any price fluctuations. The only alternative and year combination that involves a quota reduction is Alternative 1b for 2019. Even under alternative 1b quotas are higher than their current levels in 2020 and 2021. Alternative 1d has the highest quotas (and potential revenues) and Alternative 1c is in between.

The catch trajectories for the options can be used to consider possible revenue differences assuming the 2017 average price of $600/MT. The tables below, show the expected DAHs and the product of the DAHs multiplied by the assumed price (the 2017 average price $600/MT) to estimate discounted (3% discount rate) *present value* potential revenues over ten years. For 1a, the same DAH as no action is used in all ten years. For 1b, a 50%-50% split with Canada is used in all years expect the first year (10,000 MT deduction) (this is the most restrictive action alternative). For 1c and 1d the rebuilding trajectories provided by the NEFSC are used with a 10,000 MT deduction for Canada. Once the stock is rebuilt, the Council's P* risk policy is applied for the remaining years. 1d has the highest revenues, then 1c, then 1b, then 1a. The Council judged however that rebuilding faster with 1c was more important than the relatively small gain with 1d. Since 1c rebuilds faster, it also results in higher revenues after being rebuilt (e.g. in 2026-2028). The big jump in DAHs and revenues from 1b to 1c/1d is partly due to the higher ABCs in 1c/1d, and partly due to the difference in how Canadian catch is handled in 1b (50% to Canada) versus 1c/1d (a 10,000 MT deduction for Canada).

Table 24. Potential DAHs from ABC Options

	Expected DAHs									
DAH	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
1a	9,177	9,177	9,177	9,177	9,177	9,177	9,177	9,177	9,177	9,177
1b	7,553	11,483	14,778	16,078	16,655	17,106	17,642	17,964	18,205	18,368
1c	17,371	20,557	21,517	21,517	21,517	23,660	24,814	25,717	26,788	27,432
1d	18,999	22,041	24,491	25,429	26,416	27,159	27,869	23,660	24,814	25,717

Table 25. Potential Revenues from ABC/DAH Options

	Annual Discounted Revenues (3% discount rate)										
Alternative	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total Discounted Revenues
1a	5,506,200	5,345,825	5,190,122	5,038,953	4,892,187	4,749,696	4,611,356	4,477,044	4,346,645	4,220,044	48,378,073
1b	4,532,081	6,689,347	8,357,738	8,828,137	8,878,461	8,853,700	8,864,854	8,763,654	8,622,836	8,446,345	80,837,153
1c	10,422,743	11,974,677	12,169,181	11,814,739	11,470,621	12,245,643	12,468,584	12,546,244	12,687,991	12,614,411	120,414,834
1d	11,399,204	12,839,380	13,850,950	13,962,777	14,082,099	14,056,580	14,004,090	11,542,693	11,752,836	11,826,038	129,316,648

Alternative Set 2- Closure Alternatives

The closure alternatives should provide for efficient operation of the fishery. All of the action closure options should result in roughly the same outcome – most of the DAH will be caught without a high risk of exceeding the ACL. Given the lack of data on fishery performance during closures it is difficult to quantitatively assess the exact outcomes. The real difference in socioeconomic outcomes is related to the ABCs/DAHs set in Alternative Set 1, and Alternative Set 2 should only result in relatively slight changes to fishery operation. Given the no action in this Alternative Set (2a) would be paired no action in Alternative Set 1, there are similar benefits with any of the action alternatives compared to no action but they are indirect and supporting the impacts described above in Alternative Set 1. Closing the directed fishery earlier and maintaining larger trip limits may benefit smaller scale operators later in the year, but of course reduces available quota for the primary directed fishery. However preserving a higher trip limit with an earlier closure may also help larger entities by allowing more incidental mackerel catch during Atlantic herring or other fishing. Given the approximately similar outcomes expected for all action alternatives in this Alternative Set, the most important issue is that performance will need to be tracked based on how the fishery actually operates and then amended if needed. The Council's demonstrated ability to track performance and make adjustments if needed further reinforces the similarity of the action alternatives, because the Council will make ongoing adjustments in future actions to ensure that the DAH can be harvested and optimum yield achieved (without having ACL overages). .

One change common among all action alternatives compared to the no-action is limiting incidental landings to 5,000 pounds once the directed fishery closes. While this will reduce the possibility of DAH/ACL overages, there is a small-scale late-season directed mackerel jig/handline fishery that has developed in recent years by vessels with open access/incidental permits. If July-December handline/jig landings are examined from 2015-2017, a 5,000 pound trip limit would have impacted 21 federally-permitted vessels. Had they been limited to 5,000 pounds during those years, their combined mackerel landings would have been reduced by 17%. Individual vessel mackerel landings for these 21 vessels would have been impacted in the 1%-37% range with an average and median reduction of 13%. Based on the average 2015-2017 price from July-Dec handline trips of $0.45 per pound, individual vessels would have approximately lost (total 3 years) between $104 and $108,917 in ex-vessel revenues with an average reduction of $14,773 and a median reduction of $5,171. The proportion of total revenues from mackerel for these 21 vessels ranged from 1% to 93% with a mean of 23% and a median of 20%. It is also possible that with the higher mackerel quotas closures will not occur so the 5,000 pound trip limit for incidental permits will not be triggered.

Alternative Set 3- RH/S Cap

Note: For this alternative set, the Council had the option of choosing one alternative from 3a-3c and then 3d, if combined with 3a-3c and implemented, has impacts additive to 3a-3c.

RH/S Cap: Lower caps can lead to less landings and mackerel revenues (and vice versa for higher caps). At a low cap and a high RH/S encounter rate, a relatively small portion of the mackerel quota might be landed before a closure, potentially resulting is forgoing most of the revenues in the tables above. The initial 89 MT trigger option (3d) will also preclude landings greater than 10,000 MT if catch rates activate the trigger. Consistent with previous evaluations, if the caps assist recovery of RH/S, then lower caps might result in additional long term benefits related to commercial revenues, recreational opportunities, ecosystem services, cultural values for RH/S, and/or other non-market existence values (i.e. value gained by the public related to the knowledge that these species are being conserved successfully). Since it is not possible to determine the effects of the caps on RH/S populations, such potential benefits can only be described qualitatively. If the fishery can avoid RH/S then the caps will not be limiting. In most cap years (2014-2017) the fishery has had a low RH/S encounter ratio, but in 2018 the RH/S encounter ratio was higher and the RH/S cap closed slightly before the mackerel quota was landed. If the fishery can continue to avoid RH/S, the caps either will not be limiting or may be minimally limiting. If the fishery has a high RH/S encounter rate then a substantial amount of mackerel DAH may be left un-landed. No action (3a) would be most likely to be limiting given it has the lowest cap amount, followed by 3b and then 3c. Adding 3d makes 3b or 3c slightly more restrictive than if 3d is not combined with 3b or 3c, but again the key factor is how well the fishery can avoid RH/S, and so far the fishery has generally been able to avoid RH/S sufficiently to avoid substantial impacts.

With just 3b, even if the fishery has a similar encounter rate as 2018 when the fishery was closed slightly early (the highest observed rate during operation of the cap), mackerel landings could still expand to close to the higher DAHs because the RH/S cap is scaled up with the quota. With the addition of 3d, the fishery would still be able to expand landings even at the higher 2018 RH/S encounter rate, but only slightly since the trigger in 3d is 89 MT when landings are less than 10,000 MT compared to the current 82 MT RH/S cap. Once the fishery lands 10,000 MT then the rest of the RH/S cap becomes available. So 3b and 3d would both allow increased landings based on the RH/S encounter rates that have been observed since the cap has been in operation. However, if the fishery triggers the 89 MT RH/S threshold before 10,000 MT of mackerel has been landed, the increase in mackerel landings will be limited, and the higher DAH will mostly remain unharvested. The fishery landed about 8,000 MT before the RH/S cap closed the fishery in 2018. 89 MT is 8.5% higher than 82 MT, so at the 2018 RH/S encounter rate, there would be a closure at approximately 8,700 MT. So landings could increase, but the DAH would be limited compared to the proposed 2019-2020-2021 DAHs of 17,371 MT, 20,557 MT, and 21,517 MT. Looking at the differences, this would leave, for 2019-2020-2021 DAHs, 8,671 MT, 11,857 MT, and 12,817 MT unharvested. For 2019-2020-2021, assuming the 2017 average price of $600/MT persists, this would represent approximately $5.2 million, $7.1 million, and $7.7 million in potentially forgone revenues (again this would not be a decrease, but a limit to a potential increase).

Atlantic Herring Fishery-Related Indirect Impacts

<u>Alternative Set 1- Rebuilding</u>

The mackerel closure provisions (Alternative Set 2) are the primary measures that impact the herring fishery. However, higher ABCs/DAHs will mean than any closures are less likely. As such, the impacts described in Alternative Set 2 are less likely to apply with higher ABCs/DAHs (1a<1b<1c<1d).

Alternative Set 2- Closure Alternatives

All of the proposed closure provisions allow for at least the current incidental retention of mackerel after mackerel closures (20,000 pounds initially with a 5,000 pound backstop at or near the full DAH) in the herring fishery at all times and therefore should not cause substantial impacts for the herring fishery; fishery participants have reported that they can operate under the current incidental mackerel limits. Therefore all of the Alternatives in this set will have similarly negligible indirect impacts on the Atlantic herring fishery.

Alternative Set 3- RH/S Cap

After a closure of the RH/S cap, there is a 20,000 pound incidental mackerel landing. Fishery participants have reported that they can operate under this incidental mackerel limit. Therefore all of the Alternatives in this set will have similarly negligible indirect impacts on the Atlantic herring fishery.

7.6 Cumulative Impacts

7.6.0. Cumulative Impacts Introduction

The proposed measures are considered the most reasonable actions to achieve the FMP’s conservation objectives while optimizing the outcomes for fishing communities given the conservation objectives, as per the objectives of the FMP, which are described in Section 4. The expected impacts of each alternative have been analyzed earlier in this section.

Definition of Cumulative Effects

A cumulative impact analysis is required by the Council on Environmental Quality's regulation for implementation of NEPA. Cumulative effects are defined under NEPA as "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action (40 CFR section 1508.7)."

The cumulative impacts of past, present, and future Federal fishery management actions (including the proposed action in this document) should generally be positive for the target species. The mandates of the MSA as currently amended and of NEPA require that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment.

Temporal Scope

The temporal scope of this analysis is primarily focused on actions that have taken place since 1976, when these fisheries began to be managed under the MSA. For endangered and other protected species, the context is largely focused on the 1980s and 1990s, when NMFS began generating stock assessments for marine mammals and turtles that inhabit waters of the U.S. EEZ. In terms of future actions, the analysis considers the period between the expected effective date of this action specifications (March 15, 2019) and Dec 31, 2023, a period of approximately five years and when the measures considered are designed to be in effect and begin the five-year rebuilding process for the mackerel stock. The temporal scope of this analysis does not extend beyond 2023 because the FMP and the issues facing these fisheries may change in ways that can't be effectively predicted.

Geographic Scope

The geographic scope of the analysis of impacts to fish species and habitat for this action is the range of the fisheries in the Western Atlantic Ocean, as described in the Affected Environment and Environmental Consequences sections of the document. For endangered and protected species the geographic range is the total range of each species. The geographic range for socioeconomic impacts is defined as those fishing communities bordering the range of the fisheries for mackerel, longfin squid, *Illex* squid, and butterfish which occur primarily from the U.S.- Canada border to Cape Hatteras, NC, although the management unit includes all the coastal states from Maine to Florida.

Summary of the Past, Present and Reasonably Foreseeable Future Actions

The following is a summary of the past, present, and reasonably foreseeable future fishing actions and effects thought most likely to impact this cumulative effects assessment. The FMP's that have had the greatest impact on mackerel fishery VECs, other than the MSB FMP, are the Atlantic Herring FMP and the Northeast Small Mesh Multispecies FMP, because of the overlap in permits for vessels that participate in these fisheries.

Past Management Actions

The earliest management actions implemented under this FMP involved the sequential phasing out of foreign fishing for these species in US waters and the development of a domestic fishing fleet. All MSB species are considered to be fully utilized by the US domestic fishery to the extent that sufficient availability would allow full harvest of the DAH/landings quota. As further discussed in Section 7.6.1 below, the effort reductions from phasing out foreign fishing also benefited non-target species, EFH, and protected species.

Specific actions (http://www.mafmc.org/msb/) which had substantial impacts on the fishery included: the implementation of a limited access program in Amendment 5 to control capacity in the squid and butterfish fisheries; revision of overfishing definitions in Amendment 6; modification of vessel upgrade rules in Amendment 7; and implementation of overfishing and rebuilding control rules and other measures in Amendment 8. Amendment 9 allowed multi-year specifications, extended the moratorium on entry into the *Illex* fishery without a sunset provision; adopted biological reference points recommended by the SARC 34 (2002) for longfin squid; designated EFH for longfin squid eggs, and prohibited bottom trawling by MSB-permitted vessels in Lydonia and Oceanographer Canyons to protect Tilefish EFH. Amendment 1 to the Tilefish FMP created closures in these canyons as well as Veatches and Norfolk canyons for bottom trawling generally. MSB Amendment 10's measures included increasing the longfin squid minimum mesh to 2 1/8 inches in Trimesters 1 and 3 and implementing a butterfish mortality cap in the longfin squid fishery. Amendment 11 implemented mackerel limited access, a recreational-commercial mackerel allocation, and EFH updates. Amendment 12 implemented a Standardized Bycatch Reporting Methodology that was vacated by court order and has been revisited through Amendment 15. Amendment 13 to the MSB FMP implemented Annual Catch Limit and Accountability Measures. Amendment 14 increased and improved reporting and monitoring (vessel, dealer, and observer) of the mackerel and longfin squid fisheries and implemented a catch cap for river herrings and shads in the mackerel fishery since 2014. Monitoring improvements include minimization of unobserved catch, observer facilitation and assistance, weekly vessel trip reporting, additional trip notification, and electronic vessel monitoring systems and reporting. Amendment 16 implemented protections for deep-water corals. Framework 9 followed-up on Amendment 14's measures to specifically improve observer operations by minimizing slippage (unobserved discards) and NMFS has implemented a new Standardized Bycatch Reporting Methodology in Amendment 15 to address observer assignment deficiencies identified in a previous lawsuit. The Mid-Atlantic Unmanaged Forage Omnibus Amendment restricted the expansion of commercial fisheries for certain forage species, some of which are encountered in the MSB fisheries. Past annual specifications have also limited catches to avoid overfishing. Through an in-season action Atlantic herring quotas were lowered in 2018 but the mackerel fishery had already closed at that point so there were no impacts to mackerel fishing. A recent framework modified the mackerel closure provisions so that some incidental mackerel catch can always be retained in late 2018.

Future Management Actions

MSB: By 2020, the Council is expected to formally integrate Atlantic chub mackerel (*Scomber colias*) into the MSB FMP, implementing an annual catch limit and other measures to prevent overfishing of this species. The Council is planning on revising the goals and objectives of the MBS FMP in 2019, which could indirectly affect future decision-making. An action in 2019 may modify the *Illex* squid permit system.

EFH: The Council is also planning on revising EFH for all species and considering the impacts of fishing on EFH before 2021. The Council plans to consider requiring commercial vessels to submit electronic Vessel Trips Reports (VTRs) to improve reporting before 2021.

Corals: Future actions at the New England Fishery Management Council (NEFMC) will likely extend deep-water coral protections in the New England area and protect deep-water corals there against any future expansion of the MSB fisheries in the rest of the continental slope.

Small Mesh Fisheries:. A recent assessment showing poor recruitment is likely to result in substantial reductions to Atlantic herring quotas in 2019 and for at least several additional years. An overfished finding in the red hake fishery may impact the whiting and/or longfin squid fisheries.

Atlantic herring: Amendment 8 to the Atlantic herring plan would cap overall Atlantic herring fishing mortality at 80% of sustainable levels. A portion of the available catch would be set aside to explicitly account for the role of Atlantic herring as forage within the ecosystem. The Amendment also bans mid-water trawling for herring-permitted vessels near the coast. See https://s3.amazonaws.com/nefmc.org/NEFMC-Approves-Atlantic-Herring-Amendment-8_181001_165323.pdf. These measures may indirectly limit mackerel fishing to some extent, but the actual effects will depend on the availability of both mackerel and Atlantic herring as well as fleet responses, so the effects are difficult to quantify. The Amendment 8 measures could increase bottom trawling for mackerel and herring, which could increase negative habitat impacts.

Protected Species: The status of several fish species are currently being reviewed by NMFS-GARFO to determine whether listing of these species under the ESA is warranted. These species are considered candidate species under the ESA and include cusk, alewife, and blueback herring. Additional information on cusk, alewife and blueback herring can be found at: https://www.fisheries.noaa.gov/endangered-species-conservation/candidate-species-under-endangered-species-act.

Summary of Management Impacts of Past, Present and Reasonably Foreseeable Future Actions

Overall all of these management actions have served to or will reduce effort or the impacts of effort through access limitations, upgrade restrictions, area and gear restrictions, EFH designations, monitoring, and accountability. These reductions have likely benefitted the managed species, habitat, protected resources, and non-target species. By ensuring the continued productivity of the managed resources, the human communities that benefit from catching the managed resources have also benefited in the long term; though at times quota reductions may have caused short-term economic dislocations.

Non-fishing Activities: Past, Present and Reasonably Foreseeable Future Actions

Non-fishing activities that occur in the marine nearshore and offshore environments and their watersheds can cause the loss or degradation of habitat and/or affect the species that reside in those areas. The following discussions of impacts are based on past assessments of activities and assume these activities will likely continue as projects are proposed.

Examples of non-fishing activities include point source and non-point source pollution, shipping, dredging, storm events, wind energy facilities, oil and gas development, construction, etc.. The impacts from these non-fishing activities, primarily stem from habitat loss tied to associated human interaction and alteration or natural disturbances. These activities are widespread and can have localized impacts to habitat such as accretion of sediments from at-sea disposal areas, oil and mineral resource exploration, aquaculture, construction of at-sea wind farms, bulk transportation of petrochemicals and significant storm events. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and as such may indirectly constrain the sustainability of managed species, non-target species, and protected species. Decreased habitat suitability tends to reduce the tolerance of valued ecosystem components to the impacts of fishing effort. Direct negative biological impacts that have been observed in fish and protected resources to result from non-fishing activities include shifting distributions, decreased reproductive ability and success, disrupted or modified food web interactions, and increased disease. The overall impact on the affected species and their habitats on a population level is unknown, but likely to be neutral to slight negative.

In addition to guidelines mandated by the MSA, NMFS reviews some of these types of effects during the review process required by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act for certain activities that are regulated by Federal, state, and local authority. The jurisdiction of these activities is in "waters of the United States" and includes both riverine and marine habitats.

Global Climate Change: Global climate change will affect all components of marine ecosystems, including human communities. Physical changes that are occurring and will continue to occur to these systems include sea-level rise, changes in sediment deposition, changes in ocean circulation, increased frequency, intensity and duration of extreme climate events, changing ocean chemistry, and warming ocean temperatures. Emerging evidence demonstrates that these physical changes are resulting in direct and indirect ecological responses within marine ecosystems which may alter the fundamental production characteristics of marine systems (Stenseth et al. 2002). Climate change will potentially exacerbate the stresses imposed by harvesting (fishing) and other non-fishing human activities and stressors (described in this section). Results from the Northeast Fisheries Climate Vulnerability Assessment (Hare et al. 2016) for Council-managed species indicate that climate change could have overall directional impacts that range from negative to positive depending on the adaptability of these managed species to the changing environment (Gaichas et al. 2016). Overall, climate change is expected to have impacts that range from positive to negative on all VECs depending on the species. However, future mitigation and adaptation strategies to climate change may mitigate some of these impacts as the science surrounding predicting, evaluating, monitoring and categorizing these changes evolves.

Energy Development: In recent years, offshore wind energy and oil and gas exploration have become more relevant activities in the Greater Atlantic region that are expected to impact all VECs, as described below. For potential biological impacts of wind, the turbines and cables may influence water currents and electromagnetic fields, respectively, which can affect patterns of movement for various species (target, non-target, protected). Habitats directly at the turbine and cable sites would be affected, and there could be scouring concerns around turbines. Impacts on human communities in a general sense will be mixed – there will be economic benefits in the form of jobs associated with construction and maintenance, and replacement of some electricity generated using fossil fuels with renewable sources. But there may be negative effects on fishing activities in terms of effort displacement, or making fishing more difficult or expensive near the turbines or cables.

For oil and gas, this timeframe would include leasing and possible surveys. Seismic surveys impact the acoustic environment within which marine species live, and have uncertain effects on fish behaviors that could cumulatively lead to negative population level impacts. The science on this is fairly uncertain. If marine resources are affected by seismic, then so in turn the fishermen targeting these resources would be affected. However, there would be an economic component in the form of increased jobs where there may be some positive effects on human communities.

While there are currently no operational wind farms in Mid-Atlantic waters, potential offshore wind energy sites have been identified off of Virginia, Maryland, New Jersey, Delaware, and New York, and there are several proposals to develop wind farms in both nearshore and offshore waters. In New England, in addition to the Rhode Island Block Island Wind farm, offshore wind project construction south of Massachusetts/Rhode Island may begin as early as 2019 (three projects including Vineyard Wind, Bay State Wind, and South Fork Wind Farm). Additional areas have been leased and will have site assessment activities in the next few years. These projects could have slight negative impacts on EFH, as well as fish species, and fishing communities if there are any negative impacts on those resources. Furthermore, there could be negative impacts on protected species of birds and marine mammals if they interact with the wind farms.

The overall impact of offshore wind energy and oil and gas exploration on the affected species and their habitats on a population level is unknown, but likely to range from no impact to moderate negative, depending on the number and locations of projects that occur, as well as the effects of mitigation efforts

7.6.1. Cumulative Effects Analysis

The cumulative impacts of this FMP were last fully addressed in final form by the EIS for Amendment 14 (http://www.greateratlantic.fisheries.noaa.gov/regs/2013/August/12smba14pr.html). All four species in the management unit are managed primarily via annual specifications to control fishing mortality so the operation of the fishery is generally reviewed annually. As noted above, the cumulative impact of on-going management of the MSB fisheries has been generally positive after passage of the Magnuson-Stevens Act and since its implementation for both the resources and communities that depend on them due to the more sustainable use of the resources. The elimination of foreign fishing, implementation of limited access, and control of fishing effort through annual specifications have had a positive impact on target and non-target species since the current domestic fishery is being prosecuted at lower levels of fishing effort compared to the historical foreign fishery. The foreign fishery was also known to take substantial numbers of marine mammals including common dolphin, white sided dolphin, and pilot whales.

Summary of Impacts from this Proposed Action

Target Species Impact Summary

The preferred management measures should allow the mackerel stock to grow and rebuild within 5 years. Changes in mackerel fishing should not impact squid or butterfish due to low catch of those species in the mackerel fishery and separate management measures control catch of those species. While Atlantic herring and mackerel are often caught together, separate management measures in the Atlantic herring fishery should ensure that overfishing does not occur on the Atlantic herring stock. Both no action and the preferred alternative should rebuild mackerel, but no action would rebuild mackerel faster than the preferred alternative.

Non-Target Species Impact Summary

Non-target interactions are relatively low in the mackerel fishery. The higher mackerel landings allowed under the preferred alternatives would have low-negative impacts on non-target species compared to no action, including river herrings (alewife and blueback herring) and shads (American and hickory). The RH/S cap should continue to limit interactions between the mackerel fishery and RH/S.

Habitat Impact Summary

Compared to no action, the limited increase in bottom trawling that could result from the preferred alternatives should not have adverse effects on habitat that are more than minimal and/or temporary in nature.

Protected Resources Impact Summary

Compared to no action, the limited increase in trawling effort that could result from the preferred alternatives could have negligible to moderately negative impacts on protected resources.

Human Communities Impact Summary

Compared to no action, the higher mackerel quotas should have positive human community impacts related to the potentially higher mackerel revenues and the associated stimulation of economic activity in communities related to those higher landings. The RH/S cap could limit mackerel landings depending on the RH/S encounter rate, in an approximately similar fashion as currently occurs.

7.6.1.1 Target Fisheries and Managed Resources

Overall, the cumulative effect of past, present, and reasonably foreseeable future fishing actions has resulted in positive effects on target species. First and foremost, the Council has met the obligations of National Standard 1 by adopting and implementing conservation and management measures that generally prevent overfishing, while achieving, on a continuing basis, the optimum yield for the four species. The latest assessment indicates that mackerel were overfished with overfishing occurring in 2016, but existing quotas and improved recruitment are projected to have ended overfishing in 2018 and brought the stock above the overfished threshold by June 2018. Longfin squid were considered overfished in 2000, but remedial action by the Council in subsequent years (i.e., reduced specifications) resulted in stock rebuilding to the point that the species in no longer considered overfished. *Illex* has never been designated as overfished since passage of the Sustainable Fisheries Act. In the case of butterfish, the fishery has been designated as fully rebuilt with a stock status above its target biomass (the assessment actually concluded it had never really been overfished in the first place).

In addition to mortality on these stocks due to fishing, there are other indirect effects from non-fishing anthropogenic activities in the Atlantic Ocean (e.g. climate change, point source and non-point source pollution, shipping, dredging, offshore energy development, etc.). In most cases the impacts of past, present and reasonably foreseeable non-fishing activities are negative, but these are generally not quantifiable at present for pelagic and semi-pelagic species like MSB other than noting that climate change is likely to affect at least the distribution of these species (e.g. Overholtz et al 2011[15]). It appears that several wind projects may begin construction in the near future, and these could have countervailing effects on longfin squid (potentially negative related to possibly disrupting spawning behavior during construction and potentially positive related to creating de facto refuges from fishing). Given the fishing that regularly occurs on spawning squid over a broad area, such impacts during construction are likely to be relatively small. Since these species occur over wide areas of the mid and north Atlantic Ocean and inhabit both inshore and offshore pelagic waters, it is not believed that any indirect anthropogenic activity currently impacts these populations significantly, even when considered together with the direct effects on these populations from fishing.

[15] From 1968–2008 the distribution of mackerel shifted about 250 km to the northeast and from deeper off-shelf locations to shallower on-shelf ones.

7.6.1.2 Essential Fish Habitat (EFH)

Overall, the cumulative effect of past, present, and reasonably foreseeable future fishing actions has resulted in slight negative effects on habitat (both in terms of MSB bottom trawl effort generally and on longfin squid eggs from all bottom trawling in applicable areas. Reductions in overall fishing effort and protection of sensitive habitats over time have mitigated negative effects. The effects of the proposed action on habitat are considered neutral, since the action is focused on the number of participants in the longfin squid fishery and not overall effort in or location of the fishery. Climate change is expected to have an impact on the physical characteristics and habitat aspects of marine ecosystems, and possibly change the very nature of these ecosystems. Increased frequency and intensity of extreme weather events, like hurricanes, may change the physical structure of coastal areas. Water circulation, currents, and the proportion of source waters/freshwater intrusion have been observed to be changing (Ecosystem Status Report, NEFSC, 2011) which influences salinity, water column stratification, transport of nutrients, and food web processes. All of these factors, in addition to others like ocean acidification and changes to water chemistry (Rebuck et al. in prep), threaten living elements of the marine environment, such as corals and shellfish, and may be related to the observed shifts in the planktonic community structure that forms the basis of the marine food web (ecosystem status report). Many additional activities, as described above, are concentrated near-shore and likely work either additively or synergistically to decrease habitat quality. The effects of these actions, combined with impacts resulting from years of commercial fishing activity, have negatively affected habitat. However, impacts from the proposed action were found to be negligible. Therefore, when considering the cumulative effects of this action in combination with past, present, and reasonably foreseeable future actions, impacts will remain slight negative and no significant impacts to the physical environment, habitat or EFH from the proposed action are expected.

7.6.1.3 Protected Species

As described in Section 6.4, there are numerous species which inhabit the environment within the management unit of this FMP that are afforded protection under the ESA and/or the MMPA. As noted above, none of the management measures under the preferred alternatives are expected to result in significant increases in fishing effort. There may be some slight increases in effort and therefore slight to moderately negative impacts. Prior to the passage of the Magnuson-Stevens Act and development of this FMP, the foreign prosecution of these fisheries occurred at much higher levels of fishing effort and were likely a major source of mortality for a number of marine mammal stocks, turtles, and sturgeon. The elimination of these fisheries and subsequent controlled development of the domestic fisheries have resulted in lower fishing effort levels. The cumulative effect of the proposed measures in conjunction with past and future management actions under the FMP and take reduction measures developed under the MMPA should continue to reduce the impact of these fisheries on the protected species listed in section 6.4.

The indirectly negative actions described above are localized in nearshore and marine project areas where protected species occur; therefore, the magnitude of those impacts on protected species is expected to be limited due to limited exposure of the populations at large. Agricultural runoff may be much broader in scope and the impacts of nutrient inputs to the coastal system may be larger in magnitude; however, the impact on protected species is not quantifiable. NMFS has several means under which it can review non-fishing actions of other Federal or state agencies that may impact protected species prior to permitting or implementation of those projects. This serves to minimize the extent and magnitude of indirect negative impacts those actions could have on protected species under NMFS' jurisdiction.

Therefore, no significant cumulative impacts to protected species are expected. The resource condition would be maintained (i.e. slight negative for ESA species and non-ESA listed MMPA species that have exceeded PBR; slight positive for non-ESA listed MMPA species below PBR), similar to previous years.

THIS SPACE INTENTIONALLY LEFT BLANK

7.6.1.4 Human Communities

National Standard 8 requires that management measures take into account fishing communities. Communities from Maine to North Carolina are involved in the harvesting of mackerel, squid and butterfish. Through implementation of the FMP for these species the Council seeks to achieve the primary objective of the Magnuson-Stevens Act which is to achieve optimum yield from these fisheries. It is important to keep in mind that by contributing to the overall functioning of and employment in coastal communities, the MSB fisheries have indirect social impacts as well. Social impacts are strongly aligned with changes to fishing opportunities and while difficult to measure can include impacts to families from income changes/volatility, safety-at-sea (related to changes in fishery operations due to regulation changes), job satisfaction and stability, and general frustration by individuals due to management's impacts especially if they perceive the management actions to be unreasonable or ill-informed. Unless otherwise noted, expanded fishing opportunities or less burdensome regulations that result in increased revenue for more individuals will have concomitant (i.e. naturally accompanying) positive social impacts. Likewise, reduced fishing opportunities or more burdensome regulations that result in lower revenue to fewer individuals will have concomitant negative social impacts.

The first cumulative human community effect of the FMP has been to guide the development of the domestic harvest and processing fishery infrastructure. Part of this fishery rationalization process included the development of limited access programs to control capitalization while maintaining harvest levels that are sustainable. In addition, by meeting the National Standards prescribed in the MSA, the Council has strived to meet one of the primary objectives of the act - to achieve optimum yield in each fishery. As noted above, while the management measures under the preferred alternatives are expected to slightly increase mackerel fishing effort and revenue, they are unlikely to result in substantial changes to levels of effort or the character of that effort relative to the status quo.

The indirectly affecting actions and activities described above have both positive and negative human community affects. For example agricultural pollution may negatively impact marine resources negatively affecting human communities, but there are also benefits to human communities from the food and jobs created during agricultural operations. The same tradeoff will exist for each of the indirectly affecting activities, resulting on overall indirect negative impacts on human communities by reducing marine resource availability; however, this effect is not quantifiable. NMFS has several means under which it can review non-fishing actions of other Federal or state agencies prior to permitting or implementation of those projects. This serves to minimize the extent and magnitude of indirect negative impacts those actions could have on human communities. Atlantic herring Amendment 8 and associated changes to annual specifications may have short term negative effects related to potentially reduced fishing opportunities but Amendment 8 presumably will only be approved by NOAA if there is a clear net benefit to the nation.

The proposed action, in conjunction with the past and future actions described above, should have ongoing positive, non-significant cumulative impacts for the communities which depend on these resources by maintaining stock sizes that lead to optimal sustainable harvests.

7.6.1.5 Non-target Species

Past management measures implemented under this FMP, and described above, which help to control or reduce discards of non-target species in these fisheries, include: 1) limited entry and specifications which are intended to control or reduce fishing effort; 2) incidental and bycatch caps or allowances; and, 3) minimum mesh requirements. Other FMPs have also regulated MSB fishing to minimize bycatch as well, such as the Scup Gear Restricted Areas implemented through the Summer Flounder, Scup, and Black Sea Bass FMP. The proposed action, in conjunction with these past and future actions, will not result in significant cumulative impacts to non-target species.

In addition to mortality on these stocks due to fishing, there are other indirect effects from non-fishing anthropogenic activities in the Atlantic Ocean (e.g. climate change, point source and non-point source pollution, shipping, dredging, etc.), but these are generally not quantifiable at present for pelagic and semi-pelagic species like those most likely to be encountered during MSB-fishing other than noting that climate change is likely to affect at least the distribution of some species (e.g. Overholtz et al 2011). Nonetheless, since most relevant species occur over wide areas of the mid and north Atlantic Ocean and inhabit both inshore and offshore pelagic waters, it is unlikely that any indirect anthropogenic activity currently impacts these populations substantially, especially in relative comparison to the direct effects on these populations as a result of fishing.

As noted above, none of the management measures under the preferred alternatives are expected to result in significantly increased levels of effort or changes to the character of that effort relative to the status quo so the baseline condition would be maintained (i.e. slight negative for non-target species), similar to previous years due to ongoing interactions and previous efforts to reduce interactions.

7.6.1.6 Summary of cumulative impacts

The direct impacts of the preferred alternatives on the biological, physical, and human environment are described in section 7. The overall implementation of the measures considered via this document are expected to generate positive impacts by allowing for additional mackerel landings and rebuilding the mackerel stock. Only a modest amount of additional fishing effort would be expected so impacts to habitat, protected resources, and non-target species are unlikely to change in a significant manner. The RH/S cap would also continue to incentivize vessels to avoid RH/S. While both the mackerel quota and the RH/S cap would increase under the preferred alternatives, both would still be less than they were as recently as 2014. Indirect benefits of the preferred alternatives are likely to affect consumers and areas of the economic and social environment that interact in various ways with these fisheries. The impact of the proposed actions, when considered together with past and future actions are not expected to result in significant cumulative impacts on the biological, physical, and human components of the environment. As long as management prevents overfishing and rebuilds overfished stocks, the fisheries and their associated communities should continue to benefit. As noted above, the historical development of the FMP resulted in a number of actions which have impacted these fisheries and other valued ecosystem components. The cumulative effects of past actions in conjunction with the proposed measures and possible future actions are discussed above. Within the construct of that analysis, the Council has concluded that no significant cumulative impacts will result from the proposed specifications.

THIS SPACE INTENTIONALLY LEFT BLANK

8.0 WHAT LAWS APPLY TO THE ACTIONS CONSIDERED IN THIS DOCUMENT?

8.1 Magnuson-Stevens Fishery Conservation and Management Act

8.1.1 National Standards

Section 301 of the Magnuson-Stevens Fishery Conservation and Management Act requires that fishery management plans contain conservation and management measures that are consistent with the ten National Standards:

In General. – Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the…national standards for fishery conservation and management.

(1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

The proposed measures would increase yield while preventing overfishing, thus helping to achieve optimum yield.

(2) Conservation and management measures shall be based upon the best scientific information available.

The data sources considered and evaluated during the development of this action include, but are not limited to: permit data, landings data from vessel trip reports, information from resource trawl surveys, sea sampling (observer) data, data from the dealer weighout purchase reports, peer-reviewed assessments including the recent mackerel benchmark assessment, original literature, and descriptive information provided by fishery participants and the public. To the best of the Council's knowledge these data sources constitute the best scientific information available. All analyses based on these data have been reviewed by National Marine Fisheries Service and the public. The projections for rebuilding and associated catches were also reviewed by the Council's SSC and determined to constitute best available scientific information.

(3) To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

The fishery management plan addresses management of the mackerel, squid, and butterfish stocks throughout the range of the species in U.S. waters, in accordance with the jurisdiction of U.S. law.

(4) Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

None of the proposed measures would discriminate between residents of different States or assign/allocate fishing privileges among U.S. fishermen.

(5) Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

There is no allocation proposed. The proposed actions are efficient in that they should facilitate full utilization of the mackerel and herring quotas. All of the action alternatives in Alternative Set 2 should help promote short and long-term efficiency by slowing the directed fishery to prevent overages and ensure that the herring fishery has sufficient bycatch to continue operations.

(6) Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

Changes in fisheries occur continuously, both as the result of human activity (for example, new technologies or shifting market demand) and natural variation (for example, oceanographic perturbations). In order to provide the greatest flexibility possible for future management decisions, the fishery management plan includes a framework adjustment mechanism with an extensive list of possible framework adjustment measures that can be used to quickly adjust the plan as conditions in the fishery change.

(7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

As always, the Council considered the costs and benefits associated with the management measures proposed in the action when developing this action. This action should not create any duplications related to managing the MSB resources. Maintaining the status quo would forgo quota (and revenue) increases that can occur while still rebuilding the mackerel resource.

(8) Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

The human community impacts of the action are described above in Section 7.5. The proposed measures would likely increase yield and revenues to human communities. The increased yield of the proposed measures are also consistent with conservation requirements that require rebuilding as quickly as possible. The Council considered information on the status and biology of mackerel, the needs of fishing communities, and the interaction of mackerel in the ecosystem when selecting the preferred alternative, Alternative 1c. A motion was put forth to use a shorter (3-year) rebuilding timeframe, but the Council decided that a 5-year rebuilding timeframe better balanced the needs of fishing communities with the biological potential to rebuild mackerel faster including considering mackerel's role in the ecosystem. The Council received substantial public input that especially given the pending potential reductions in Atlantic herring quotas, having the opportunity to access the mackerel quotas available under a 5-year rebuilding timeline could be important for the stability of fishing communities. The rebuilding projections also have biomass at 94% of rebuilt after three years under the 5-year rebuilding plan, versus 104% of rebuilt after three years under the 3-year plan, so in terms of overall mackerel abundance, there is not a substantial difference between the 3-year and 5-year rebuilding timelines after 3 years; mackerel is projected to be largely rebuilt after three years even under the 5-year rebuilding timeline. However, the proposed 5-year rebuilding better provides for the sustained participation of fishing communities.

(9) Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

The Magnuson-Stevens Act defines "bycatch" as fish that are harvested in a fishery, but are not retained (sold, transferred, or kept for personal use), including economic discards and regulatory discards. Incidentally landed catch are fish, other than the target species, that are harvested while fishing for a target species and retained and/or sold. Previous actions have reduced bycatch to the extent practicable, as described elsewhere in this document. The RH/S cap should continue to control catch of those species in the mackerel fishery. The proposed closure mechanisms (Alternative 2d) also should allow retention of incidentally-caught mackerel to minimize mackerel discards after closure of the directed fisheries.

(10) Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

Fishing is a dangerous occupation; participants must constantly balance the risks imposed by weather against the economic benefits. According to the National Standard guidelines, the safety of the fishing vessel and the protection from injury of persons aboard the vessel are considered the same as "safety of human life at sea." The safety of a vessel and the people aboard is ultimately the responsibility of the master of that vessel. Each master makes many decisions about vessel maintenance and loading and about the capabilities of the vessel and crew to operate safely in a variety of weather and sea conditions. This national standard does not replace the judgment or relieve the responsibility of the vessel master related to vessel safety. No measures in this action are expected to negatively impact safety at sea.

8.1.2 Other Required Provisions of the Magnuson-Stevens Act

Section 303 of the MSA contains 15 additional required provisions for FMPs, which are listed and discussed below. Nothing in this action is expected to contravene any of these required provisions.

(1) contain the conservation and management measures, applicable to foreign fishing and fishing by vessels of the United States, which are-- (A) necessary and appropriate for the conservation and management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery; (B) described in this subsection or subsection (b), or both; and (C) consistent with the National Standards, the other provisions of this Act, regulations implementing recommendations by international organizations in which the United States participates (including but not limited to closed areas, quotas, and size limits), and any other applicable law

The MSB FMP has evolved over time through 20 Amendments and currently uses Acceptable Biological Catch recommendations from the Council's Scientific and Statistical Committee to sustainably manage the Mackerel, Squid, and Butterfish fisheries. Under the umbrella of limiting catch to the Acceptable Biological Catch, a variety of other management and conservation measures have been developed to meet the goals of the fishery management plan and remain consistent with the National Standards. The current measures are codified in the Code of Federal Regulations (50 C.F.R. § 648 Subpart B - http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=1e9802ffddb05d0243d9c657fade956c&rgn=div5&view=text&node=50:12.0.1.1.5&idno=50) and summarized at http://www.greateratlantic.fisheries.noaa.gov/regs/infodocs/msbinfosheet.pdf. This action proposes measures that should continue to promote the long-term health and stability of the fisheries, consistent with the MSA. This action proposes a rebuilding program to rebuild the mackerel stock in 5 years, which is consistent with the MSA, as detailed elsewhere in this document.

(2) contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be

incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any

Every Amendment to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan provides this information. This document updates this information as appropriate in Section 6.

(3) assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from, the fishery, and include a summary of the information utilized in making such specification

For the mackerel stock, the present and probable future condition, the maximum sustainable yield, optimum yield, and a summary of the assessment used to determine this information has been included in Section 6.1. For other MSB species, other actions have included this information. Full assessment reports are available at: http://www.nefsc.noaa.gov/saw/.

(4) assess and specify-- (A) the capacity and the extent to which fishing vessels of the United States, on an annual basis, will harvest the optimum yield specified under paragraph (3); (B) the portion of such optimum yield which, on an annual basis, will not be harvested by fishing vessels of the United States and can be made available for foreign fishing; and (C) the capacity and extent to which United States fish processors, on an annual basis, will process that portion of such optimum yield that will be harvested by fishing vessels of the United States

Based on past performance and capacity analyses (e.g. Amendment 11 and the pending Squid Amendment), if Atlantic mackerel, squid, and butterfish are sufficiently abundant and available, the domestic fishery has the desire and ability to fully harvest the available quotas, and domestic processors can process the fish/squid.

(5) specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter fishing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, and the estimated processing capacity of, and the actual processing capacity utilized by, United States fish processors

Previous Amendments have specified the data that must be submitted to NMFS in the form of vessel trip reports, vessel monitoring system trip declarations and catch reports, and dealer reports.

(6) consider and provide for temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safe conduct of the fishery; except that the adjustment shall not adversely affect conservation efforts in other fisheries or discriminate among participants in the affected fishery

There are no such requests pending, but the plan contains provisions for framework actions to make modifications regarding access/permitting if necessary.

(7) describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat

Section 6.3 of this document summarizes essential fish habitat (EFH). Amendments 9 and 11 evaluated habitat impacts, updated essential fish habitat designations, and implemented measures to reduce habitat impacts (primarily related to tilefish essential fish habitat). Amendment 16 implemented measures to protect deep-sea corals. An upcoming review of EFH will review EFH designations and potential adverse impacts to EFH from Council-managed fisheries.

(8) in the case of a fishery management plan that, after January 1, 1991, is submitted to the Secretary for review under section 304(a) (including any plan for which an amendment is submitted to the Secretary for such review) or is prepared by the Secretary, assess and specify the nature and extent of scientific data which is needed for effective implementation of the plan

The preparation of this action included a review of the scientific data available to assess the impacts of all alternatives considered. No additional data was deemed needed for effective implementation of the plan at this time.

(9) include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on-- (A) participants in the fisheries and fishing communities affected by the plan or amendment; and (B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants;

Section 7.5 of this document provides an assessment of the likely effects on fishery participants and communities from the considered actions.

(10) specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished (with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery) and, in the case of a fishery which the Council or the Secretary has determined is approaching an overfished condition or is overfished, contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery

Amendments 8 and 9 to the fishery management plan established biological reference points for the species in the plan, and Amendment 10 contained measures for butterfish rebuilding. Mackerel was recently declared overfished and a rebuilding action is under development through this action. If a fishery is declared overfished or if overfishing is occurring, another Amendment or appropriate action would be undertaken to implement effective corrective measures. A recent omnibus framework also streamlined incorporation of new overfished/overfishing reference points (they are automatically incorporated once accepted through a peer-review process). The reference points for mackerel are described in Section 6.1. Since the stock was declared overfished, this action is specifically designed to rebuild the mackerel stock and avoid overfishing, as described in Sections 5 and 7.

(11) establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority-- (A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided

NMFS has implemented an omnibus amendment to implement a revised standardized reporting methodology since the previous methodology was invalidated by court order. See http://www.greateratlantic.fisheries.noaa.gov/mediacenter/2013/09/draftsbrmamendment.html for details.

(12) assess the type and amount of fish caught and released alive during recreational fishing under catch and release fishery management programs and the mortality of such fish, and include conservation and management measures that, to the extent practicable, minimize mortality and ensure the extended survival of such fish

The Atlantic mackerel, squid, and butterfish fisheries are primarily commercial. There are some discards in the recreational mackerel fishery, but these are minimal related to the overall scale of the mackerel fishery. There are no size limits that would lead to regulatory recreational discarding of mackerel. There are no specific catch and release fishery management programs.

There is some recreational longfin squid fishing, but it is thought to be relatively minor and the Council can consider if a survey is appropriate to further investigate longfin squid recreational fishing.

(13) include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors

This document updates this information as appropriate in Section 6. There is minimal recreational and charter fishing for squid, and no measures in this action would restrict such activity.

(14) to the extent that rebuilding plans or other conservation and management measures which reduce the overall harvest in a fishery are necessary, allocate any harvest restrictions or recovery benefits fairly and equitably among the commercial, recreational, and charter fishing sectors in the fishery.

Substantial harvest reductions are not anticipated as part of this rebuilding plan for mackerel.

(15) establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability.

The annual specifications process addresses this requirement. Acceptable Biological Catch recommendations from the Council's Scientific and Statistical Committee are designed to avoid overfishing and form the upper bounds on catches. There are a variety of proactive and reactive accountability measures for these fisheries, fully described at: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=1e9802ffddb05d0243d9c657fade956c&rgn=div5&view=text&node=50:12.0.1.1.5&idno=50#50:12.0.1.1.5.2.

8.1.3 DISCRETIONARY PROVISIONS OF THE MAGNUSON-STEVENS ACT

Section 303b of the Magnuson-Stevens Act contains 14 additional discretionary provisions for Fishery Management Plans. See https://www.fisheries.noaa.gov/topic/laws-policies#magnuson-stevens-act. Of import for this action, these discretionary provisions allow seasons, fishery closures, trip limits, and measures to control incidental catch of non-target species.

8.1.4 Essential Fish Habitat Assessment

The measures under the preferred alternatives proposed in this action are not expected to result in substantial changes in effort that impacts habitat, as described in Section 7. Therefore, the Council concluded in section 7 of this document that the proposed measures will have no additional adverse impacts on EFH that are more than minimal or temporary. Thus no mitigation is necessary. The adverse impacts of bottom trawls used in MSB fisheries on other managed species (not MSB), which were determined to be more than minimal and not temporary in Amendment 9, were minimized to the extent practicable by the Lydonia and Oceanographer canyon closures to squid fishing. In addition, Amendment 1 to the Tilefish FMP closed those canyons plus Veatch's and Norfolk Canyons to all bottom trawling. Deepwater corals were also protected in Amendment 16. Therefore, the adverse habitat impacts of MSB fisheries "continue to be minimized." Amendment 11 revised the MSB EFH designations and EFH impacts will continue to be monitored and addressed as appropriate.

8.2 NEPA

8.2.1 Finding of No Significant Impact (FONSI)

The Council on Environmental Quality (CEQ) Regulations state that the determination of significance using an analysis of effects requires examination of both context and intensity, and lists ten criteria for intensity (40 CFR 1508.27). In addition, the Companion Manual for National Oceanic and Atmospheric Administration Administrative Order 216-6A provides sixteen criteria, the same ten as the CEQ Regulations and six additional, for determining whether the impacts of a proposed action are significant. Each criterion is discussed below with respect to the proposed action and considered individually as well as in combination with the others.

1. Can the proposed action reasonably be expected to cause both beneficial and adverse impacts that overall may result in a significant effect, even if the effect will be beneficial?

As described in Section 7 of this document, the proposed action will have both beneficial and slightly adverse impacts because effort and landings of mackerel may increase modestly, but the impacts are not expected to be significant as only a small amount of additional effort would be expected. The positive impacts are related to increases in revenues related to higher quotas. The slightly adverse impacts are related to associated effort increases and effects on habitat, protected resources, and non-target species.

2. Can the proposed action reasonably be expected to significantly affect public health or safety?

As described in Section 7 of this document, none of the proposed measures substantially alter the manner in which the industry conducts fishing activities for the target species. Therefore, the proposed actions in these fisheries are not expected to adversely impact public health or safety.

3. Can the proposed action reasonably be expected to result in significant impacts to unique characteristics of the geographic area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?

The action proposed addresses management of the MSB fisheries, which was established in the FMP and modified in various amendments, frameworks, and specifications. Although there are shipwrecks present in the area where fishing occurs, including some registered on the National Register of Historic Places, vessels typically avoid fishing too close to wrecks due to the possible loss or entanglement of fishing gear. As described in Section 7 of this document, none of the measures substantially alter the manner in which the industry conducts fishing activities for the target species. Therefore, it is not likely that the preferred alternative would adversely affect the historic resources listed above.

4. Are the proposed action’s effects on the quality of the human environment likely to be highly controversial?

The proposed action modifies existing measures contained in the FMP and should rebuild the mackerel stock in only five years without reducing mackerel quotas. While increasing, both the proposed mackerel catch and the accompanying RH/S cap would still be lower than as recently as 2014. As a result, the effects of the proposed action herein are not expected to be highly controversial.

The increased yield of the proposed measures are also consistent with conservation requirements of the MSA that require rebuilding as quickly as possible. The Council considered information on the status and biology of mackerel, the needs of fishing communities, and the interaction of mackerel in the ecosystem when selecting the preferred alternative, Alternative 1c. A motion was put forth to use a shorter (3-year) rebuilding timeframe, but the Council decided that a 5-year rebuilding timeframe better balanced the needs of fishing communities with the biological potential to rebuild mackerel faster including considering mackerel's role in the ecosystem. The Council received substantial public input that especially given the pending potential reductions in Atlantic herring quotas, having the opportunity to access the mackerel quotas available under a 5-year rebuilding timeline could be important for the stability of fishing communities. The rebuilding projections also have biomass at 94% of rebuilt after three years under the 5-year rebuilding plan, versus 104% of rebuilt after three years under the 3-year plan, so in terms of overall mackerel abundance, there is not a substantial difference between the 3-year and 5-year rebuilding timelines after 3 years; mackerel is projected to be largely rebuilt after three years even under the 5-year rebuilding timeline. However, the proposed 5-year rebuilding better provides for the sustained participation of fishing communities.

5. Are the proposed action's effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

While there is always a degree of variability in the year to year performance of the relevant fisheries, and the rebuilding projections used to estimate future changes to the mackerel stock size involve some uncertainty, they are not unusually uncertain nor do they involve unique or unknown risks. The Council also expects a mackerel assessment update in 2020 which will allow evaluation of rebuilding progress and indicate if any additional actions are necessary.

6. Can the proposed action reasonably be expected to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

The proposed action modifies existing measures and the modifications have been proposed and evaluated consistent with the existing fishery management plan and therefore is neither likely to establish a precedent for future actions with significant effects nor to represent a decision in principle about a future consideration. Making adjustments to the risk policy was explicitly contemplated in previous actions so this is not precedent-setting.

7. Is the proposed action related to other actions that when considered together will have individually insignificant but cumulatively significant impacts?

The cumulative impacts of the preferred alternatives on the biological, physical, and human environment are described in Section 7 of this document. The overall interaction of the proposed action with other past, present and reasonably foreseeable future actions, including non-fishing activities, are not expected to result in significant cumulative impacts on the biological, physical, and human components of the environment.

8. Can the proposed action reasonably be expected to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?

The action proposed addresses management of the MSB fisheries, which was established in the FMP and modified in various amendments, frameworks, and specifications. Other types of commercial fishing already occur in this area, and although it is possible that historic or cultural resources such as shipwrecks could be present, vessels try to avoid fishing too close to wrecks due to the possible loss or entanglement of fishing gear. Therefore, it is not likely that the preferred alternative would result in substantial impacts to unique areas.

9. Can the proposed action reasonably be expected to have a significant impact on endangered or threatened species, or their critical habitat as defined under the Endangered Species Act of 1973?

The proposed action is not expected to alter overall fishing operations, lead to a substantial increase of fishing effort, or alter the spatial and/or temporal distribution of current fishing effort (see Section 7 of this document) in a manner that would substantially increase interaction rates with protected species.

This action falls within the range of impacts considered in the Batched Fisheries Biological Opinion for the Atlantic Mackerel, Squid, and Butterfish Fisheries (December 16, 2013).

However, in a memorandum dated October 17, 2017, GARFO's Protected Resources Division reinitiated consultation on the Batched Biological Opinion. As part of the reinitiation, it was determined that allowing these fisheries to continue during the reinitiation period will not violate ESA sections 7(a)(2) and 7(d) because it will not increase the likelihood of interactions with protected species above the amount that was previously considered in the 2013 Batched Biological Opinion. Therefore, conducting the proposed action during the reinitiation period would not be likely to jeopardize the continued existence of any whale, sea turtle, Atlantic salmon, or sturgeon species.

The Atlantic mackerel, squid, and butterfish fisheries will not affect the essential physical and biological features of North Atlantic right whales or loggerhead sea turtles (Northwest Atlantic Ocean DPS) critical habitat and therefore, will not result in the destruction or adverse modification of critical habitat (NMFS 2014a;NMFS2015a,b).

10. Can the proposed action reasonably be expected to threaten a violation of Federal, state, or local law or requirements imposed for environmental protection?

As described in Section 7 of this document, overall fishing effort is not expected to substantially increase in magnitude under the proposed action. In addition, none of the proposed measures are expected to substantially alter fishing methods, activities, or the spatial and/or temporal distribution of fishing effort. Thus, it is not expected that they would threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment. The proposed measures have been found to be consistent with other applicable laws as described in this Section.

11. Can the proposed action reasonably be expected to adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act?

The MSB fisheries are known to interact with MMPA protected species. As described in Section 7 of this document, fishing effort is not expected to substantially increase in magnitude under the proposed measures. In addition, none of the proposed measures are expected to substantially alter fishing methods, activities, or the spatial and/or temporal distribution of fishing effort. Based on this, and for the reasons described in section 7.3, depending on alternative and MMPA species under consideration, impacts to non-ESA listed marine mammals are expected to range from slight positive to moderately negative.

12. Can the proposed action reasonably be expected to adversely affect managed fish species?

As described in Section 7 of this document, none of the proposed measures are expected to jeopardize the sustainability of any target species affected by the action. The preferred measures should lead to a rebuilding of the Atlantic mackerel stock. The preferred alternatives are consistent with the FMP and best available scientific information. As such, the proposed action is expected to ensure the long term sustainability of harvests from the MSB stocks. The proposed action is not expected to jeopardize the sustainability of any non-target species (see section 7 of this document) because the proposed measures are not expected to result in substantial increases in overall fishing effort and the mackerel fishery has relatively low incidental catch rates. The RH/S cap will continue to control RH/S incidental catch and incentivize avoidance. In addition, none of the measures are expected to substantially alter fishing methods or the temporal and/or spatial distribution of fishing activities. Therefore, none of the proposed actions are expected to jeopardize the sustainability of managed or other non-target species.

13. Can the proposed action reasonably be expected to adversely affect essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act?

The proposed action is not expected to cause damage to the ocean, coastal habitats, and/or EFH as defined under the Magnuson Stevens Act and identified in the FMP (see Section 7). In general, bottom tending mobile gear, primarily otter trawls, which are used to harvest mackerel, squid, and butterfish, have the potential to adversely affect EFH for the benthic lifestages of a number of species in the Northeast region that are managed by other FMPs. However, because as described in Section 7 of this document none of the management measures proposed in this action should cause any substantial increase in overall fishing effort relative to the status quo, they are not expected to have any substantial negative impact on EFH or on coastal and ocean habitats.

14. Can the proposed action reasonably be expected to adversely affect vulnerable marine or coastal ecosystems, including but not limited to, deep coral ecosystems?

Deep coral ecosystems have been protected from bottom-tending mobile gear used in the MSB fisheries by previous Council actions. Overall fishing effort is not expected to substantially increase in magnitude under the proposed action (see Section 7 of this document). In addition, none of the proposed measures are expected to substantially alter fishing methods, activities, or the spatial and/or temporal distribution of fishing effort. Thus, it is not expected that they would adversely affect vulnerable marine or coastal ecosystems, including but not limited to, deep coral ecosystems.

15. Can the proposed action reasonably be expected to adversely affect biodiversity or ecosystem functioning (e.g., benthic productivity, predator-prey relationships, etc.)?

These fisheries are prosecuted using bottom otter trawls, which have the potential to impact bottom habitats. In addition, a number of non-target species are taken incidentally to the prosecution of these fisheries. However, fishing effort is not expected to substantially increase in magnitude under the proposed measures (see Section 7 of this document). In addition, none of the proposed measures are expected to substantially alter fishing methods, activities or the spatial and/or temporal distribution of fishing effort. Therefore, the proposed action is not expected to have a substantial impact on biodiversity or ecosystem function (e.g. food webs) within the affected area.

16. Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

There is no evidence or indication that these fisheries have ever resulted or would ever result in the introduction or spread of nonindigenous species.

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for this action, it is hereby determined that these proposed MSB FMP measures will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an environmental impact statement for this action is not necessary.

______________________________ ____________________

Michael Pentony Date

Greater Atlantic Regional Administrator, NOAA

8.3 Marine Mammal Protection Act

The various species which inhabit the management unit of this FMP that are afforded protection under the Marine Mammal Protection Act of 1972 (MMPA) are described in Section 6.4. As provided in section 6.4, various MMPA protected species have the potential to interact with the gear types used in the FMP (i.e., mid-water and/or bottom trawl gear). None of the proposed measures are expected to significantly alter fishing methods or activities or result in substantially increased effort. The Council has reviewed the impacts of the proposed measures on marine mammals and concluded that the management actions proposed are consistent with the provisions of the MMPA and would not alter existing measures to protect the species likely to inhabit the management units of the subject fisheries. For further information on the potential marine mammal impacts of the fishery and the proposed management action, see Sections 6 and 7 of this Environmental Assessment.

8.4 Endangered Species Act

The batched fisheries Biological Opinion completed on December 16, 2013, concluded that the actions considered would not jeopardize the continued existence of any listed species. On

October 17, 2017, NMFS reinitiated consultation on the batched Biological Opinion due to updated information on the decline of Atlantic right whale abundance.

Section 7(d) of the ESA prohibits Federal agencies from making any irreversible or irretrievable commitment of resources with respect to the agency action that would have the effect of foreclosing the formulation or implementation of any reasonable and prudent alternatives during the consultation period. This prohibition is in force until the requirements of section 7(a)(2) have been satisfied. Section 7(d) does not prohibit all aspects of an agency action from proceeding during consultation; non-jeopardizing activities may proceed as long as their implementation would not violate section 7(d). Per the October 17, 2017, memo, it was concluded that allowing those fisheries specified in the batched Biological Opinion to continue during the reinitiation period will not increase the likelihood of interactions with ESA listed species above the amount that would otherwise occur if consultation had not been reinitiated. Based on this, the memo concluded that the continuation of these fisheries during the reinitiation period would not be likely to jeopardize the continued existence of any ESA listed species. Taking this, as well as our analysis of the proposed action into consideration, we do not expect the proposed action, in conjunction with other activities, to result in jeopardy to any ESA listed species.

This action does not represent any irreversible or irretrievable commitment of resources with respect to the FMP that would affect the development or implementation of reasonable and prudent measures during the consultation period. NMFS has discretion to amend its Magnuson-Stevens Act and ESA regulations and may do so at any time subject to the Administrative Procedure Act and other applicable laws. As a result, the Council has preliminarily determined that fishing activities conducted pursuant to this action will not affect endangered and threatened species or critical habitat in any manner beyond what has been considered in prior consultations on this fishery.

8.5 Administrative Procedures Act

Section 553 of the Administrative Procedure Act establishes procedural requirements applicable to informal rulemaking by Federal agencies. The purpose of these requirements is to ensure public access to the Federal rulemaking process, and to give the public adequate notice and opportunity for comment. At this time, the Council is not requesting any abridgement of the rulemaking process for this action.

8.6 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control and, to the extent possible, minimize the paperwork burden for individuals, small businesses, nonprofit institutions, and other persons resulting from the collection of information by or for the Federal Government. This action would not modify existing collections or require new collections.

8.7 Coastal Zone Management Act

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all Federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. Pursuant to the Coastal Zone Management Act regulations at 15 CFR 930.35, a negative determination may be made if there are no coastal effects and the subject action: (1) Is identified by a state agency on its list, as described in ' 930.34(b), or through case-by-case monitoring of unlisted activities; or (2) which is the same as or is similar to activities for which consistency determinations have been prepared in the past; or (3) for which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity. NMFS is reviewing applicable coastal policies of affected states and will make an appropriate determination as part of the rulemaking process.

8.8 Section 515 (Data Quality Act)

Pursuant to NOAA guidelines implementing section 515 of Public Law 106-554 (the Data Quality Act), all information products released to the public must first undergo a Pre-Dissemination Review to ensure and maximize the quality, objectivity, utility, and integrity of the information (including statistical information) disseminated by or for Federal agencies. The following section addresses these requirements.

Utility

The information presented in this document should be helpful to the intended users (the affected public) by presenting a clear description of the purpose and need of the proposed action, the measures proposed, and the impacts of those measures. A discussion of the reasons for selecting the proposed action is included so that intended users may have a full understanding of the proposed action and its implications, as well as the Council's rationale.

Until a proposed rule is prepared and published, this document is the principal means by which the information contained herein is available to the public. The information provided in this document is based on the most recent available information from the relevant data sources. The development of this document and the decisions made by the Council to propose this action are the result of a multi-stage public process. Thus, the information pertaining to management measures contained in this document has been improved based on comments from the public, the fishing industry, members of the Council, and NMFS.

The Federal Register notice that announces the proposed rule and the final rule and implementing regulations will be made available in printed publication, on the website for the Greater Atlantic Regional Fisheries Office, and through the Regulations.gov website. The Federal Register documents will provide metric conversions for all measurements.

Integrity

Prior to dissemination, information associated with this action, independent of the specific intended distribution mechanism, is safeguarded from improper access, modification, or destruction, to a degree commensurate with the risk and magnitude of harm that could result from the loss, misuse, or unauthorized access to or modification of such information. All electronic information disseminated by NOAA Fisheries adheres to the standards set out in Appendix III, Security of Automated Information Resources,@ of OMB Circular A-130; the Computer Security Act; and the Government Information Security Act. All confidential information (e.g., dealer purchase reports) is safeguarded pursuant to the Privacy Act; Titles 13, 15, and 22 of the U.S. Code (confidentiality of census, business, and financial information); the Confidentiality of Statistics provisions of the Magnuson-Stevens Act; and NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics.

Objectivity

For purposes of the Pre-Dissemination Review, this document is considered to be a Natural Resource Plan. Accordingly, the document adheres to the published standards of the Magnuson-Stevens Act; the Operational Guidelines, FMP Process; the EFH Guidelines; the National Standard Guidelines; and NOAA Administrative Order 216-6A, Compliance with the National Environmental Policy Act and its Companion Manual.

This information product uses information of known quality from sources acceptable to the relevant scientific and technical communities. Stock status (including estimates of biomass and fishing mortality) reported in this product are based on either assessments subject to peer-review through the Stock Assessment Review Committee or on updates of those assessments prepared by scientists of the Northeast Fisheries Science Center. Landing and revenue information is based on information collected through the Vessel Trip Report and Commercial Dealer databases. Information on catch composition, by tow, is based on reports collected by the NOAA Fisheries observer program and incorporated into the sea sampling or observer database systems. These reports are developed using an approved, scientifically valid sampling process. In addition to these sources, additional information is presented that has been accepted and published in peer-reviewed journals or by scientific organizations. Original analyses in this document were prepared using data from accepted sources, and the analyses have been reviewed by members of the Mackerel, Squid and Butterfish Monitoring Committee or other NMFS staff with expertise on the subject matter.

Despite current data limitations, the conservation and management measures proposed for this action were selected based upon the best scientific information available. The analyses conducted in support of the proposed action were conducted using information from the most recent complete calendar years, generally through 2017 except as noted. The data used in the analyses provide the best available information on the number of seafood dealers operating in the northeast, the number, amount, and value of fish purchases made by these dealers. Specialists (including professional members of plan development teams, technical teams, committees, and Council staff) who worked with these data are familiar with the most current analytical techniques and with the available data and information relevant to these fisheries.

The policy choices are clearly articulated in Section 5 of this document as well as the management alternatives considered in this action. The supporting science and impact analyses, upon which the policy choices are based, are described in Sections 6 and 7 of this document. All supporting materials, information, data, and analyses within this document have been, to the maximum extent practicable, properly referenced according to commonly accepted standards for scientific literature to ensure transparency.

The review process used in preparation of this document will involve the responsible Council, the Northeast Fisheries Science Center, the Greater Atlantic Regional Fisheries Office, and NOAA Fisheries Headquarters. The Center's technical review is conducted by senior level scientists with specialties in population dynamics, stock assessment methods, demersal resources, population biology, and the social sciences. The Council review process involves public meetings at which affected stakeholders have opportunity to provide comments on the document. Review by staff at the Regional Office is conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. Final approval of the action proposed in this document and clearance of any rules prepared to implement resulting regulations is conducted by staff at NOAA Fisheries Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget.

8.9 Regulatory Flexibility Analysis

The purpose of the Regulatory Flexibility Act is to reduce the impacts of burdensome regulations and recordkeeping requirements on small businesses. To achieve this goal, the Regulatory Flexibility Act requires Federal agencies to describe and analyze the effects of proposed regulations, and possible alternatives, on small business entities. Section 12.0 at the end of this document will include the Regulatory Flexibility Act Analysis.

8.10 Executive Order (E.O.) 12866 (Regulatory Planning and Review)

To enhance planning and coordination with respect to new and existing regulations, this Executive Order requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be significant. Section 12.0 at the end of this document includes the Regulatory Impact Review, which includes an assessment of the costs and benefits of the proposed action, in accordance with the guidelines established by Executive Order 12866. The analysis shows that this action is not a significant regulatory action because it will not affect in a material way the economy or a sector of the economy.

8.11 Executive Order (E.O.) 13132 (Federalism)

This Executive Order established nine fundamental federalism principles for Federal agencies to follow when developing and implementing actions with federalism implications. The Executive Order also lists a series of policy making criteria to which Federal agencies must adhere when formulating and implementing policies that have federalism implications. However, no federalism issues or implications have been identified relative to the measures proposed measures. This action does not contain policies with federalism implications sufficient to warrant preparation of an assessment under Executive Order 13132. The affected states have been closely involved in the development of the proposed management measures through their representation on the Council (all affected states are represented as voting members of at least one Regional Fishery Management Council). No comments were received from any state officials relative to any federalism implications that may be associated with this action

9.0 LITERATURE CITED AND SELECTED OTHER BACKGROUND DOCUMENTS

Adelman, W.J., Jr., Arnold, J.M., and Gilbert, D.L. 2013. Squid as Experimental Animals. Springer Science & Business Media, N.Y., NY.

Arkhipkin, Alexander, I., Paul G. K. Rodhouse, Graham J. Pierce, Warwick Sauer, Mitsuo Sakai, Louise Allcock, Juan Arguelles, John R. Bower, Gladis Castillo, Luca Ceriola, Chih-Shin Chen, Xinjun Chen, Mariana Diaz-Santana, Nicola Downey, Angel F. González, Jasmin Granados Amores, Corey P. Green, Angel Guerra, Lisa C. Hendrickson, Christian Ibáñez, Kingo Ito, Patrizia Jereb, Yoshiki Kato, Oleg N. Katugin, Mitsuhisa Kawano, Hideaki Kidokoro, Vladimir V. Kulik, Vladimir V. Laptikhovsky, Marek R. Lipinski, Bilin Liu, Luis Mariátegui, Wilbert Marin, Ana Medina, Katsuhiro Miki, Kazutaka Miyahara, Natalie Moltschaniwskyj, Hassan Moustahfid, Jaruwat Nabhitabhata, Nobuaki Nanjo, Chingis M. Nigmatullin, Tetsuya Ohtani, Gretta Pecl, J. Angel A. Perez, Uwe Piatkowski, Pirochana Saikliang, Cesar A. Salinas-Zavala, Michael Steer, Yongjun Tian, Yukio Ueta, Dharmamony Vijai, Toshie Wakabayashi, Tadanori Yamaguchi, Carmen Yamashiro, Norio Yamashita & Louis D. Zeidberg. 2015. World squid fisheries. Rev. in Fish. Sci. & Aquacult., 23:2, 92-252.

Atlantic States Marine Fisheries Commission (ASMFC). 2007a. American Shad Stock Assessment Report for Peer Review. Stock Assessment Report No. 07-01. Available at: http://www.asmfc.org/shadRiverHerring.htm.

Atlantic States Marine Fisheries Commission (ASMFC). 2007b. Special Report to the Atlantic Sturgeon Management Board: Estimation of Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic. August 2007. 95 pp.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Atlantic States Marine Fisheries Commission. 2012. River Herring Benchmark Stock Assessment. Stock Assessment Report No. 12-02. Available at: http://www.asmfc.org/shadRiverHerring.htm.

Bain, M. B., N . Haley, D. Peterson, J. R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River Estuary: Lessonsfor Sturgeon Conservation. Instituto Espanol de Oceanografia. Boletin 16: 43-53.

Baum, E.T. 1997. Maine Atlantic Salmon - A National Treasure. Atlantic Salmon Unlimited, Hermon, Maine.

Beanlands, G.E. and Duinker, P.N. (1984) 'An Ecological Framework for Environmental Impact Assessment', Journal of Environmental Management, 18: 267-277.

Beardsall, J.W., M. F. McLean, S. J. Cooke, B. C. Wilson, M. J. Dadswell, A. M. Redden, and M. J.
W. Stokesbury. 2013. Consequences of Incidental Otter Trawl Capture on Survival and Physiological Condition of Threatened Atlantic Sturgeon. Transactions of the American Fisheries Society 142:1202–1214.

Birkenbach, Anna, Kaczan, David, and Smith, Martin. 2017. Catch shares slow the race to fish. Nature volume 544, pages 223–226.

Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, and B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. Endangered Species Research 2:51-61.

Branch et. al. 2006. Fleet dynamics and fishermen behavior: lessons for fisheries managers. Canadian Journal of Fisheries and Aquatic Sciences, 2006, Vol. 63, No. 7 : pp. 1647-1668.

Boletzky Sv, Hanlon RT. 1983. A review of the laboratory maintenance, rearing and culture of cephalopod molluscs. Mem Natl Mus Vic 44:147–187

Braun, J., and S.P. Epperly. 1996. Aerial surveys for sea turtles in southern Georgia waters, June 1991. Gulf of Mexico Science 1996(1):39-44.

Braun-McNeill, J., and S.P. Epperly. 2002. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). Marine Fisheries Review 64(4):50-56.

Braun-McNeill, J., C.R. Sasso, S.P.Epperly, C. Rivero. 2008. Feasibility of using sea surface temperature imagery to mitigate cheloniid sea turtle–fishery interactions off the coast of northeastern USA. Endangered Species Research: Vol. 5: 257–266, 2008.

Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report or the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.

Chavez-Rosales S, Lyssikatos MC, Hatch J. 2017. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2011-2015. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-16; 18 p. Available from: http://www.nefsc.noaa.gov/publications/

Christensen, D.J., W.J. Clifford, P.G. Scarlett, R.W. Smith, and D. Zachea. 1979. A survey of the 1978
spring recreational fishery for the Atlantic mackerel, *Scomber scombrus*, in the Middle Atlantic region. NMFS Sandy Hook Lab Report No. 78-43. 22 p.

Chetrick, Joel. 2006. Record Six-Month Exports of U.S. Frozen Mackerel to EU Eclipse 2005 Sales.
FAS Worldwide. United States Department of Agriculture, Foreign Agricultural Service. Available online at: http://www.fas.usda.gov/info/fasworldwide/2006/10-2006/EUMackerel.pdf.

Cross, J.N., C.A. Zetlin, P.L. Berrien, D.L. Johnson, and C. McBride. 1999. Essential fish habitat
source document: Butterfish, Peprilus triacanthus, life history and habitat characteristics, NOAA Tech. Memo. NMFS NE-145. 50 p.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Mattila, C.A. Mayo, M.A. Murphy and S. Pittman. 1993. Seasonal occurrence and annual return of humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. Can. J. Zool. 71: 440-443.

Collins, M. R. and T. I. J. Smith. 1997. Distribution of shortnose and Atlantic sturgeons in South Carolina. North American Journal of Fisheries Management. 17: 995-1000.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.

Curry, B. E. and Smith, J. 1997. Phylogeographic structure of the bottlenose dolphin (Tursiops truncatus): stock identification and implications for management. In: A. E. Dizon, S. J. Chivers and W. F. Perrin (eds), Molecular genetics of marine mammals, pp. 227-247. The Society of Marine Mammalogy, Allen Press, Lawrence.

Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. Fisheries 31: 218-229.

Dadswell, M. J., B. D. Taubert, T. S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on Shortnose Sturgeon, Acipenser brevirostrum, LeSuer 1818.

Dodd, C.K., Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). Fish and Wildlife Service Biological Report 88(14). 110pp. Available at: http://www.seaturtle.org/documents/Dodd_1988_Loggerhead.pdf.

Dodge, K.L., B. Galuardi, T. J. Miller, and M. E. Lutcavage. 2014. Leatherback Turtle Movements, Dive Behavior, and Habitat Characteristics in Ecoregions of the Northwest Atlantic Ocean. PLOS ONE 9 (3) e91726: 1-17.

Dovel, W.L. and T.J. Berggren. 1983. Atlantic sturgeon of the Hudson River Estuary, New York. New York Fish and Game Journal 30: 140-172.

Dunton, K.J., A. Jordaan, K.A. McKown, D.O. Conover, and M.J. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. Fishery Bulletin 108:450-465.

Dunton, K.J., D. Chapman, A. Jordaan, K. Feldheim, S. J. O'Leary, K. A. McKown, and M. G. Frisk. 2012. Brief Communications: Genetic mixed-stock analysis of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* in a heavily exploited marine habitat indicates the need for routine genetic monitoring. Journal of Fish Biology 80: 207–217.

Dunton, K.J., A. Jordaan, D. O. Conover, K.A. McKown, L. A. Bonacci, and M. G. Frisk. 2015. Marine Distribution and Habitat Use of Atlantic Sturgeon in New York Lead to Fisheries Interactions and Bycatch. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 7:18–32.

Eckert, S.A., D. Bagley, S. Kubis, L. Ehrhart, C. Johnson, K. Stewart, and D. DeFreese. 2006. Internesting and postnesting movements of foraging habitats of leatherback sea turtles (*Dermochelys coriacea*) nesting in Florida. Chel. Cons. Biol. 5(2): 239-248.

Ecosystem Assessment Program (EAP). 2009. Ecosystem Assessment Report for the Northeast U.S.
Continental Shelf Large Marine Ecosystem. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-11; 61 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/crd/crd0911/crd0911.pdf.

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93:254-261.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995b. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bulletin of Marine Science 56(2):547-568.

Epperly, S.P., J. Braun, and A. Veishlow. 1995c. Sea turtles in North Carolina waters. Conservation Biology 9(2):384-394.

Erickson, D. L., A. Kahnle, M. J. Millard, E. A. Mora, M. Bryja, A. Higgs, J. Mohler, M. DuFour, G. Kenney, J. Sweka, and E. K. Pikitch. 2011. Use of pop-up satellite archival tags to identify oceanic-migratory patterns for adult Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus* Mitchell, 1815. J. Appl. Ichthyol. 27: 356–365.

Fay, C., M. Bartron, S. Craig, A. Hecht, J. Pruden, R. Saunders, T. Sheehan, and J. Trial. 2006. Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States. Report to the National Marine Fisheries Service and U.S. Fish and Wildlife

Service. 294 pages.

Fujita, R. & Bonzon, K. Rev Fish Biol Fisheries (2005) 15: 309. Kluwer Academic Publishers

Griffin, D.B., S. R. Murphy, M. G. Frick, A. C. Broderick, J. W. Coker, M. S. Coyne, M. G. Dodd, M. H. Godfrey, B. J. Godley, L. A. Hawkes, T. M. Murphy, K. L. Williams, and M. J. Witt. 2013. Foraging habitats and migration corridors used by a recovering subpopulation of adult female loggerhead sea turtles: implications for conservation. Mar. Biol. 160: 3071–3086.

Haas, H.L. 2010. Using observed interactions between sea turtles and commercial bottom-trawling vessels to evaluate the conservation value of trawl gear modifications. Mar. Coast. Fish. 2, 263-276.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf. Reports of the International Whaling Commission 42: 653-669.

Hanlon RT. 1990. Maintenance, rearing and culture of teuthoid and sepioid squids. In: Gilbert DL, Adelman Jr WJ, Arnold JM (eds) Squid as experimental animals. Plenum Press, New York, pp 35–62.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. Current Biology 16: 990-995.

Hawkes, L.A., M.J. Witt, A.C. Broderick, J.W. Coker, M.S. Coyne, M. Dodd, M.G. Frick, M.H. Godfrey, D.B. Griffin, S.R. Murphy, T.M. Murphy, K.L. Williams, and B.J. Godley. 2011. Home on the range: spatial ecology of loggerhead turtles in Atlantic waters of the USA. Diversity and Distributions 17:624–640.

Hayes, S.A., E. Josephson , K. Maze-Foley , and P. E. Rosel. 2017. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2016. NOAA Technical Memorandum NMFS-NE-241.

Hayes, S.A, E. Josephson, K. Maze-Foley, and P. Rosel. 2018. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessment-2017. NOAA Technical Memorandum NMFS-NE-245.

Hendrickson, L. C. 2017. Longfin Inshore Squid (*Doryteuthis* (*Amerigo*) *pealeii*) Stock Assessment Update for 2017 (available at http://www.mafmc.org/ssc-meetings/2017/may-17-18), 11 pp.

Hendrickson, L. 2016. Report to the Mid-Atlantic Fishery Management Council: Fishery and Survey Data Updates Regarding the Northern Shortfin Squid (Illex illecebrosus) and Longfin Inshore Squid (Doryteuthis (Amerigo) pealeii) stocks through 2015. 29 pp.

Hendrickson, L. C., and E. M. Holmes. Essential fish habitat source document: northern shortfin squid,
Illex illecebrosus, life history and habitat characteristics, 2nd Ed. NOAA Tech. Memo. NMFS-NE-191.

Iglesias, José, Fuentes, Lidia, Villanueva, Roger, Editors. 2014. Cephalopod Culture. Springer Netherlands. Chapter: Vidal, Erica et al. Loligo vulgaris and Doryteuthis opalescens.

Henry AG, Cole TVN, Hall L, Ledwell W, Morin D, Reid A. 2015. Mortality and serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States east coast and Atlantic Canadian provinces, 2009-2013. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-10; 45 p. doi: 10.7289/V5C53HTB

Hilborn, R. (2007), Managing fisheries is managing people: what has been learned?. Fish and Fisheries, 8: 285–296.

Hirth, H.F. 1997. Synopsis of the biological data of the green turtle, *Chelonia mydas* (Linnaeus 1758). USFWS Biological Report 97(1):1-120.

Holland, Daniel and Ginter, Jay. 2001. Common property institutions in the Alaskan groundfish fisheries. Marine Policy 25 (2001) 33-42.

Hyvarinen, P., P. Suuronen and T. Laaksonen. 2006. Short-term movement of wild and reared Atlantic salmon smolts in brackish water estuary – preliminary study. Fish. Mgmt. Eco. 13(6): 399 -401.

Jacobson, L.D. 2005. Essential fish habitat source document: Longfin inshore squid, Loligo Pealei ,
life history and habitat characteristics (2nd edition) NOAA Tech. Memo. NMFS NE-193. 52 p.

James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005. Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle. Proc. R. Soc. B, 272: 1547-1555.

James, M.C., S.A. Sherrill-Mix, K. Martin, and R. A. Myers. 2006. Canadian waters provide critical foraging habitat for leatherback sea turtles. Biological Conservation 133: 347-357.

Jefferson, T.A., D. Fertl, J. Bolanos-Jimenez and A.N. Zerbini. 2009. Distribution of common dolphins (*Delphinus spp.*) in the western North Atlantic: a critical re-examination. Mar.

Biol. 156:1109-1124.

Johnson, M.R., C. Boelke, L.A. Chiarella, P.D. Colosi, K. Greene, K. Lellis-Dibble, H. Ludemann, M.
Ludwig, S. McDermott, J. Ortiz, D. Rusanowsky, M. Scott, J. Smith 2008. Impacts to marine fisheries habitat from nonfishing activities in the Northeastern United States. NOAA Tech. Memo. NMFS-NE-209, 328 p.

Jones, Nicholas, and McCarthy, Ian, Editors. 2013. Aquaculture rearing techniques for the common
cuttlefish Sepia officinalis and the Atlantic bobtail squid Sepiola atlantica. SEAFARE project (project number 2009-1/123). Work Funded under the European Union Atlantic Area Transitional Programme (2007-2013).

Kocik. J.F., S.E. Wigley, and D. Kircheis. 2014. Annual Bycatch Update Atlantic Salmon 2013 U.S. Atlantic Salmon Assessment Committee Working Paper 2014:05. Old Lyme, CT. 6 pp.(cited with permission of authors).

Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitat used by shortnose sturgeon in two Massachusetts rivers, with notes on estuarine Atlantic sturgeon: A hierarchical approach. Transactions of the American Fisheries Society 129: 487-503.

Lacroix, G.L. and McCurdy, P. 1996. Migratory behavior of post-smolt Atlantic salmon during initial stages of seaward migration. J. Fish Biol. 49, 1086-1101.

Lacroix, G. L, McCurdy, P., Knox, D. 2004. Migration of Atlantic salmon post smolts in relation to habitat use in a coastal system. Trans. Am. Fish. Soc. 133(6): pp. 1455-1471.

Lacroix, G.L. and D. Knox. 2005. Distribution of Atlantic salmon (*Salmo salar*) postsmolts of different origins in the Bay of Fundy and Gulf of Maine and evaluation of factors affecting migration, growth, and survival. Can. J. Fish. Aquat. Sci. 62: 1363–1376.

Laney, R.W., J.E. Hightower, B.R. Versak, M.F. Mangold, W.W. Cole Jr., and S.E. Winslow 2007. Distribution, habitat use, and size of Atlantic sturgeon captured during cooperative winter tagging cruises, 1988–2006. Pages 167-182. In: J. Munro, D. Hatin, J. E. Hightower, K. McKown, K. J. Sulak, A. W. Kahnle, and F. Caron, (editors), Anadromous sturgeons: Habitats, threats, and management. Am. Fish. Soc. Symp. 56, Bethesda, MD.

Lenfest 2012. Pikitch, E. et al. 2012. Little Fish, Big Impact: Managing a Crucial Link in Ocean
Food Webs. Lenfest Ocean Program. Washington, DC. 108 pp. Available at: http://www.oceanconservationscience.org/foragefish/.

Leos 1998. The Biological Characteristics fo the Monterey Bay Squid Catch and the Effect of a Two-
Day-Per-Week Fishing Closure. CalCOFI Report, Volume 39.

Lyssikatos MC. 2015. Estimates of cetacean and pinniped bycatch in Northeast and mid-Atlantic bottom trawl fisheries, 2008-2013. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-19.

Macy, W.K., and J.K.T. Brodziak. 2001. Seasonal maturity and size at age of Loligo pealeii in waters of southern New England. ICES J. Mar. Sci. 58: 852-864.

MAFMC 2008. Amendment 9 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. Available at: http://www.mafmc.org/fisheries/fmp/msb.

MAFMC 2010. Amendment 10 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. Available at: http://www.mafmc.org/fisheries/fmp/msb.

MAFMC 2013a. 2014 Atlantic Mackerel, Squid, and Butterfish Specifications and Management Measures Environmental Assessment. Available at https://www.greateratlantic.fisheries.noaa.gov/regs/2014/January/14smb2014specsprea.pdf.

MAFMC 2013b. EIS for Amendment 14 to the MSB FMP. Available at http://www.mafmc.org/msb/.

MAFMC 2014. Report of May 2014 SSC, available at http://www.mafmc.org/s/SSC-2014-May-Report.pdf.

MAFMC 2015a. Report of May 2015 SSC, available at http://www.mafmc.org/ssc-meetings/2015/may-13-14.

MAFMC 2015b. Report of May 2015 MSB Monitoring Committee, available at https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/5568b8dbe4b0e4f916c033d7/1432926427055/Tab+02_MSB.pdf.

MAFMC 2016. EA for 2016-2016 MSB Specifications, available at https://www.greateratlantic.fisheries.noaa.gov/regs/2016/January/16msb2016specspr.html.

MAFMC 2016b. Mid-Atlantic Fishery Management Council Ecosystem Approach to Fisheries Management Guidance Document. Available at http://www.mafmc.org/s/EAFM_Guidance-Doc_2017-02-07.pdf.

MAFMC 2017. EA for 2018- 2020 MSB Specifications, available at https://www.greateratlantic.fisheries.noaa.gov/regs/.

MAFMC 2018. March 29, 2018 FMAT Summary. Available at http://www.mafmc.org/s/Tab02_MSB-Issues-Apr2018.pdf.

MAFMC 2018b. 2018 RH/S Update. Available at http://www.mafmc.org/council-events/2018/joint-msb-rhs-committee-meeting.

MAFMC 2018c. 2018 Fishery Performance Report. Available at http://www.mafmc.org/ssc-meetings/2018/may-8-9.

Mansfield, K.L., V.S. Saba, J. Keinath, and J.A. Musick. 2009. Satellite telemetry reveals a dichotomy in migration strategies among juvenile loggerhead sea turtles in the northwest Atlantic. Marine Biology 156:2555-2570.

McClellan, C.M., and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. Biology Letters 3:592-594

Miller T., Adams, C., and Rago, P. 2013. Feasible Bounds on Historic Butterfish Stock Size and Fishing Mortality Rates from Survey and Catch Data. Report to the MAFMC SSC. Available at: http://www.mafmc.org/ssc-meetings/2013/april-may.

Miller, T. and G. Shepard. 2011. Summary of Discard Estimates for Atlantic Sturgeon. Northeast Fisheries Science Center, Population Dynamics Branch, August 2011.

Murawski S.A. and G.T. Waring. 1979. A population assessment of butterfish, *Peprilus triacanthus*, in
the Northwest Atlantic Ocean. Tran. Am. Fish. Soc. 108(5): 427-439.

Miller, T. and G. Shepard. 2011. Summary of Discard Estimates for Atlantic Sturgeon. Northeast Fisheries Science Center, Population Dynamics Branch, August 2011.
Miller and Shepard 2016?

Mitchell, G.H., R.D. Kenney, A.M. Farak, and R.J. Campbell. 2003. Evaluation of occurrence of endangered and threatened marine species in naval ship trial areas and transit lanes in the Gulf of Maine and offshore of Georges Bank. NUWC-NPT Technical Memo 02-121A. March 2003. 113 pp.

Moltschaniwskyj et al 2002. An assessment of the use of short-term closures to protect spawning
southern calamary aggregations from fishing pressure in Tasmania, Australia, Bulletin of Marine Science, 2002, vol. 71 (pg. 501-514).

Morreale, S.J. and E.A. Standora. 2005. Western North Atlantic waters: Crucial developmental habitat for Kemp's ridley and loggerhead sea turtles. Chel. Conserv. Biol. 4(4):872-882.

Murphy, T.M., S.R. Murphy, D.B. Griffin, and C. P. Hope. 2006. Recent occurrence, spatial Distribution, and temporal variability of leatherback turtles (*Dermochelys coriacea*) in nearshore waters of South Carolina, USA. Chel. Cons. Biol. 5(2): 216-224.

Murray, K.T., 2008. Estimated Average Annual Bycatch of Loggerhead Sea Turtles (*Caretta caretta*) in U.S. Mid-Atlantic Bottom Otter Trawl Gear, 1996–2004, second ed. U.S. Dep. Commer., Northeast Fish Sci. Cent. Ref. Doc. 08-20, p. 32. <http://www.nefsc.noaa.gov/publications/crd/crd0820>.

Murawski S.A. and G.T. Waring. 1979. A population assessment of butterfish, Peprilus triacanthus, in
the Northwest Atlantic Ocean. Tran. Am. Fish. Soc. 108(5): 427-439.

Murray, K.T. 2015. The importance of location and operational fishing factors in estimating and reducing loggerhead turtle (*Caretta caretta*)interactions in U.S. bottom trawl gear. Fisheries Research 172: 440–451.

NEFSC 2004. Northeast Fisheries Science Center. 2004. Report of the 38th Northeast Regional Stock
Assessment Workshop (38th SAW): advisory report. Northeast Fish. Sci. Cent. Ref. Doc. 04-04; 24 p. Available at: http://www.nefsc.noaa.gov/nefsc/publications/.

NEFSC 2005. 42nd Northeast Regional Stock Assessment Workshop (42nd SAW): 42nd SAW assessment summary report. U.S. Dep Commer, Northeast Fish Sci Cent Ref Doc. 06-01; 61 p. Available at: http://www.nefsc.noaa.gov/publications/crd/crd0601/.

NEFSC 2010. Northeast Fisheries Science Center. 2010. 49th Northeast Regional Stock Assessment
Workshop (49th SAW) Assessment Report. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 10-01; 383 p. Available at: http://www.nefsc.noaa.gov/nefsc/publications/

NEFSC 2011. 51st Northeast Regional Stock Assessment Workshop (51st SAW) Assessment Report.
U.S. Dept Commer, Northeast Fish. Sci. Cent. Ref. Doc. 11-01; 70 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

NEFSC 2011b. Ecosystem Status Report for the Northeast Shelf Large Marine Ecosystem – 2011. Northeast Fisheries Science Center Reference Document 12-07. Available at https://www.nefsc.noaa.gov/publications/crd/crd1207/crd1207.pdf.

NEFSC. 2014. 58th Northeast Regional Stock Assessment Workshop (58th SAW) Assessment Report.
US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-04; 784 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/crd/crd1404/.

NEFSC. 2017. Butterfish Assessment Update. Available at http://www.mafmc.org/ssc-meetings/2017/may-17-18.

NEFSC 2018. 64th Northeast Regional Stock Assessment Workshop (64th SAW) Assessment Summary Report. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 18-03; 27 p.

NEFSC 2018b. 65th Northeast Regional Stock Assessment Workshop (64th SAW) Assessment Summary Report. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 18-08; 38 p.

NMFS 1991. Final recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, MD. 105 pp.

NMFS. 1994. Report of 17th NEFSC Stock Assessment Workshop. NEFSC, Woods Hole Lab. Ref. Doc. 94-03.

NMFS. 1996. Draft Report of the 20th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA.

NMFS. 1996. Report of the 21th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA. June 1996.

NMFS. 1998. Guidelines for Regulatory Analysis of Fishery Management Actions. Office of Sustainable Fisheries, National Marine Fisheries Service, Silver Spring, Maryland 20910. Revised April 15, 1998.

NMFS. 1999. Report of the 29th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA. June 1999.

NMFS 1999. Essential Fish Habitat Source Document: Butterfish, Peprilus triacanthus, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-145. Available at: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm145/tm145.pdf.

NMFS. 2001. Report of the 34th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA. June 1999.

NMFS 2005. Final Environmental Impact Statement for Minimizing Impacts of the Atlantic Herring Fishery on Essential Fish Habitat. NOAA/NMFS NE Regional Office, Gloucester, MA, 273 pp.

NMFS 2010. NMFS Marine Mammal List of Fisheries. 2010. Available at: http://www.nmfs.noaa.gov/pr/interactions/lof/#lof.

NMFS 2010. IMPORTS AND EXPORTS OF FISHERY PRODUCTS ANNUAL SUMMARY, 2010. Available at: http://www.st.nmfs.noaa.gov/st1/trade/documents/TRADE2010.pdf.

NMFS. 2010. Final recovery plan for the fin whale (*Balaenoptera physalus*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 121 pp.

NMFS. 2011. Final recovery plan for the sei whale (*Balaenoptera borealis*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 108 pp.

NMFS 2012. Year-end Butterfish Mortality Cap Report for the 2011 Fishing Year. Available at: http://www.mafmc.org/meeting_materials/SSC/2012-05/3-2011-Butterfish-Cap-Report%28May%202012%29.pdf.

NMFS. 2013. NMFS-Greater Atlantic Region Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries.

NMFS. 2014. NMFS-Greater Atlantic Region (GARFO). Memo to the record: Determination regarding reinitiation of Endangered Species Act section 7 consultation on 12 GARFO fisheries and two Northeast Fisheries Science Center funded fisheries research surveys due to critical habitat designation for loggerhead sea turtles. Memo issued September 17, 2014.

NMFS 2015. Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB). Northeast Fisheries Observer Program: Incidental Take Reports. Omnibus data request + supplemental data for 2014 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html.

NMFS. 2015a. Endangered Species Act Section 4(b)(2) Report: Critical Habitat for the North Atlantic Right Whale (*Eubalaena glacialis*). Prepared by National Marine Fisheries Service Greater Atlantic Regional Fisheries Office and Southeast Regional Office, December 2015. http://www.greateratlantic.fisheries.noaa.gov/regs/2016/January/16narwchsection4_b__2_report012616.pdf

NMFS. 2015b. North Atlantic Right Whale (*Eubalaena glacialis*). Source Document for the Critical Habitat Designation: A review of information pertaining to the definition of "critical habitat" Prepared by National Marine Fisheries Service Greater Atlantic Regional Fisheries Office and Southeast Regional Office, July 2015.

NMFS 2016. Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB). Northeast Fisheries Observer Program: Incidental Take Reports. Omnibus data request + supplemental data for 2015 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html.

NMFS 2017. NMFS NEFSC FSB (Northeast Fisheries Science Center, Fisheries Sampling Branch). Northeast Fisheries Observer Program (NEFOP) and At-Sea Monitoring (ASM) Program: Incidental Take Reports for Sea Turtles, Sturgeon, and Salmon. Omnibus data request + supplemental data from 1989-2016. Data compiled on May 10 and 15, 2017.

National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB). 2018. Northeast Fisheries Observer Program: Incidental Take Reports. Omnibus data request + supplemental data for 2017 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html

NMFS and U.S. Fish and Wildlife Service (USFWS). 1991. Recovery plan for U.S. population of Atlantic green turtle (*Chelonia mydas*). National Marine Fisheries Service, Washington, D.C. 58 pp.

NMFS and U.S. Fish and Wildlife Service (USFWS). 1992. Recovery plan for leatherback turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. Silver Spring, Maryland: National Marine Fisheries Service. 139 pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 1998a. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle (*Dermochelys coriacea*). Silver Spring, Maryland: National Marine Fisheries Service. 65 pp.

NMFS USFWS (U.S. Fish and Wildlife Service). 1998b. Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*). Silver Spring, Maryland: National Marine Fisheries Service. 84 pp.

NMFS and U.S. Fish and Wildlife Service (USFWS). 2005. Recovery plan for the Gulf of Maine distinct population segment of the Atlantic salmon (*Salmo salar*). National Marine

Fisheries Service, Silver Spring, MD.

NMFS and U.S. Fish and Wildlife Service (USFWS). 2016.Draft recovery plan for the Gulf of Maine distinct population segment of the Atlantic Salmon (*Salmo salar*). http://www.fisheries.noaa.gov/pr/pdfs/20160329_atlantic_salmon_draft_recovery_plan.pdf

NMFS and USFWS (U.S. Fish and Wildlife Service). 2007a. Kemp's ridley sea turtle *(Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 50 pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 2007b. Green sea turtle (*Chelonia mydas*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 102 pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 2008. Recovery plan for the Northwest Atlantic population of the loggerhead turtle (*Caretta caretta*), Second revision. Washington, D.C.: National Marine Fisheries Service. 325 pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 2013. Leatherback sea turtle (*Dermochelys coriacea*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 91 pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 2015. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 62 pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 2016. Draft Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*). http://www.fisheries.noaa.gov/pr/pdfs/20160329_atlantic_salmon_draft_recovery_plan.pdf

NMFS and USFWS (U.S. Fish and Wildlife Service), and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, MD. 156 pp. + appendices.

Okutani, T. 1977. Stock assessment of cephalopod resources fished by Japan. U.N. Food and Agriculture Organization Fish. Tech. paper No. 173. 62 p.

Oliver, M.J., M. W. Breece, D. A. Fox, D. E. Haulsee, J. T. Kohut, J. Manderson, and T. Savoy. 2013. Shrinking the Haystack: Using an AUV in an Integrated Ocean Observatory to Map Atlantic Sturgeon in the Coastal Ocean. Fisheries 38(5): 210-216.

O'Leary, S.J., K. J. Dunton, T. L. King, M. G. Frisk, and D.D. Chapman. 2014. Genetic diversity and effective size of Atlantic sturgeon, *Acipenser oxyrhinchus oxyrhinchus,* river spawning populations estimated from the microsatellite genotypes of marine-captured juveniles. Conserv Genet: DOI 10.1007/s10592-014-0609-9; ISSN 1566-0621.

Overholtz, W.J. 1989. Density-dependent growth in the Northwest Atlantic stock of Atlantic mackerel
(*Scomber scombrus*). J. Northw. Atl. Fish. Sci. (9):115-121.

W.J. Overholtz, J.A. Hare & C.M. Keith (2011): Impacts of Interannual Environmental Forcing and
Climate Change on the Distribution of Atlantic Mackerel on the U.S. Northeast Continental Shelf, Marine and Coastal Fisheries, 3:1, 219-232

Patterson, K. (1992). Fisheries for small pelagic species: an empirical approach to management targets. Reviews in Fish and Fisheries 2:321-338.

Payne, P.M. and D.W. Heinemann. 1993. The distribution of pilot whales (*Globicephala sp*.) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Rep. Int. Whal. Comm. (Special Issue) 14: 51- 68.

Payne, P.M., L. A**.** Selzer, and A. R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Marine Fisheries Service-NEFSC, Woods Hole, MA. 294pp.

Payne, P.M., J.R. Nicholas, L. O'Brien and K.D. Powers 1986. The distribution of the humpback whale, *Megaptera novaeangliae*, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, *Ammodytes americanus*. Fish. Bull. 84: 271-277.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham and J.W. Jossi 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fish. Bull. 88: 687-696.

Pierce and Guerra 1994. Stock Assessment Methods Used for Cephalopod Fisheries. Fisheries Research. Elsevier.

Read, A.J., P. Drinker, and S. Northridge. 2006. Bycatch of Marine Mammals in the U.S. and Global Fisheries. Conservation Biology 20(1): 163-169.

Reddin, D.G. 1985. Atlantic salmon (*Salmo salar*) on and east of the Grand Bank. J. Northwest Atl. Fish. Soc. 6(2):157-164.

Reddin, D.G and P.B. Short. 1991. Postsmolt Atlantic salmon (*Salmo salar*) in the Labrador Sea. Can. J. Fish Aquat. Sci. 48:2-6.

Reddin, D.G and K.D. Friedland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. 4th Int. Atlantic Salmon Symposium. St. Andrews, N.B. Canada.

Risch, D., C. W. Clark, P. J. Dugan, M. Popescu, U. Siebert, and S. M. Van Parijs. 2013. Minke whale acoustic behavior and multi-year seasonal and diel vocalization patterns in Massachusetts Bay, USA. Mar Ecol Prog Ser 489: 279–295.

SARC 34. 2002. Stock Assessment Review Committee Report. Available at: http://www.nefsc.noaa.gov/saw/.

SARC 38. 2004. Stock Assessment Review Committee Report. Available at: http://www.nefsc.noaa.gov/saw/.

SARC 42. 2006. Stock Assessment Review Committee Report. Available at: http://www.nefsc.noaa.gov/saw/.

SARC 49. 2010. Stock Assessment Review Committee Report. Available at: http://www.nefsc.noaa.gov/saw/.

Sasso, C.R., and S.P. Epperly. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. Fisheries Research 81:86-88.

Savoy, T., and D. Pacileo. 2003. Movements and important habitats of subadult Atlantic sturgeon in Connecticut waters. Transactions of the American Fisheries Society. 132: 1-8.

Schevill, W.E., W.A. Watkins, and K.E. Moore. 1986. Status of *Eubalaena glacialis* off Cape Cod. Report of the International Whaling Commission, Special Issue 10: 79-82.

Schilling, M. R., I. Seipt, M. T. Weinrich, S. E. Frohock, A. E. Kuhlberg, and P. J. Clapham. 1992. Behavior of individually-identified sei whales *Balaenoptera borealis* during an episodic influx into the southern Gulf of Maine in 1986. Fishery Bulletin 90:749–755.

Seminoff, J.A., C.D. Allen, G.H. Balazs, P.H. Dutton, T. Eguchi, H.L. Hass, S.A. Hargrove, M. Jensen, D.L. Klemm, A.M. Lauritsen, S.L. MacPherson, P. Opay, E.E. Possardt, S. Pultz, E. Seney, K.S. Van Houtan, and R.S. Waples. 2015. Status Review of the Green Turtle (Chelonia mydas) Under the Endangered Species Act. NOAA Technical Memorandum: NOAA-TM-NMFS-SWFSC-539. NMFS Southwest Fisheries Science Center, March 2015.

Shashar, Nadav and Hanlon, Rodger. 2013. Spawning behavior dynamics at communal egg beds in the squid Doryteuthis (Loligo) pealeii. Journal of Experimental Marine Biology and Ecology 447 (2013) 65–74. Available at: https://www.researchgate.net/profile/Roger_Hanlon/publication/275163046_Spawning_behavior_dynamics_at_communal_egg_beds_in_the_squid_Doryteuthis_Loligo_pealeii/links/56b216fd08aed7ba3fedb656.pdf?origin=publication_list.

Sheehan, T.F., D.G. Reddin, G. Chaput and M.D. Renkawitz. 2012. SALSEA North America: A pelagic ecosystem survey targeting Atlantic salmon in the Northwest Atlantic. ICES Journal of Marine Science, doi:10.1093/icesjms/fss052.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Schuller, P. and D. L. Peterson. 2006. Population status and spawning movements of Atlantic sturgeon in the Altamaha River, Georgia. Presentation to the 14th American Fisheries Society Southern Division Meeting, San Antonio, February 8-12th, 2006.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004a. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. Transactions of the American Fisheries Society 133: 527-537.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004b. Atlantic sturgeon marine bycatch and mortality on the continental shelf of the Northeast United States. North American Journal of Fisheries Management 24: 171-183.

Stevenson D, Chiarella L, Stephan D, Reid R, Wilhelm K, McCarthy J, Pentony M. 2004. Characterization of the fishing practices and marine benthic ecosystems of the Northeast U.S. Shelf, and an evaluation of the potential effects of fishing on essential fish habitat. Woods Hole (MA): National Marine Fisheries Service, Northeast Fisheries Science Center, NOAA Technical Memorandum NMFS-NE-181. 179 p.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9: 309-315.

TEWG (Turtle Expert Working Group). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409:1-96.

TEWG (Turtle Expert Working Group). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444:1-115.

TEWG (Turtle Expert Working Group). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555:1-116.

TEWG (Turtle Expert Working Group). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575:1-131.

Timoshkin, V. P. 1968. Atlantic sturgeon (*Acipenser sturio* L.) caught at sea. Prob. Ichthyol. 8(4):598.

TRAC 2010. Transboundary Resources Assessment Committee (TRAC). TRAC Summary Report
(TSR). Available online at: http://www.mar.dfo-mpo.gc.ca/science/trac/tsr.html.

U.S. Atlantic Salmon Assessment Committee (USASAC). 2004.Annual Report of the U.S. Atlantic Salmon Assessment Committee.

Vidal, Erica. 2002. Optimizing rearing conditions of hatchling loligbid squid. Marine Biology. January 2002.

Vu, E., D. Risch, C. Clark, S. Gaylord, L. Hatch, M. Thompson, D. Wiley, and S. Van Parijs. 2012. Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aq. Biol.14(2):175–183.

Waldman, J.R., T. King, T. Savoy, L. Maceda, C. Grunwald, and I. Wirgin. 2013. Stock Origins of Subadult and Adult Atlantic Sturgeon, *Acipenser oxyrinchus*, in a Non-natal Estuary, Long Island Sound. Estuaries and Coasts 36:257–267.

Warden, M.L. 2011a. Modeling loggerhead sea turtle (*Caretta caretta*) interactions with U.S. Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. Biological Conservation 144: 2202–2212.

Warden, M.L. 2011b. Proration of loggerhead sea turtle (*Caretta caretta*) interactions in U.S. Mid-Atlantic bottom otter trawls for fish and scallops, 2005-2008, by managed species landed. NEFSC Reference Document 11-04; 8 pp. http://www.nefsc.noaa.gov/publications/crd/.

Waring, G. T., C. P. Fairfield, C. M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the northeastern USA shelf. ICES C.M. 1992/N:12 29 pp

Waring G.T., E. Josephson, C.P. Fairfield-Walsh , K. Maze-Foley K, editors. 2007. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2007. NOAA Tech Memo NMFS-NE- 205. 415 pp.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2014a. U.S. Atlantic and

Gulf of Mexico marine mammal stock assessments—2013. NOAA Tech Memo NMFS-NE-228. 475 pp.

Waring, G.T, F. Wenzel, E. Josephson, M.C. Lyssikatos. 2014b. Serious Injury Determinations for Small Cetaceans and Pinnipeds Caught in Commercial Fisheries off the Northeast U.S. Coast, 2007-2011. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-13; 26 p. doi: 10.7289/V5QN64QH

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2015. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2014. http://www.nmfs.noaa.gov/pr/sars/pdf/atl2014_final.pdf

Waring, G.T. , E. Josephson , K. Maze-Foley , and P. E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2015. NOAA Technical Memorandum NMFS-NE-238. http://www.nmfs.noaa.gov/pr/sars/pdf/atlantic2015_final.pdf

Wigley SE, Rago, PJ, Sosebee, KA and Palka, DL. 2007. The analytic component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: sampling design and estimation of precision and accuracy (2nd edition). U.S. Dep. Commer., NortheastFish. Sci. Cent. Ref. Doc. 07-09; 156 p. Available on-line: http://www.nefsc.noaa.gov/publications/crd/crd0709/index.htm.

Wiedenmann, J. 2015. Application of data-poor harvest control rules to Atlantic mackerel. Report to
the Mid-Atlantic Fishery Management Council. 52pp. Available at: http://www.mafmc.org/ssc-meetings/2015/may-13-14.

Wippelhauser, G.S. 2012. A Regional Conservation Plan For Atlantic Sturgeon in the U. S. Gulf of Maine. Prepared on behalf of Maine Department of Marine Resources, Bureau of Science. NOAA Species of Concern Grant Program Award #NA06NMF4720249A.

Wippelhauser, G.S., and T.S. Squiers. 2015. Shortnose Sturgeon and Atlantic Sturgeon in the Kennebec River System, Maine: a 1977–2001 Retrospective of Abundance and Important Habitat. Transactions of the American Fisheries Society 144:591–601

Wirgin, I., L. Maceda, J.R. Waldman, S. Wehrell, M. Dadswell, and T. King. 2012. Stock origin of migratory Atlantic sturgeon in the Minas Basin, Inner Bay of Fundy, Canada, determined by microsatellite and mitochondrial DNA analyses.

Wirgin, I., M. W. Breece , D. A. Fox , L. Maceda , K. W. Wark, and T. King. 2015a. Origin of Atlantic Sturgeon Collected off the Delaware Coast during Spring Months. North American Journal of Fisheries Management 35: 20–30.

Wirgin, I., L. Maceda, C. Grunwald, and T. L. King. 2015b. Population origin of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* by-catch in U.S. Atlantic coast fisheries. Journal of Fish Biology 86(4):1251–1270.

10.0 LIST OF AGENCIES AND PERSONS CONSULTED

In preparing this document the Council consulted with the NMFS, New England and South Atlantic Fishery Management Councils, Fish and Wildlife Service, Department of State, and the states of Maine through Florida through their membership on or participation with the Mid-Atlantic, New England and/or South Atlantic Fishery Management Councils. In addition, states that are members within the management unit were consulted through the Coastal Zone Management Program consistency process.

11.0 LIST OF PREPARERS AND POINT OF CONTACT

This environmental assessment was prepared by the following member of the Council staff: Jason Didden. Review and document improvement was conducted by NMFS staff at the Greater Atlantic Regional Office in Gloucester, MA and the Northeast Fisheries Science Center in Woods Hold, MA. Questions about this environmental assessment or additional copies may be obtained by contacting Jason Didden, Mid-Atlantic Fishery Management Council, 800 N. State Street, Dover, DE 19901 (302-674-2331). This Environmental Assessment may also be accessed by visiting the NMFS Greater Atlantic Region website at http://www.greateratlantic.fisheries.noaa.gov/regs/.

THIS SPACE INTENTIONALLY LEFT BLANK

12.0 REGULATORY FLEXIBILITY ANALYSIS AND IMPACT REVIEW

12.0 Regulatory Flexibility Analysis

The Regulatory Flexibility Act (RFA), first enacted in 1980, and codified at 5 U.S.C. 600-611, was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a Federal regulation. Major goals of the RFA are: 1) to increase agency awareness and understanding of the impact of their regulations on small business; 2) to require that agencies communicate and explain their findings to the public; and 3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting significant adverse impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts, while still achieving the stated objective of the action.

Basis and purpose of the rule and summary of preferred alternatives

The basis of the rules proposed in this action are the provisions of the MSA for federal fishery management to rebuild fisheries and avoid overfishing by control catches. As discretionary provisions of FMPs the MSA also allows restriction of fishing by time/season and allows measures to reduce incidental catch of non-target species (i.e. the RH/S cap).

This action is needed to rebuild the mackerel stock, effectively manage the fishery, and control RH/S bycatch in the mackerel fishery. The purpose and need for this action is further described in Section 4, while a full description of all alternatives is provided in Section 5. To assist with further evaluation of the measures proposed in this document, the following is a brief summary of the preferred alternative selected by the Council for this action:

The preferred rebuilding Alternative 1c or Alternative Set 1, is projected to rebuild mackerel in slightly under 5 years. Since the rebuilding catches are higher than what would occur under the Council's current standard risk policy, the Council would adjust its risk policy to indicate that in this case of mackerel rebuilding initiation, the risk policy of the Council is adjusted to use the 5-year rebuilding timeline for mackerel in Alternative 1c. The associated Acceptable Biological Catches (ABCs) are 29,184 metric tons (MT), 32,480 MT, and 33,474 MT (these are higher than the 2018 ABC of 19,898 MT). 10,000 MT would be deducted for expected Canadian landings, 1,209 MT would be set-aside for expected recreational catch, and a 3% management uncertainty buffer would be utilized. In addition, 0.37% of expected commercial catch would be set aside for expected discards. These measures do allow commercial landings to increase from the current 9,177 MT to 17,371 MT in 2019, 20,557 MT in 2020, and 21,517 MT in 2021.

To effectively utilize the available commercial landings, the Council selected Alternative 2d of Alternative Set 2 (which was 2e in the original motion and August 2018 briefing materials). Under this alternative, when 90% of the DAH is projected to be landed, trip limits of 40,000 pounds would be implemented for Tier 1-3 directed permits and 5,000 pounds for incidental/open access permits. When 98% of the DAH is projected to be landed, a 5,000 pound trip limit would be implemented for all permits for the rest of the fishing year to cover remaining incidental catches. The existing initial Tier 2 (135,000 pounds) and Tier 3 (100,000 pounds) trip limits would remain the same, as would the Tier 3 7% limit. If in November and December of each year NMFS determines that keeping the mackerel fishery open longer than the set percentage triggers (in any phase of the fishery) is unlikely to cause a DAH overage, then NMFS shall have the discretion, based on a projection, to not close (or not further close) the fishery so that optimum yield can be harvested.

To continue to control RH/S catch in the mackerel fishery, the Council selected Alternative 3b and 3d of Alternative Set 3. Under 3b the RH/S cap would scale with the mackerel DAH based on the 0.74% ratio used in 2015. The ratio of cap to all catch on mackerel trips (accounting for mostly co-caught Atlantic herring) would be about 0.53%. This is a lower ratio than used in 2018 (0.89% to mackerel quota or about 0.64% to all catch), but since the mackerel quotas are proposed to increase, the absolute value of the RH/S caps would increase from 82 MT currently to 129 MT in 2019, 152 MT in 2020, and 159 MT in 2021. To ensure active avoidance when mackerel landings are low, the Council added a provision via Alternative 3d where the cap starts at 89 MT and only increases beyond 89 MT if the fishery can first land 10,000 MT of mackerel without hitting the initial 89 MT RH/S cap.

Description and estimate of the number of small entities to which the rule applies

The measures proposed in this action apply to vessels that hold any commercial permits for Atlantic mackerel. Some small entities own multiple vessels with mackerel permits. Staff queried NMFS databases for 2017 mackerel permit holders, and then cross-referenced those results with ownership data provided by the Social Science Branch of NMFS' Northeast Fisheries Science Center. This analysis found that 1829 separate vessels held mackerel permits in 2017. In 2017 1379 entities owned those vessels, and based on current SBA definitions (under $11 million to be a commercial fishing small business entity and $7.5 million for for-hire operations), 1368 are small business entities. Based on revenues, 951 were commercial fishing entities, 116 were for-hire entities, and 301 had no revenue (but are considered small businesses). For those small businesses with revenues, their average revenues were $0.6 million in 2017. There were 299 entities that reported revenue from mackerel during 2017. Of these entities, 4 were large and 295 were small. In 2017, 145 vessels were issued limited access permits and may be affected by the directed fishery closure measures in this action. They are owned by 105 entities, of which 98 are small entities.

Description and estimate of economic impacts on small entities

In Alternative Set 1, the proposed increases in the mackerel quota should benefit all participants and associated small entities. The potential revenues from the current DAH (no action) are about $5.5 million and the potential revenues from the proposed 2019 DAH (Alternative 1c) are about $10.4 million. Future years potential revenues are slightly higher. Therefore, the preferred action would likely increase revenues by nearly $5 million, with individual vessel benefits varying by past and future fishing activity. In recent years approximately 20-55 vessels have landed more than 10,000 pounds of mackerel and would be the most likely vessels to benefit from DAH increases, though any of the permitted and/or active vessels/entities described in the preceding paragraph could potentially take advantage of DAH increases.

The various management measures in Alternative Set 2 should generally have positive impacts to fishery participants, including small entities. These measures should allow for the DAH increases proposed in Alternative Set 1 to be achieved without exceeding ACLs. The measures also allow for retention of incidentally-caught mackerel after the directed fishery has closed. The preferred alternative allows an increase in the trip limit after the closure of the directed fishery, which should minimize potential discards in other fisheries, including Atlantic herring. The measures maintain a 5,000 pound backstop once most of the DAH has been harvested to avoid/minimize ACL overages and minimize the potential for regulatory discarding. Because of the overall DAH overages, the combined result is that more DAH is available for the directed fishery and a higher trip limit is available after the closure of the directed fishery, so all participants should benefit.

There is one provision of the preferred alternative 2d that might have some impacts on vessels that have recently been directing on mackerel with open access/incidental permits, which start with 20,000 pound trip limits and then go to 5,000 pound trip limits once the directed fishery closes under the preferred alternative (they currently always stay at 20,000 pounds). If July-December handline/jig landings are examined from 2015-2017, a 5,000 pound trip limit would have impacted 21 federally-permitted vessels, which are all small entities. Had they been limited to 5,000 pounds, their combined mackerel landings would have been reduced by 17%. Individual vessel mackerel landings for these 21 vessels would have been impacted in the 1%-37% range with an average and median reduction of 13%. Based on the average 2015-2017 price from July-Dec handline trips of $0.45 per pound, individual vessels would have approximately lost (total 3 years) between $104 and $108,917 in ex-vessel revenues with an average reduction of $14,773 and a median reduction of $5,171. The proportion of total revenues from mackerel for these 21 vessels ranged from 1% to 93% with a mean of 23% and a median of 20%. It is possible that with the higher mackerel quotas closures will not occur so the 5,000 pound trip limit for incidental permits will not be triggered.

The preferred alternatives for Alternative Set 3, 3b combined with 3d, increase the RH/S cap but slightly reduce the tolerated ratio of RH/S in the mackerel fishery when landings are above 10,000 MT. Under 10,000 MT, the same ratio as applies currently would persist. The impact of the RH/S cap depends on the fleet's ability to avoid RH/S. In most years of the cap the fishery has not been constrained by the cap, but in 2018 the fishery closed slightly early due to the RH/S cap. Given recent performance, it does not appear that the RH/S cap is likely to substantially constrain landings beyond the standard constraints of the DAH, i.e. the fleet has generally maintained a low-enough RH/S encounter rate. If the RH/S cap triggers a closure, the 145 vessels with limited access permits are potentially affected, and they represent 105 entities, of which 98 are small entities. If RH/S encounter rates are relatively low, as has occurred in most years the cap has been in operation (2014-2017) then they will not be impacted at all. If RH/S encounter rates are high, then it is possible that a substantial portion of the mackerel DAH could go unharvested after a closure due to the RH/S cap. With just 3b, even if the fishery has a similar encounter rate as 2018 when the fishery was closed slightly early (the highest observed rate during operation of the cap), mackerel landings could still expand to close to the higher DAHs because the RH/S cap is scaled up with the quota. With the addition of 3d, the fishery would still be able to expand landings even at the higher 2018 RH/S encounter rate, but only slightly since the trigger in 3d is 89 MT when landings are less than 10,000 MT compared to the current 82 MT RH/S cap. Once the fishery lands 10,000 MT then the rest of the RH/S cap becomes available. So 3b and 3d would both allow increased landings based on the RH/S encounter rates that have been observed since the cap has been in operation. However, if the fishery triggers the 89 MT RH/S threshold before 10,000 MT of mackerel has been landed, the increase in mackerel landings will be limited, and the higher DAH will mostly remain unharvested. The fishery landed about 8,000 MT before the RH/S cap closed the fishery in 2018. 89 MT is 8.5% higher than 82 MT, so at the 2018 RH/S encounter rate, there would be a closure at approximately 8,700 MT. So landings could increase, but the DAH would be limited compared to the proposed 2019-2020-2021 DAHs of 17,371 MT, 20,557 MT, and 21,517 MT. Looking at the differences, this would leave, for 2019-2020-2021 DAHs, 8,671 MT, 11,857 MT, and 12,817 MT unharvested. For 2019-2020-2021, assuming the 2017 average price of $600/MT persists, this would represent approximately $5.2 million, $7.1 million, and $7.7 million in potentially forgone revenues (again this would not be a decrease, but a limit to a potential increase).

If the cap is triggered, the mackerel trip limit for all permits becomes 20,000 pounds, which is not a change from the current measures. Under the preferred measures, then if 90% of the DAH was still somehow able to be caught, incidental permits would go to 5,000 pounds. Then if 98% of the DAH was still somehow caught all permits would go to a 5,000 pound trip limit, but remaining at a 20,000 pound trip limit would be most likely given a RH/S cap closure means more DAH will be available.

12.1 Regulatory Impact Review

INTRODUCTION

Executive Order 12866 requires a Regulatory Impact Review (RIR) in order to enhance planning and coordination with respect to new and existing regulations. This Executive Order requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be “significant.” The analysis included in this RIR further demonstrates that this action is not a “significant regulatory action” because it will not affect in a material way the economy or a sector of the economy.

Executive Order 12866 requires a review of proposed regulations to determine whether or not the expected effects would be significant, where a significant regulatory action is one that may:

1. Have an annual effect on the economy of $100 million or more, or adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;
2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
3. Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
4. Raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in the Executive Order.

The mackerel fishery was worth between $3.3 million and $4.1 million from 2015-2017 (ex-vessel revenues). The proposed measures could allow ex-vessel revenues to increase to around $10.4 to $12.2 million dollars over 2019-2021. The impacts for open access vessels described above related to a lower trip limit are relatively small. The RH/S cap could limit mackerel landings and revenues but has not been substantially containing so far. This could change depending on fishery performance, as described above.

This action is consistent with previous actions by the Council and NOAA Fisheries, and there is no known conflict with other agencies. There is no known impact on any entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof. There is also no known conflict with other legal mandates, the President’s priorities, or the principles set forth in the Executive Order. Making adjustments to the Council’s risk policy was explicitly contemplated in previous actions so this is not precedent-setting or novel.

As such, the Proposed Action is not considered significant as defined by Executive Order 12866 given the relatively small size of this fishery and the expected impacts, at least as defined for Executive Order 12866.

13.0 APPENDIX 1: MATRIX OF RELEVANT CLOSURE TRIGGER THRESHOLDS (ALTERNATIVE SET 2, ALTERNTAIVES 2B-2D) FOR RELEVANT DAHS (ALTERNATIVE SET 1, ALTERNATIVES 1B-1D)

For Alternative 2b.

Proposed Option 1b + 2b In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	19,025	26,183	33,001
Canadian Deduction (10,000 MT in 2019, 50% in 2020-21)	10,000	13,092	16,501
DAH (Commercial Quota)	7,553	11,483	14,778
1st Close at 80% of DAH	6,043	9,187	11,822
Quota between 1st and 2nd close	1,360	2,067	2,660
2nd Close at 98% of DAH	7,402	11,254	14,482
Quota after 2nd close	151	230	296
Extra Management Uncertainty Buffer from 1b	234	356	459

Proposed Option 1c + 2b In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	29,184	32,480	33,474
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
1st Close at 80% of DAH	13,897	16,445	17,214
Quota between 1st and 2nd close	3,127	3,700	3,873
2nd Close at 98% of DAH	17,024	20,145	21,087
Quota after 2nd close	347	411	430
Extra Management Uncertainty Buffer from 1c	539	638	668

Proposed Option 1d + 2b In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	30,868	34,016	36,551
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	18,999	22,041	24,491
1st Close at 80% of DAH	15,199	17,633	19,593
Quota between 1st and 2nd close	3,420	3,967	4,408
2nd Close at 98% of DAH	18,619	21,600	24,001
Quota after 2nd close	380	441	490
Extra Management Uncertainty Buffer from 1d	590	684	760

For Alternative 2c

Proposed Option 1b + 2c In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	19,025	26,183	33,001
Canadian Deduction (10,000 MT in 2019, 50% in 2020-21)	10,000	13,092	16,501
DAH (Commercial Quota)	7,553	11,483	14,778
1st Close at 85% of DAH	6,420	9,761	12,561
Quota between 1st and 2nd close	982	1,493	1,921
2nd Close at 98% of DAH	7,402	11,254	14,482
Quota after 2nd close	151	230	296
Extra Management Uncertainty Buffer from 1b	234	356	459

Proposed Option 1c + 2c In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	29,184	32,480	33,474
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
1st Close at 85% of DAH	14,766	17,473	18,290
Quota between 1st and 2nd close	2,258	2,672	2,797
2nd Close at 98% of DAH	17,024	20,145	21,087
Quota after 2nd close	347	411	430
Extra Management Uncertainty Buffer from 1c	539	638	668

Proposed Option 1d + 2c In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	30,868	34,016	36,551
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	18,999	22,041	24,491
1st Close at 85% of DAH	16,149	18,735	20,817
Quota between 1st and 2nd close	2,470	2,865	3,184
2nd Close at 98% of DAH	18,619	21,600	24,001
Quota after 2nd close	380	441	490
Extra Management Uncertainty Buffer from 1d	590	684	760

For Alternative 2d

Proposed Option 1b + 2d In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	19,025	26,183	33,001
Canadian Deduction (10,000 MT in 2019, 50% in 2020-21)	10,000	13,092	16,501
DAH (Commercial Quota)	7,553	11,483	14,778
1st Close at 90% of DAH	6,798	10,335	13,300
Quota between 1st and 2nd close	604	919	1,182
2nd Close at 98% of DAH	7,402	11,254	14,482
Quota after 2nd close	151	230	296
Extra Management Uncertainty Buffer from 1b	234	356	459

Proposed Option 1c + 2d In-Season Measures All numbers are in metric tons (MT) (PREFERRED)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	29,184	32,480	33,474
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	17,371	20,557	21,517
1st Close at 90% of DAH	15,634	18,501	19,365
Quota between 1st and 2nd close	1,390	1,645	1,721
2nd Close at 98% of DAH	17,024	20,145	21,087
Quota after 2nd close	347	411	430
Extra Management Uncertainty Buffer from 1c	539	638	668

Proposed Option 1d + 2d In-Season Measures All numbers are in metric tons (MT)			
Specification	Mackerel 2019 (MT)	Mackerel 2020 (MT)	Mackerel 2021 (MT)
Total Acceptable Biological Catch (ABC) from SSC	30,868	34,016	36,551
Canadian Deduction (10,000 MT)	10,000	10,000	10,000
DAH (Commercial Quota)	18,999	22,041	24,491
1st Close at 90% of DAH	17,099	19,837	22,042
Quota between 1st and 2nd close	1,520	1,763	1,959
2nd Close at 98% of DAH	18,619	21,600	24,001
Quota after 2nd close	380	441	490
Extra Management Uncertainty Buffer from 1d	590	684	760

14.0 APPENDIX 2: MATRIX OF RELEVANT RH/S CAPS OPTIONS (3B-3C) FOR ALL RELEVANT DAH OPTIONS (1B-1D)

For Alternative 3b

Proposed Option 3b RH/S Cap Option (0.74%) with 1B Rebuilding All numbers are in metric tons (MT)			
Specification	2019	2020	2021
Mackerel DAH	7,553	11,483	14,778
RH/S Cap	56	85	109

Proposed Option 3b RH/S Cap Option (0.74%) with 1C Rebuilding All numbers are in metric tons (MT) (PREFERRED)			
Specification	2019	2020	2021
Mackerel DAH	17,371	20,557	21,517
RH/S Cap	129	152	159

Proposed Option 3b RH/S Cap Option (0.74%) with 1D Rebuilding All numbers are in metric tons (MT)			
Specification	2019	2020	2021
Mackerel DAH	18,999	22,041	24,491
RH/S Cap	141	163	181

For Alternative 3c

Proposed Option 3c RH/S Cap Option (0.89%) with 1B Rebuilding All numbers are in metric tons (MT)			
Specification	2019	2020	2021
Mackerel DAH	7,553	11,483	14,778
RH/S Cap	67	102	132

Proposed Option 3c RH/S Cap Option (0.89%) with 1C Rebuilding All numbers are in metric tons (MT)			
Specification	2019	2020	2021
Mackerel DAH	17,371	20,557	21,517
RH/S Cap	155	183	192

Proposed Option 3c RH/S Cap Option (0.89%) with 1D Rebuilding All numbers are in metric tons (MT)			
Specification	2019	2020	2021
Mackerel DAH	18,999	22,041	24,491
RH/S Cap	169	196	218

15.0 APPENDIX 3: 2018 MACKEREL DATA

One key uncertainty of the recent mackerel benchmark assessment is the magnitude of the 2015 year class (i.e. the 2016 recruitment estimate). It was the 4th highest over the last 30 years, and its magnitude drives the rebuilding projections, which suggest that rebuilding should occur quickly. As accepted in the assessment, the rebuilding projections also assume typical (roughly the median) recruitment from the 2016 year class and beyond. It is currently expected that there will be an assessment update as early as 2020 to evaluate rebuilding progress. However, Council staff worked with NMFS staff to obtain what data are currently available to provide some clues about the 2015 and 2016 year classes, which would be age 3s and age 2s respectively in 2018.

Given the age truncation seen in the assessment, catches in 2018 would be expected to be mostly comprised of young fish simply because older fish are rare. The mackerel fishery closed on February 27, 2018 and effectively operated for 6 weeks. It steadily averaged approximately 3 million pounds per week during that time, which was the most robust landing period since early 2009.

Portside and observer data suggests most fish that were being caught in 2018 were likely from the 2015 and 2016 year classes. Figure A4 from the benchmark assessment indicates that age 2 fish have a mean length of approximately 27 cm and age 3 fish have a mean length of approximately 31.5 cm. Small fish of one age class can overlap with large fish of the younger age class (Figure A6 from benchmark assessment). Of the 2,576 mackerel measured portside in early 2018, 79.5% were between 26 cm and 32 cm, which are predominately going to be age 2 and 3 fish (figure M.A1). Quite similarly, 79.4% of measured mackerel in early 2018 observer data were in the 26-32 cm range (figure M.A2). Aged catch data from the Spring 2018 NMFS NEFSC Bigelow trawl survey have also become available (Figure M.A3) and show a relatively high proportion of age 3s (the 2015 year class) but relatively few age 2s (the 2016 year class) or age 1s (the 2017 year class).

THIS SPACE INTENTIONALLY LEFT BLANK

Figure M.A1. NMFS Early 2018 Mackerel Port Sampling Data

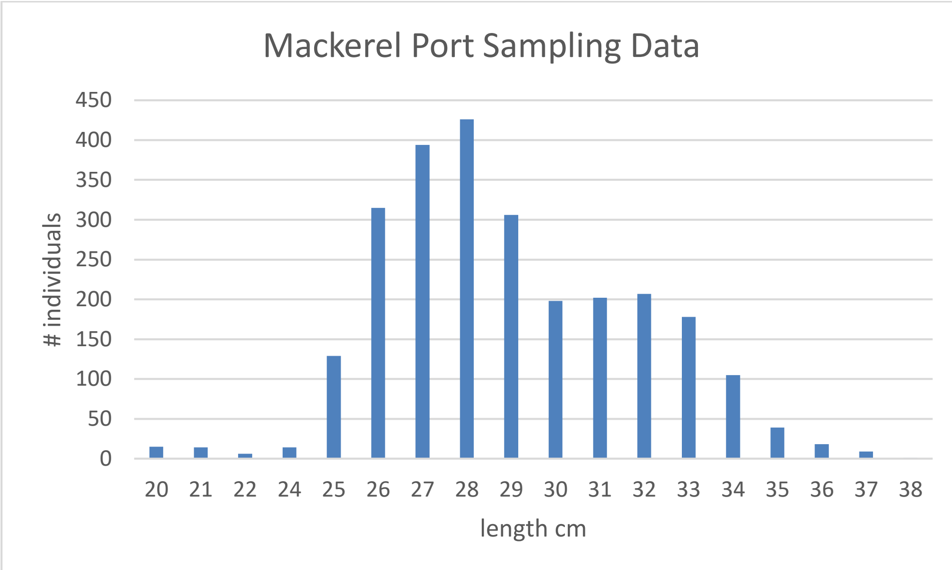


Figure M.A2. NMFS Early 2018 Mackerel Observer Sampling Data

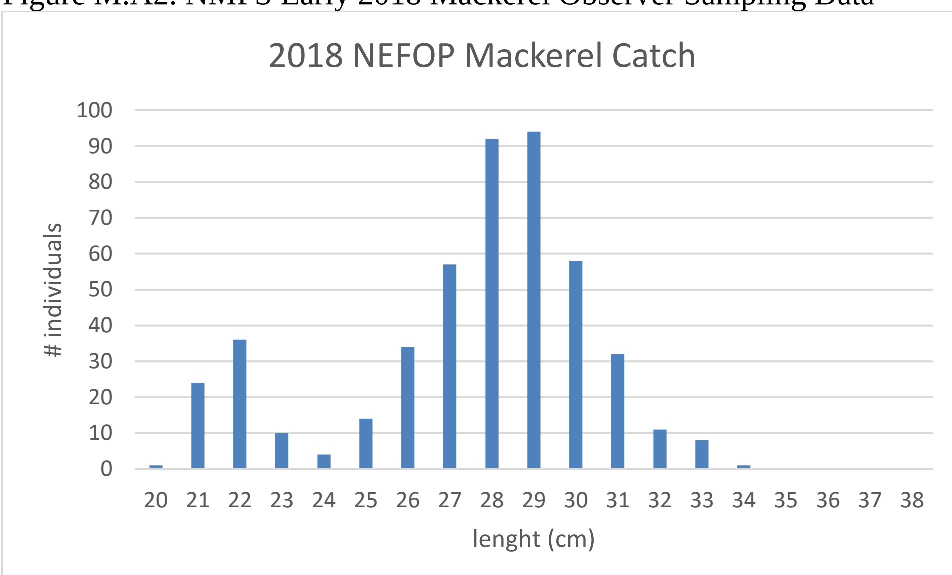
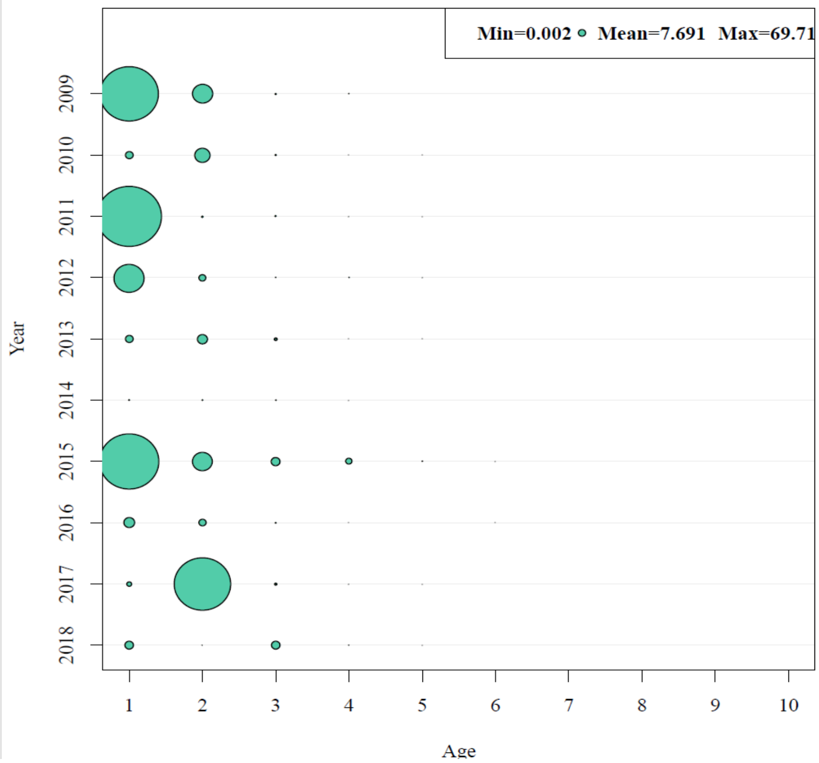


Figure M.A3. Atlantic mackerel catch-at-age in the NEFSC spring Bigelow 2009-2018.



Overall, these data sources seem consistent with what would be predicted based on the benchmark assessment, that fish caught in 2018 would be expected to mostly be age 2-3. While the data generally suggest that recruitment from the 2015 and 2016 year classes is entering the fishery, they are not sufficient to indicate whether the actual magnitude of recruitment from the 2015-2017 year classes may be lower or higher than anticipated.

THIS IS THE END OF THIS DOCUMENT