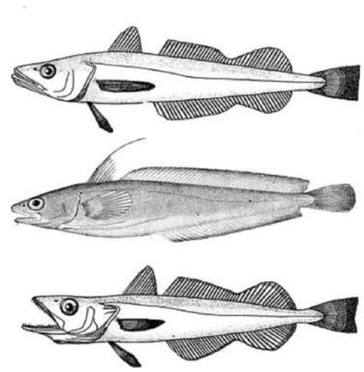
Northeast Multispecies Fishery Management Plan

Framework Adjustment 62 for Whiting, Red Hake, & Offshore Hake

Including an Environmental Assessment and
Regulatory Flexibility Analysis



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FRAMEWORK ADJUSTMENT 62 TO THE NORTHEAST MULTISPECIES FISHERY MANAGEMENT PLAN

Preferred alternatives: Propose a rebuilding plan and adjust management measures for the southern red hake stock.

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Abstract: The New England Fishery Management Council, in consultation with NOAA National Marine Fisheries Service, has prepared Framework Adjustment 62 to the Northeast Multispecies Fishery Management Plan, which includes an environmental assessment that presents the range of alternatives to achieve the goals and objectives of a rebuilding plan and management measures for the southern red hake stock. The document describes the affected environment including the valued ecosystem components and analyzes the impacts of the alternatives on both. It addresses the requirements of the Magnuson Stevens Fishery Conservation and Management Act, the National Environmental Policy Act, the Regulatory Flexibility Act, and other applicable laws.

1.0 EXECUTIVE SUMMARY

The purpose of Framework Adjustment 62 (FW62) to the Northeast Multispecies FMP is to establish a rebuilding plan and management measures for the southern red hake stock.

The need for this action is to prevent overfishing, ensure rebuilding, and help achieve optimum yield in the commercial fishery consistent with the requirements of Magnuson Stevens Fishery Management and Conservation Act (MSA). This document includes alternatives for a rebuilding plan with a rebuilding schedule and change in possession limits for southern red hake.

Preferred Alternatives

If the preferred alternative(s) identified in this document are adopted, this action would implement the measures summarized in Section 4.0.

The Preferred Alternatives include:

- *Rebuilding Plan*
    - The preferred alternative would establish a rebuilding plan for southern red hake. A rebuilding plan includes a schedule to rebuild the stock as well as a revision on limiting total catch at levels expected to promote rebuilding.
- *Management Alternatives – Possession Limits*
    - The preferred alternative would adopt a lower, tiered year-round trip possession limit based on gear selectivity for southern red hake with the in-season accountability measure remaining in place.

Impacts of the Preferred Alternatives

The environmental impacts of the alternatives under consideration are described in Section 6.0. Summaries of the most substantial impacts are provided in the following paragraphs.

Impacts on Target Species

The preferred alternatives for the rebuilding plan and the dual possession limit would result in a moderately positive to low positive impacts on the target species, southern red hake stock. Specifically, they would establish a seven-year rebuilding schedule for southern red hake, reducing the ABC to 75% of the F_{msy} proxy, and would decrease the year-round possession limit from 5,000 lb. to a dual 1,000-lb./600-lb. possession limit based on gear selectivity. The in-season accountability measure (AM) would be maintained. There is no forecasting method using this stock's index-based stock assessment and according to the recent research track assessment, fishing may not be the main driver of changes in stock biomass. Most trips catching red hake would have a lower 600 lb. southern red hake possession limit but could reduce discards and increase red hake landings by using more selective trawls. Similarly, trips already using large-mesh or selective small-mesh trawls would have a higher 1,000 lb. possession limit and discard fewer red hake than they would if a straight 600 lb. possession limit applied. It is not possible to quantitatively estimate how many trips would convert to use more selective small-mesh trawls or how effective those more selective trawls would be for reducing red hake catch. However, given the cost of switching gears, fishermen are not expected to switch gears in order to land the higher possession limit because southern red hake is not typically targeted. The reduced opportunity to land southern red hake due to the lower possession limit likely would not change fishing behavior and catch because 60-80% of southern red hake are currently discarded due to lack of marketability (Section 6.2).

Impacts on Non-Target Species

The preferred alternatives, the rebuilding plan and dual possession limit, would likely have low positive to low negative impacts on non-target species, depending on whether the non-target species are overfished and experiencing overfishing. Some fishermen who use small-mesh trawls could be expected to switch to more selective trawls in order to land the higher possession limit. The costly changes in gear would not be very likely in response to the tiered possession limit because the low relative value of the extra 400 lb., which is the difference between 600 lb. and 1,000 lb., of southern red hake is small (Section 6.3).

Impacts on Protected Species

The preferred alternatives (rebuilding plan and dual possession limit) would likely have low negative to low positive impacts on protected species (MMPA non-ESA listed species range from low negative to low positive impacts; ESA listed species with low negative impacts) for both the rebuilding plan and possession limit preferred alternatives. Bottom trawl gear is used to target whiting. Interactions, resulting in the injury or mortality to ESA listed and/or MMPA protected species have been observed or documented (Section 6.4). Fishing behavior and levels of fishing effort are generally expected to remain similar to current levels because southern red hake is not typically targeted. The reduction in ABC through a rebuilding plan and decrease in possession limit from 5,000 lb. to dual 1,000 lb./600 lb. depending on gear selectivity are not expected to introduce new or elevated interaction risks to non-ESA listed marine mammal stocks in poor condition or to ESA listed species. Specifically, the amount of gear in the water, tow times, and overlap between protected species and fishing gear is expected to remain unchanged relative to current conditions.

Impacts on Physical Environment and Essential Fish Habitat (EFH)

The preferred alternatives (rebuilding plan and dual possession limit) would likely have low negative impacts on the physical environment and EFH because the interactions of trawl gear would continue to degrade the quality of habitat in similar areas (Section 6.5). Fishing activity would likely remain similar to previous years and would continue to degrade habitat quality because southern red hake is typically not targeted, so the incentive to land the higher 1,000 lb. possession limit would not be substantial enough to reduce habitat impact. The higher 1,000 lb. possession limit could mean additional effort (more tows, longer trips, etc.) in order to land the higher possession limit compared to the lower 600 lb. possession limit, however, based on the observer data this is not likely, thus, fishing behavior and levels of fishing effort are generally expected to remain similar to current levels. The potential decrease in habitat impact from the more selective gear under the higher possession limit could be offset by the habitat impact from the standard small-mesh trawl gear under the lower possession limit.

Impacts on Human Communities

The preferred alternatives (rebuilding plan and dual possession limit) would likely have low negative impacts on human communities in the short term because lower possession limits would likely slightly decrease revenue and social benefits through increased discarding of southern red hake (Section 6.6). This marginal decrease in revenue could be mitigated through the slight increase in harvest of other species. The higher possession limit of 1,000 lb. could mean additional effort (more tows, longer trips, etc.) in order to land the higher possession limit compared to the lower 600 lb. possession limit but based on the observer data, this is not likely to occur, thus, fishing behavior and levels of fishing effort are generally expected to remain similar to current levels. Southern red hake is not typically targeted and the reduced opportunity to land this stock would most likely not substantially change fishing behavior and catch. If southern red hake rebuilds, the long-term impact on human communities would likely be low positive because of sustainably managing the stock resulting in a higher biomass and potentially higher revenue in the future.

Alternatives to the Preferred Alternatives

Besides the preferred alternatives, other alternatives were considered, detailed in Section 4.0.

Rebuilding Plan

Under No Action, a rebuilding schedule would not be specified and would retain the maximum fishing mortality level at MSY, subject to scientific and management uncertainty buffers.

Management Alternatives – Possession Limits

Under No Action, the 5,000 lb. possession limit would be maintained but would also apply a 40.4% post-season AM trigger which would take effect in the 2021 fishing year. When landings exceed this trigger, the southern red hake possession limit is automatically lowered from 5,000 lb. to 400 lb.

Impacts of Alternatives to the Preferred Alternatives

The environmental impacts of the alternatives to the preferred alternative (Table 1) are detailed in Section 6.0.

Impacts on Target Species

The No Action alternative would not specify a rebuilding plan for the stock and would not adjust the year-round possession limit for southern red hake. This alternative could have a high negative impact on southern red hake because the alternative would not be consistent with the MSA National standard 1 and if rebuilding does not occur, the fishery would not achieve MSY and/or achieve optimum yield, and would likely remain in an overfished condition. The higher 5,000 lb. possession limit would remain with the 40.4% AM in place in FY2021. The No Action southern red hake possession limit alternative would have a low positive effect on the southern red hake population because the alternative could act to prevent catch from exceeding the overfishing level. If the stock productivity is less than average, an overfished condition might continue with little or no rebuilding, however, the stock could rebuild if recruitment is average or above, keeping fishing mortality below the overfishing level. It is important to note that the No Action alternative will have an AM (40.4% of the TAL instead of 90% of the TAL under Status Quo) that is more restrictive on catch levels than the regulations that were in place when southern red hake become overfished.

Impacts on Non-Target Species

The impacts of No Action on non-target species that co-occur or act similar to red hake on the bottom would likely be no impact if a rebuilding plan is not established because fishing would continue at present levels. Under No Action, impact on non-target species could be slight low positive to low negative if year-round possession limits are not reduced, depending on the non-target species and whether or not the non-target species are overfished and experiencing overfishing. Fishing effort and behavior changes would likely be minor and catch of non-target species is largely controlled through other FMPs so non-target catches would be unchanged from levels that have been previously determined to be sustainable (Section 6.3).

Impacts on Protected Species

The No Action alternatives would not establish a rebuilding plan and would maintain the previously established year-round possession limit and AM, thus, fishing patterns and fishing behavior would likely remain similar to present patterns (e.g., no spatial or temporal shifts in effort; no changes in gear type, quantity, or relative soak/tow time). Therefore, gear interactions with protected species would likely be similar to previous fishing years, so impacts to protected resources would likely be low negative to negligible, depending on the species.

Impacts on Physical Environment and Essential Fish Habitat (EFH)

The No Action alternative for southern red hake possession limit would likely not result in a change in fishing effort and therefore impacts on the physical environment and EFH would likely remain low negative because the fishery would continue to degrade the quality of the habitat areas in which the fishery already interacts in the fishery. Effort in the whiting fishery is capped by the overall TAL and effort controls, thus, the impacts are also restricted. The total impact on EFH is controlled by fishing effort in the other fisheries in which southern red hake is caught. The No Action alternative would likely have low negative impacts on EFH as trawl gear is a mobile bottom tending gear and overall fishing effort would likely not significantly change from recent fishing years.

Impacts on Human Communities

The human communities impacts of the No Action alternative would likely be low positive in the short term because the fishing mortality would not be adjusted, thus effort and behavior could continue as in years past. The impacts in the long term would be low negative because if southern red hake stock does not rebuild, then in-season AMs could continue to be put in place before the end of the fishing season resulting in a slight loss of revenue and a decrease in job satisfaction. Under the No Action alternative for the possession limit alternative, the overall impacts would be low negative in both the short and long term because even though fishermen would be able to land the higher possession limit, the TAL is substantially reduced because of the previous TAL overage. This could result in a TAL trigger to 400 lb. earlier in the fishing year, thereby reducing the socioeconomic benefits. In the long term, there would be a low negative impact to human communities because if no action is taken, then that will negatively impact the overfished resource and not contribute to recovery and rebuilding so economic and social impacts will be low negative in the future if southern red hake continues to decline. The southern red hake stock size could continue to decrease and more drastic regulations could occur in the small-mesh multispecies fishery and potentially other fisheries in order to protect the overfished southern red hake stock, negatively impacting fishermen and coastal communities in the long term.

Table 1. Summary of Framework Adjustment 62 impacts expected on each VEC (preferred alternatives shaded).

Alternatives			Target Species	Non-target Species	Protected Resources	Physical Env. (EFH)	Human Communities
Rebuilding	**Alt. 1 – No Action / Status Quo**		High -	Stocks not overfished: Low + to Overfished stocks: Low -	Low - to low +	Low -	Short term: Low + Long term: Low -
	Alt. 2 – Rebuilding Estimates	**Option A – 75% of F_{MSY} proxy**	Moderate +	Stocks not overfished: Low + to Overfished stocks: Low -	Low + to low–	Low -	Short term: Low – Long term: Low +
		Option B – 50% of F_{MSY} proxy	Moderate +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
Management Alternatives	**Alt. 1 – No Action**		Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low - Long term: Low -
	Alt. 2 – Status Quo		Low -	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low + to low - Long term: Low -
	Alt. 3 – Year-round Possession Limits with AM	**Option A - 0 lb.**	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low - Long term: Low +
		Option B - 400 lb.	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
		Option C - 600 lb.	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
		Option D - 1,000 lb.	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low+	Low -	Short term: Low – Long term: Low +
	Alt. 4 - Dual 1,000 lb./600 lb. Year-round Possession Limit with AM		Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +

2.0 TABLE OF CONTENTS

2.1 Tables

2.2 FIGURES

2.3 Maps

2.4 Acronyms

ABC	Acceptable Biological Catch
ACL	Annual Catch Limit
AIM	An Index Method of Analysis
ALWTRP	Atlantic Large Whale Take Reduction Plan
AM	Accountability Measure
ANPR	Advanced Notice of Proposed Rulemaking
AP	Advisory Panel
APA	Administrative Procedures Act
ASMFC	Atlantic States Marine Fisheries Commission
B_{MSY}	Biomass that would allow for catches equal to Maximum Sustainable Yield when fished at the overfishing threshold (F_{MSY})
BiOp, BO	Biological Opinion, a result of a review of potential effects of a fishery on Protected Resource species
CAI	Closed Area I
CAII	Closed Area II
CEQ	Council on Environmental Quality
CPUE	Catch per unit of effort
DAM	Dynamic Area Management

DAS	Day(s)-at-sea
d/K	Ratio of discarded fish to kept catch in weight
DFO	Department of Fisheries and Oceans (Canada)
DMF	Division of Marine Fisheries (Massachusetts)
DMR	Department of Marine Resources (Maine)
DPWG	Data Poor Working Group
DSEIS	Draft Supplemental Environmental Impact Statement
EA	Environmental Assessment
EEZ	Exclusive economic zone
EFH	Essential fish habitat
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
F	Fishing mortality rate
FEIS	Final Environmental Impact Statement
FMP	Fishery management plan
FW	Framework
FY	Fishing year
GARFO	Greater Atlantic Regional Fisheries Office
GARM	Groundfish Assessment Review Meeting
GB	Georges Bank
GIS	Geographic Information System
GOM	Gulf of Maine
GRT	Gross registered tons/tonnage
HAPC	Habitat area of particular concern
HPTRP	Harbor Porpoise Take Reduction Plan
IFM	Industry-funded monitoring
IFQ	Individual fishing quota
ITQ	Individual transferable quota
IVR	Interactive voice response reporting system
IWC	International Whaling Commission
MA	Mid-Atlantic
MAFAC	Marine Fisheries Advisory Committee
MAFMC	Mid-Atlantic Fishery Management Council
MMPA	Marine Mammal Protection Act
MPA	Marine protected area
MRI	Moratorium Right Identifier
MRIP	Marine Recreational Information Program
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	Maximum Sustainable Yield
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFMC	New England Fishery Management Council
NEFOP	Northeast Fisheries Observer Program
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NLSA	Nantucket Lightship closed area
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OBDBS	Observer database system
OLE	Office for Law Enforcement (NMFS)

OY	Optimum yield
PBR	Potential Biological Removal
PDT	Plan Development Team
PRA	Paperwork Reduction Act
RFA	Regulatory Flexibility Act
RMA	Regulated Mesh Area
RPA	Reasonable and Prudent Alternatives
SA	Statistical Area
SAFE	Stock Assessment and Fishery Evaluation
SAP	Special Access Program
SARC	Stock Assessment Review Committee
SAS	Stock Assessment Subcommittee
SAW	Stock Assessment Workshop
SBNMS	Stellwagen Bank National Marine Sanctuary
SIA	Social Impact Assessment
SNE	Southern New England
SNE/MA	Southern New England-Mid-Atlantic
SSB	Spawning stock biomass
SSC	Scientific and Statistical Committee
TAL	Total allowable landings
TED	Turtle excluder device
TEWG	Technical Expert Working Group
TMS	Ten-minute square
TRAC	Trans boundary Resources Assessment Committee
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VMS	Vessel monitoring system
VEC	Valued ecosystem component
VPA	Virtual population analysis
VTR	Vessel trip report
WGOM	Western Gulf of Maine
YPR	Yield-per-recruit

3.0 BACKGROUND AND PURPOSE

3.1 BACKGROUND

The Small-Mesh Multispecies Fishery Management Plan (FMP) specifies the management measures for five species (two stocks of whiting, silver hake, two stocks of red hake, and one stock of offshore hake) off the New England and Mid-Atlantic coasts. Silver and offshore hake are commonly known as "whiting," and the fishery that harvests these species is known as the "whiting fishery." Silver and red hake each comprise two stocks that are attributed to different geographic areas: northern and southern silver hake; northern and southern red hake. Commercial fishermen harvest all the silver hake and virtually all of the red hake. Because vessels in the fishery use small mesh, they are regulated through a series of exemptions from the Northeast (NE) Multispecies FMP. Amendment 12 to the NE Multispecies FMP in 2000 implemented the first management measures for the whiting fishery. Since then, the FMP has been updated through a series of amendments and framework adjustments.

The whiting fishery adopted a system of annual catch limits (ACLs) and accountability measures (AMs) designed to ensure catches remain below desired targets for each stock of the management complex. AMs are management controls to prevent ACLs from being exceeded and to correct or mitigate overages of the ACL if they occur. AMs should address and minimize both the frequency and magnitude of overages and correct the problems that caused the overages in as short a time as possible. AMs can be either in season AMs or AMs for when the ACL is exceeded.

There is no requirement that AMs and ACLs be implemented as hard TACs or quotas, but conservation and management measures must prevent the ACL from being exceeded and AMs must apply if the ACL is exceeded (74 FR 3184). While many measures in the management system are intended to control fishing mortality and might be interpreted to be AMs since they are "management controls to prevent the ACL from being exceeded," the term AM is usually applied to specific, automatic measures that are implemented either as an ACL is approached or after an ACL is exceeded.

This framework (Framework Adjustment 62, FW 62) would establish a rebuilding plan and adjust management measures for southern red hake, which was declared overfished in January 2018.

This EA is being prepared using the 1978 CEQ NEPA Regulations. NEPA reviews initiated prior to the effective date of the 2020 CEQ regulations may be conducted using the 1978 version of the regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020. This review began on September 3, 2020 and the agency has decided to proceed under the 1978 regulations.

3.2 PURPOSE AND NEED

The purpose for this framework is to establish a rebuilding plan and adjust management measures for southern red hake to address the overfished condition of the stock, declared overfished in January 2018. The need for this action is to meet regulatory requirements and adjust management measures that are necessary to prevent overfishing, ensure rebuilding, and help achieve optimum yield in the fishery consistent with the status of stocks and the requirements of the MSA.

The primary purpose of FW 62 is to develop a rebuilding plan and adjust management measures for southern red hake.

To better demonstrate the link between the purpose and need for this action, Table 2 summarizes the need for the action and corresponding purposes.

Table 2. Purpose and need for Framework Adjustment 62 to the Northeast Multispecies FMP.

Purpose	Need
To meet statutory requirements to develop a rebuilding plan for southern red hake, which was declared overfished in 2018.	To achieve the objectives of the Small-Mesh Multispecies FMP to rebuild the southern red hake stock.

3.3 Management History

The small-mesh multispecies fishery consists of three species: Silver hake (*Merluccius bilinearis*), red hake (*Urophycis chuss*), and offshore hake (*Merluccius albidus*). There are two stocks of silver hake (northern and southern), two stocks of red hake (northern and southern), and one stock of offshore hake, which primarily co-occurs with the southern stock of silver hake. There is little to no separation of silver and offshore species in the market, and both are generally sold under the name "whiting." Throughout the document, "whiting" is used to refer to silver hake and offshore and silver hake combined catches. Collectively, the small-mesh multispecies fishery is managed under a series of exemptions from the Northeast Multispecies Fishery Management Plan including exemptions from mesh size requirements. In the Gulf of Maine and Georges Bank Regulated Mesh Areas (Map 1), there are six exemption areas, which are open seasonally (Table 3).

Table 3. Northern area exemption program seasons.

	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Cultivator		June 15 – October 31										
GOM[*] Grate			July 1 – November 30									
Small I			July 15 – November 30									
Small II	– June 30								January 1 –			
Cape Cod[††]					Sept 1 – Nov 20							
					September 1 – December 31							

[*] GOM = Gulf of Maine
[†] RFT = Raised Footrope Trawl

The Gulf of Maine Grate Raised Footrope area is open from July 1 through November 30 of each year and requires the use of an excluder grate on a raised footrope trawl with a minimum mesh size of 2.5 inches. Small Mesh Areas I and II are open from July 15 through November 15, and January 1 through June 30, respectively. A raised footrope trawl is required in Small Mesh Areas I and II, and the trip limits are mesh size dependent. Cultivator Shoal Exemption Area is open from June 15 – October 31 and requires a minimum mesh size of 3 inches. The Raised Footrope Trawl Exemption Areas are open from September 1 through November 20, with the eastern portion remaining open until December 31. A raised footrope trawl, with a minimum mesh size of 2.5-inch square or diamond mesh, is required. The Southern New England and Mid-Atlantic Regulated Mesh Areas are open year-round and have mesh size dependent possession limits for the small-mesh multispecies. The mesh size dependent possession limits for all the areas with that requirement are shown below (Table 4).

Table 4. Mesh size dependent possession limits for southern red hake.

Codend Mesh Size	Red Hake South
Smaller than 2.5”	5,000 lb.
Larger than 2.5”, but smaller than 3.0”	5,000 lb.
Equal to or greater than 3.0”	5,000 lb.
Accountability measure, in-season TAL trigger	400 lb. 90% of TAL

The exemption areas (Map 1) were implemented as part of several different amendments and framework adjustments to the Northeast Multispecies FMP. In 1991, Amendment 4 incorporated silver and red hake and established an experimental fishery on Cultivator Shoal. Framework Adjustment 6 (1994) was intended to reduce the catch of juvenile whiting by changing the minimum mesh size from 2.5 inches to 3 inches. Small Mesh Areas I and II, off the coast of New Hampshire, were established in Framework Adjustment 9 (1995). The New England Fishery Management Council (Council) established essential fish habitat (EFH) designations and added offshore hake to the plan in Amendment 12 (2000). Also, in Amendment 12, the Council proposed to establish limited entry into the small-mesh fishery. However, that measure was disapproved by the Secretary of Commerce because it did not comply with National Standard 4[1] as a result of measures that benefited participants in the Cultivator Shoal experimental fishery and because of the “sunset” provision that would have ended the limited entry program at some date. The Raised Footrope Trawl Area off Cape Cod was established in Framework Adjustment 35 (2000). A modification to Framework Adjustment 35 in 2002 adjusted the boundary along the eastern side of Cape Cod and extended the season to December 31 in the new area. Framework Adjustment 37 modified and streamlined some of the varying management measures to increase consistency across the exemption areas. In 2003, Framework Adjustment 38 established the Grate Raised Footrope Exemption Area in the inshore Gulf of Maine area.

The Northeast Multispecies FMP was implemented primarily to manage the groundfish fisheries in the Gulf of Maine and Georges Bank. The FMP is complicated and has been changed numerous times since 1985. Several amendments and framework adjustments addressed the small-mesh fishery specifically and are described below.

Amendment 1 (1987) reduced the spatial footprint of the winter inshore whiting fishery in order to protect struggling large-mesh species like, gray sole, and dabs; focused the small-mesh target species to large-mesh species ratio on a selected set of species; and reduced the size of the Georges Bank whiting fishery area to protect yellowtail flounder.

Amendment 2 (1989) made some additional, minor changes to the exempted fishery program for whiting and other small-mesh stocks.

Amendment 4 (1991) established the Cultivator Shoals Exemption Area and formally incorporated silver hake and red hake into the FMP. This amendment also established a minimum mesh size for the directed small-mesh fishery as well. This was intended to control mortality of whiting and red hake in this fishery.

[1] National Standard 4 states that measures “shall not discriminate between residents of different States,” and that fishing privileges must be “fair and equitable to all such fishermen.”

Amendment 5 (1994) established an overfishing definition for red hake and implemented some other minor modifications to small-mesh management, including a standardized bycatch amount of 500 lb. of large-mesh groundfish.

Framework Adjustment 3 (1994) modified the 500-lb. bycatch limit to reduce the incentive for vessels to target groundfish with small-mesh. This action changed the limit to "10-percent of the total weight of fish on board, or 500 lb., whichever is less." This preserved the Council's original intent of minimizing mortality on juvenile groundfish, while allowing the legitimate small-mesh fishery to continue.

Framework Adjustment 6 (1994) was intended, in part, to reduce juvenile whiting mortality in the Cultivator Shoals whiting fishery and modified the requirements of that program.

Framework Adjustment 9 (1995) established Small Mesh Areas I and II in the Gulf of Maine and implemented the requirements for fishing in those areas.

An Adjustment to Amendment 7 (1996) made some minor modifications to non-groundfish bycatch limits in the Cultivator Shoals fishery.

Amendment 12 (1999/2000) addressed many small-mesh issues. This amendment officially incorporated offshore hake into the FMP; established essential fish habitat designations for all three small-mesh species; standardized the mesh-size based possession limits (see below); required a Letter of Authorization for several small-mesh exemption areas; and established a provision to allow the transfer of up to 500 lb. of small-mesh multispecies at sea. Amendment 12 also proposed a limited access permit program for this fishery. However, that program was not implemented because NMFS determined that it did not comply with the requirement to treat residents of different states equally (National Standard 4).

Framework Adjustment 35 (2000) established the Raised Footrope Trawl Exemption Area off Cape Cod. A Modification to Framework 35 (2002) modified the boundaries and seasons of the Cape Cod exemption areas.

Framework Adjustment 37 (2003) eliminated some of the now unnecessary provisions from Amendment 12, clarified the transfer-at-sea provisions, and reinstated the full season (back to an October 31 end date) for the Cultivator Shoal Exempted Fishery. This framework also standardized the types and amounts of incidental species that could be retained in the small-mesh exemption areas between Small Mesh Areas I and II and the Cape Cod Exemption Area.

A new Control Date (2003) was formally established with the intentions of developing a limited access permit program.

Framework Adjustment 38 (2003) established the Inshore Gulf of Maine Grate Raised Footrope Trawl Exemption Area along the coast of Maine.

A Secretarial Amendment (2012) brought this portion of the FMP into compliance with the Magnuson-Stevens Act requirements to have (1) annual catch limits and (2) measures to ensure accountability for each Council managed fishery. A Secretarial Amendment was necessary because the development of Amendment 19, the mechanism through which the Council was intending to adopt the new requirements, was delayed.

The Control Date for the small-mesh multispecies was modified to November 28, 2012.

Amendment 19 (2013) allowed the Council to incorporate updated stock assessment information and adopt the annual catch limit structure implemented in the 2012 Secretarial Amendment. Amendment 19 modified the accountability measures, adopted new biological reference points, and established a trip limit for red hake. It established specifications for the four stocks in the fishery and an accountability measure in the form of a triggered 400 lb. red hake possession limit when landings reach 90% of the TAL. This TAL trigger is reduced for prior overages, i.e. when total catch exceeds the ACL to reduce the risk of continued overfishing.

Framework Adjustment 50 (2013) established a separate, sub-annual catch limit of Georges Bank yellowtail flounder for the small-mesh fishery (whiting and squid fisheries.)

Framework Adjustment 51 (2014) implemented accountability measures for that sub-annual catch limit.

Post-season Accountability Measure (2015) reduced the TAL trigger for northern red hake from 90% of the TAL to 62.5% of the TAL.

Specifications for 2015-2017 (2016) (NEFMC 2014, 2015) adjusted the OFL, ABC, ACL, and TAL to account for changes in stock biomass. The specification document also changed the northern red hake possession limit to 3,000 lb. at the beginning of the fishing year, which would automatically drop to 1,500 lb. when landings reach 62.5% of the TAL. Due to prior overages, the TAL trigger was reduced to 45% of the TAL.

Post-season Accountability Measure (2016) reduced the northern red hake TAL trigger from 45% of the TAL to 37.9%. The 1,500 lb. possession limit is still in effect, but it is superseded by the post-season AM is triggered before the 1,500 lb. possession limit would take effect.

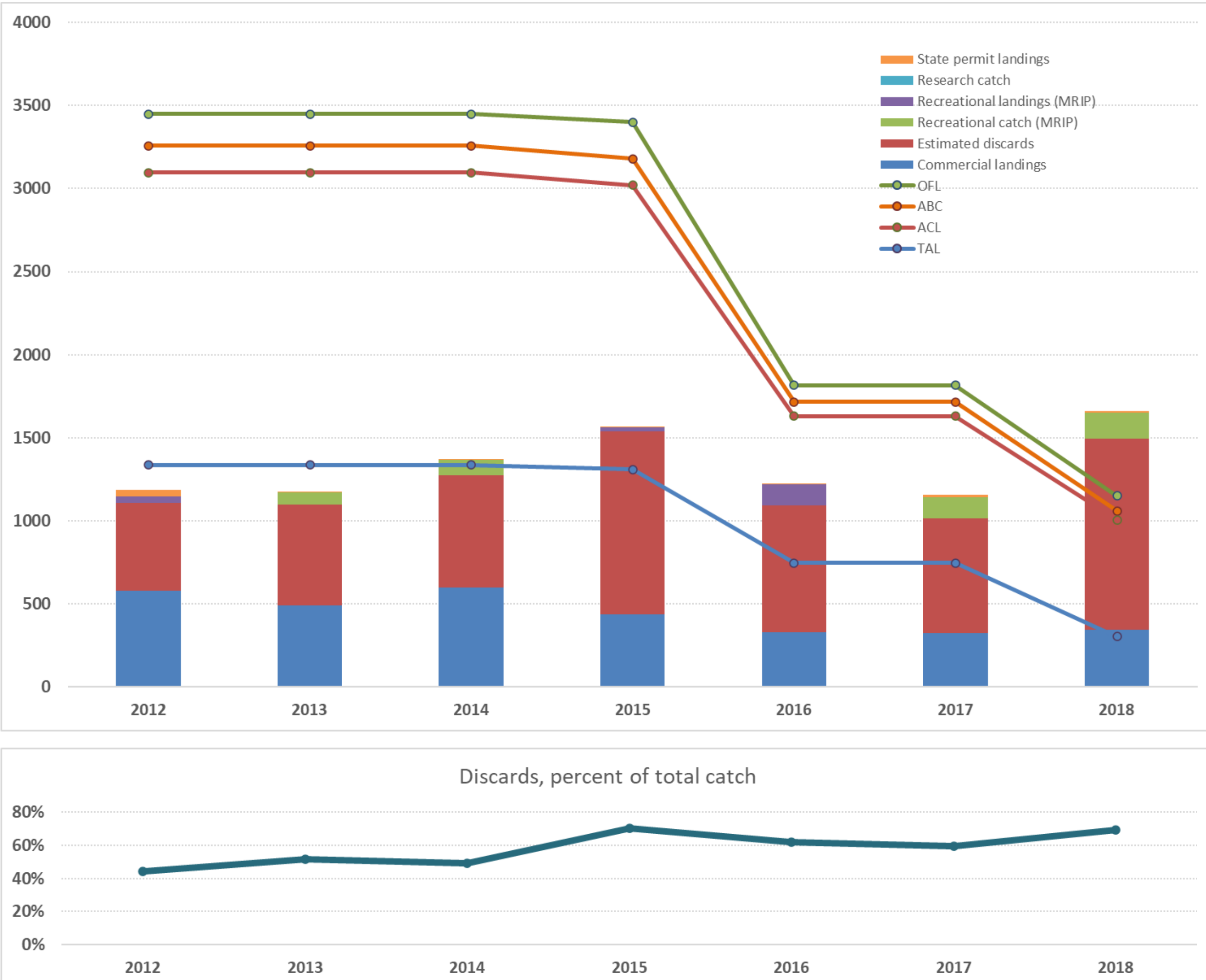
Specifications for 2018-2020 (NEFMC 2017) adjusted the OFL, ABC, ACL, and TALs to account for changes in stock biomass. Spring survey biomass declined since the 2014 survey and the 2018-2020 specification were set at a considerably lower level in accordance with the harvest control rule.

Although landings in 2018 were about the same as landings in 2017, discards in 2018 increased. Discards in 2012 to 2017 averaged 57% but increased to 69% in 2018. Much of the increase was associated with the squid fishery and occurred due to an increase in availability of squid and fishing effort (NEFMC 2019). Combined with the reduced specifications, total catch in 2018 exceeded the ACL by 49.6%, which triggered a reduction in the TAL trigger from 90% to 40.4%. This change will take effect at the beginning of the 2021 fishing year.

The Council will also encourage fishermen to use and provide information to the Bycatch Avoidance Network program to reduce excess catches of southern red hake (SMAST 2020).

The following figure summarizes the past, current, and proposed possession limit changes for southern red hake (Figure 1).

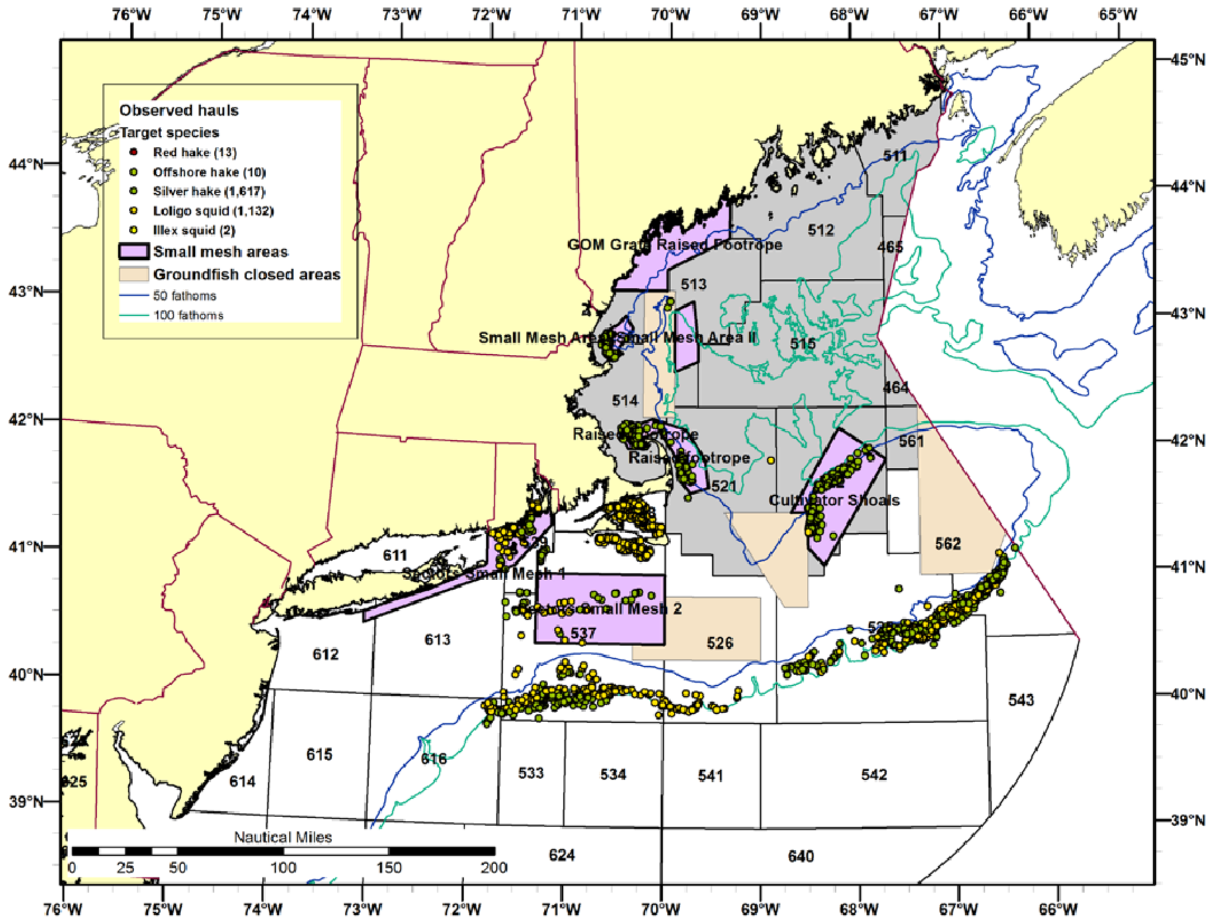
Figure 1. Annual specifications, catch estimates, and proportion discarded for southern red hake.



Vessels participating in any of the exemption areas must have a Northeast Multispecies limited access or open access category K permit and must have a letter of authorization from the Regional Administrator to fish in Cultivator Shoal and the Cape Cod. The Gulf of Maine Grate Raised Footrope Area has a possession limit of 7,500 lb., with a 2.5-inch minimum mesh size, and Cultivator Shoal has a possession limit of 30,000 lb., with a 3-inch minimum mesh size.

The red hake possession limit is 5,000 lb., regardless of area fished. Amendment 19 also implemented a 40,000 lb. possession limit for vessels fishing in the southern stock area.

Map 1. Location of small-mesh fishing during 2002-2013 and exemption areas. Vessels that belong to a groundfish sector may fish for small-mesh multispecies in the two shaded exemption area off NY, CT, and southern MA. The northern stock area is shaded grey, while the southern stock area is not shaded. The locations of groundfish closed areas shaded beige are shown for reference.



3.4 Goals and Objectives

The Council's objective is to manage fisheries catching red, silver, and offshore hake that maintain stock size at levels capable of sustaining Maximum Sustainable Yield (MSY) on a continuing basis. In addition to existing restrictions on fishing through exemption areas and seasons to minimize groundfish bycatch, other measures are intended to optimize size selectivity and keep landings from temporarily flooding limited markets. These measures include red hake possession limits. Amendment 19 established and specified catch and landings limits which are deemed to be sustainable, including accountability measures which either reduce the risk that catches will exceed the ACL or to account for those overages in later seasons if they do occur.

3.4.1 Overfishing Definitions

The following overfishing definitions were chosen by the Council in Amendment 12 (https://www.nefmc.org/library/amendment-12-2) and modified by the Council after they were re - evaluated in the 2010 benchmark assessment (NEFSC 2011).

3.4.1.1 Red Hake

Red hake is overfished when the three-year moving arithmetic average of the spring survey weight per tow is less than one half of the B_{MSY} proxy (i.e., below the biomass threshold), where the B_{MSY} proxy is defined as the average observed from 1980 – 2010. The current estimates of $B_{THRESHOLD}$ for the northern and southern stocks are 1.27 kg/tow and 0.51 kg/tow, respectively (Table 5).

Overfishing occurs when the ratio between catch and spring survey biomass for the northern and the southern stocks exceeds 0.163 kt/kg and 3.038 kt/kg, respectively, derived from AIM analyses from 1980-2009.

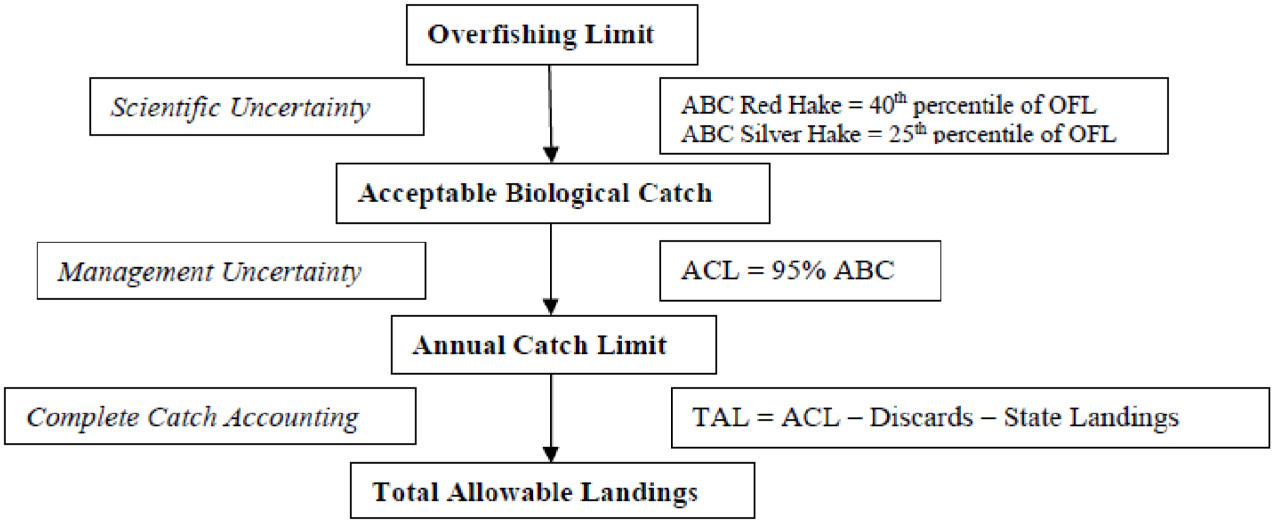
Table 5. Red hake overfishing definition reference points by management area.

Stock	Threshold	Target
Northern Red Hake	½ B_{MSY} Proxy (1.27kg/tow) F_{MSY} Proxy (0.163 kt/kg)	B_{MSY} Proxy (n/a) F_{MSY} Proxy (n/a)
Southern Red Hake	½ B_{MSY} Proxy (0.51 kg/tow) F_{MSY} Proxy (3.038 kt/kg)	B_{MSY} Proxy (n/a) F_{MSY} Proxy (n/a)

3.4.2 Formulas for Specifications

The process and formulae for developing specifications for red, silver, and offshore hake are described in §648.90(b). The regulations require an annual review and three-year adjustment cycle where the Council sets specifications for at least a three-year period, using best available science. The specifications for each stock include an overfishing limit (OFL), which is associated with maximum sustainable yield (MSY); an acceptable biological catch (ABC), which accounts for scientific uncertainty; an annual catch limits (ACLs) (ACL), which accounts for management uncertainty; and a total allowable landings (TAL) limit that accounts for discards and catch by state-only permitted vessels.

This ACL framework, including the OFLs and ABCs, is illustrated below:



The OFL is derived from the average exploitation rate during a period that is considered to represent conditions that generated MSY. Adopted in the last benchmark assessment (SAW 51, NEFSC 2011), these baseline reference periods were 1980-2009 for red hake and 1973-1982 for silver hake. These average exploitation rates derived from the assessments were applied to the most recent three-year moving average biomass estimates gives the OFL (in mt) that is consistent with current stock conditions.

Precision (or conversely, scientific uncertainty) is estimated and a level of precaution was selected in Amendment 19 to account for scientific uncertainty. For red hake, the 40th percentile of the distribution of scientific uncertainty estimates was chosen as an appropriate level of precaution. For silver hake, a more conservative 25th percentile was chosen. This buffer between the OFL and ABC will vary with the degree of scientific uncertainty (getting smaller with greater amounts of precision in the estimates). In Amendment 19, the Council also chose a 5% buffer to account for management uncertainty to set the ACL. A three-year average discard rate (discards/catch) is applied for each stock to set the TAL, after deducting an assumed 3% catch for state-only permitted vessels.

Details about the estimation procedures and values derived from the latest stock assessment are given in the SAFE Report for the 2013 fishing year (NEFMC 2014).

4.0 ALTERNATIVES UNDER CONSIDERATION

The Council considered the alternatives described below in Sections 4.1 and 4.2. It did consider one other alternative on measures to reduce bycatch (described in Section 4.3) but this was rejected by the Council.

4.1 Action 1 – Rebuilding

The current status of southern red hake based on the most recent operational assessment update in 2017 (determining exploitation rate and overfishing status using NEFSC spring survey data through 2017 and catch data through calendar year 2016) and 2019 biomass update (determining biomass level and overfished status using survey data through spring 2019) is given in Section 5.2.2. At the time of the 2019 biomass update, the three-year mean of the spring biomass index was 0.38 kg/tow (74% of the overfished threshold of 0.51 kg/tow and 38% of the biomass target of 1.01 kg/tow.

Southern red hake have been assessed using the AIM ("An Index Method") model. This model estimates the relationship between the time series of relative stock abundance from the spring index using a three-year moving average catch data. The relative fishing mortality (defined as kt, or thousand tons, of catch divided by the stratified mean weight per tow) and recent three-year moving average of the spring survey stratified mean weight per tow are both compared to a 1980-2010 baseline (serving as a proxy for MSY). The Overfishing Limit (OFL) is determined by applying the Fmsy proxy to the recent three-year average of the survey biomass index. There is not a forecasting method for this model and the relationship between spawning and recruitment is unknown, hence it is impossible to directly estimate rebuilding potential.

The 2017 Northern and Southern Silver Hake and Red Hake Stock Assessment Update Report (http://doi.org/10.7289/V5/RD-NEFSC-18-02) determined that the southern red hake biomass was below the threshold (0.51 Kg/tow). Thus, in January 2018, NOAA Fisheries determined that the southern red hake stock was overfished and notified (https://www.fisheries.noaa.gov/species/red-hake) the Council that southern red hake was overfished, giving the Council two years to develop a rebuilding plan. This action would address that requirement.

In the meantime, 2018-2020 specifications were determined with the updated biomass index and the annual catch limit (ACL) was reduced by 38%. Those specifications were intended to address overfishing. The Annual Monitoring Report for fishing year 2018 (https://s3.amazonaws.com/nefmc.org/Annual-Monitoring-Report-for-Fishing-Year-2018_web.pdf) determined that catches exceeded the ACL by 49.6% and that overfishing was occurring. This event triggered the post-season accountability measure that causes a reduction in the possession limit from 5,000 lb. to 400 lb. earlier in the season when landings exceed the total allowable landings (TAL) trigger.

As of fishing year 2018, stock biomass (using a three-year moving average) is 38% percent of the target (0.38 kg/tow divided by 1.01 kg/tow proxy for B_{msy}). The biomass index increased from 0.25 kg/tow in 2018 to 0.65 kg/tow in 2019. This increase appears partially due to an above average year class first observed in the 2019 spring survey but may also be partially attributable to interannual survey variability (changes in catchability and availability to the survey – the Federal survey does not sample shallow coastal water where red hake partially inhabit).

Rationale for the Proposed Alternatives

Without a method to estimate rebuilding potential, it is not possible to determine whether or not southern red hake can rebuild to the target in 10 years or less when F=0. Thus, other factors must be considered to determine a range of rebuilding timeline (i.e. T_{min}, T_{target}, and T_{max}). While reviewing approaches for groundfish stock rebuilding for stocks that did not have a method for stock projections to evaluate rebuilding potential, the Council's SSC said that they "did not prefer setting arbitrary rebuilding dates but noted that there is some procedural value in having a timeline, and they felt that there were some mechanisms that could be used to set a timeline that would be less arbitrary and could be customized to the species being investigated."

During 2006-2011, stock biomass increased from 0.30 kg/tow (three-year moving average) to 1.38 kg/tow, which is within the range observed in recent biomass and target levels (Figure 3). During this period, the relative exploitation rate, was below the maximum proxy fishing mortality threshold by a substantial amount, but the fishery continued to catch and retain southern red hake. Recruitment during this period was not exceptionally high, but there may have been some immigration of red hake from the northern stock that could have contributed to the increase in biomass (Ashford, et al., unpublished). Thus, the PDT determined that it is possible to rebuild southern red hake biomass from current levels in as little as 5 years.

Although no direct method for estimating a mean generation time is available and the recruit survival has not been estimated, some estimates of life-history parameters and reasonable assumptions may be applied to estimate a mean generation time. This estimate of mean generation time is described in Section 5.2.3. It is used here to specify a maximum time to rebuild, equivalent to the estimate of two generation times, or about 10 years.

4.1.1 Alternative 1 - No Action/Status Quo

No Action would not specify a rebuilding schedule and would retain the maximum fishing mortality level at F_{MSY}, subject to scientific and management uncertainty buffers. Scientific uncertainty varies and is estimated based on the joint probability distribution in the proxy fishing reference point and the three-year average NEFSC spring survey stratified mean weight per tow. This scientific uncertainty estimate applies to the overfishing limit (OFL) to derive the acceptable biological catch (ABC). A five percent uncertainty buffer is applied to the annual catch limit (ACL) which is a function of the ABC. The TAL is derived from the OFL, accounting for scientific and management uncertainty buffers, estimated discards, and reported state water catches (NEFMC 2018b).

Table 6. Status quo southern red hake specifications for 2018-2020 fishing years.

Specification[2]	Catch limit (mt)	Percent
OFL	1,150	100% of MFMT
ABC	1,060	92% of OFL
ACL	1,007	95% of ABC
TAL	305	70% of ACL

Although measures to rebuild southern red hake could be chosen without specifying a rebuilding schedule, it would not allow for a determination of whether adequate progress was being made to rebuild the stock consistent with the rebuilding schedule.

Rationale: This alternative will allow the stock to equilibrate at a level that is consistent with current southern red hake productivity, while achieving MSY, and the March 2020 research track assessment states that fishing is unlikely to be the primary driver of changes in stock biomass (NEFSC 2020a). No formal estimate of a mean generation time is available because the fecundity at age and an SSB/R relationship has not been estimated and the gaps in age data could be a limiting factor. Thus, given the uncertainty in stock productivity and that fishing is not a primary driver of changes in biomass, a rebuilding schedule is not possible to estimate.

4.1.2 Alternative 2 – Rebuilding Estimates and Maximum Mortality

Rebuilding would be expected to be achieved within 5 to 10 years with a target rebuilding schedule of 7 years. The mean generation time '1G' is the estimated time that it would take for a female red hake to replace itself and one male with a breeding pair in a successive generation.

- T_{min} – 5 years (based on previously observed biomass increases)
- T_{target} – 7 years
- T_{max} – 10 years (~2G)

[2] OFL = Overfishing limit, derived from the proxy for F_{MSY}, which serves as the maximum fishing mortality threshold.

ABC = Allowable Biologic Catch, accounting for scientific uncertainty in the OFL. For southern red hake, this is set based on a probability of overfishing that is equal to 40% (P*=40)

ACL = Annual Catch Limit, accounting for a 5% management uncertainty buffer.

TAL = Total Allowable Landings, accounting for the estimated proportion of catch that is landed vs. discarded.

Rationale**:** The proposed rebuilding schedule is a range from a minimum associated with a similar increase in biomass that occurred during 2006-2011 to a longer duration that accounts for biological characteristics of red hake. Lacking an analytical or forecast model for southern red hake, the Council cannot say that this rebuilding plan has a 50% chance of rebuilding in five years, or some other probability. It is a relatively short period, approximating one generation timespan, so it is expected that rebuilding can be achieved in T_{min} with a low to medium probability.

Southern red hake are fully mature on average at age 3 and the maximum age observed in 2011-2019 survey data is 10 years. By applying the estimated maturation rate and using biomass at age as a guide, assuming that M=0.4 (used for the March 2020 research track assessment, NEFSC 2020a) and making reasonable assumptions that fecundity (increases by 5% per year after age 3) and egg viability (full viability at age 5) increase with age, the Whiting PDT estimated that 50% of lifetime egg production of an unfished female population occurs at 4.4 years. By definition, it would take 50% of a female's egg production to exactly replace itself and its mate with progeny that would spawn a successive generation (Table 10 and Table 11). It would be reasonable to expect a higher level of confidence that southern red hake can rebuild in approximately two generations, thus T_{max} of 10 years is proposed. T_{target} is approximately half of T_{min} and T_{max}.

4.1.2.1 Option A – 75% of the Overfishing Limit or F_{MSY} Proxy *(Preferred Alternative)*

This alternative would reduce the ABC to 75% of the overfishing limit or F_{MSY} proxy for the duration of the rebuilding period or until the southern red hake biomass reaches the B_{MSY} target (currently estimated to be 1.01 kg/tow), whichever happens first.

Table 7. Status quo southern red hake specifications adjusted for reducing the ABC to 75% of the OFL or F_{MSY} proxy.

Specification	Catch limit (mt)	Percent
OFL	1,150	100% of MFMT
ABC	863	75% of OFL
ACL	819	95% of ABC
TAL	248	70% of ACL

Rationale: This maximum catch level would be substantially less than the existing ACL but would be similar to the levels chosen to promote rebuilding of certain groundfish stocks that were overfished (Table 7). This level approximates the exploitation rate that was estimated for the 2006-2011 period when southern red hake biomass increased from approximately current levels to the target (assuming that it had applied at the time before the present overfishing definition was approved).

4.1.2.2 Option B – 50% of the Overfishing Limit or F_{MSY} Proxy

This alternative would reduce the ABC to 50% of the F_{MSY} proxy for the duration of the rebuilding period or until the southern red hake biomass reaches the B_{MSY} target (currently estimated to be 1.01 kg/tow), whichever happens first (Table 8).

Table 8. Status quo southern red hake specifications adjusted for reducing the ABC to 50% of the OFL or F_{MSY} proxy.

Specification	Catch limit (mt)	Percent
OFL	1,150	100% of MFMT
ABC	575	50% of OFL
ACL	546	95% of ABC
TAL	165	70% of ACL

Rationale: This maximum catch level would be expected to promote rebuilding at a faster rate than Alternative 1 and Alternative 2A and have less uncertainty in achieving the rebuilding objective.

4.2 Action 2 – Management Alternatives – Possession Limits

4.2.1 Alternative 1 – No Action

Under Alternative 1 (No Action), the 5,000 lb. possession limit would be maintained but would also apply a 40.4% post-season AM. The first application of the reduced TAL trigger will be in the 2021 fishing year. When landings exceed this trigger, the southern red hake possession limit is automatically reduced from 5,000 lb. to 400 lb.

***Rationale*:** In FY2018, catches of southern red hake exceeded the ACL by 49.6%, which triggers the post-season AM adjustment in a future fishing year that would reduce the possession limit adjustments trigger from 90% of the TAL to 40.4%. This reduction in post-AM was intended to reduce the incentive to target southern red hake and increase the incentive to avoid the catching red hake and discarding. Red hake is however a non-target species for the majority of the small-mesh fishing trips. The AM in this alternative along with a 3,000 lb./1,500 lb. tiered possession limit allowed northern red hake rebuilding in 2014/2015. Other factors such as a very large 2014-year class and some targeting of red hake in the northern area should however be considered in whether No Action would be effective in the southern management area.

This alternative could result in a TAL trigger to 400 lb. possession limit earlier in the fishing year relative to the status quo alternative. However, this alternative could result in a change in fishing behavior to avoid catching southern red hake. This AM will become effective in 2021, due to the catch exceeding the FY2018 ACL (NEFMC 2018a). This reduced AM remains in effect henceforth in future fishing years, but it may be revised by the Council if the fishery is not fully utilizing the resource, i.e. catches are well below the ACL determined by the alternatives in Section 4.1. During 2018, this alternative would have affected 6.2% of trips that landed southern red hake.

4.2.2 Alternative 2 – Status Quo

Under Alternative 2, the FY2018 fishing regulations would be in place which include a 5,000 lb. possession limit and AMs in place that reduce the southern red hake possession limit to 400 lb. when landings reach 90% of the TAL.

***Rationale*:** Alternative 2 would not incorporate the fishery performance and accountability measures that were triggered by catch exceeding the ACL for FY2018 by 49.6% but would maintain the regulations as set forth in the 2018-2020 specifications when landings reach 90% of the TAL. These possession limits were in effect when the stock became overfished and is included for comparison with the expected impacts of other possession limit alternatives. During 2018, this alternative would have affected 1.2% of trips that landed southern red hake.

4.2.3 Alternative 3 – Year-Round Possession Limits for All Gear and Fisheries

The following alternatives would reduce the southern red hake possession limit year around, unless an in-season AM is in place which would reduce the possession limit to 400 lb. when the landings meet or exceed the TAL trigger at 40.4% of the ACL, impacting Option C or D. The following possession limits would apply to any vessel fishing in the southern management area or transiting the southern management area without properly stowing fishing gear according to existing regulations with respect to stowage.

4.2.3.1 Option A – 0 lb. Possession Limit

A year-round possession limit of 0 lb. would ban landings of southern red hake for all gears and fisheries. The in-season AM would still be in effect but would have no effect with a 0 lb. possession limit.

***Rationale*:** Option A represents the maximum possession limit reduction to potentially reduce total southern red hake catch. This option would affect any trip that would otherwise land southern red hake. Relative to other options in this alternative, it would cause the maximum reduction in landings and highest cost option relative to other alternatives. During 2018, this alternative would have affected 100% of trips that landed southern red hake.

4.2.3.2 Option B – 400 lb. Possession Limit

A year-round possession limit of 400 lb. would restrict landings of southern red hake for all gears and fisheries. This alternative would maintain the 400 lb. possession limit but throughout the fishing year even if the in-season AM occurred, because the 400 lb. possession limit is the same amount as the in-season AM.

***Rationale*:** This limit was chosen by the Council in Amendment 19 to represent a level consistent with unavoidable incidental catch in the whiting fishery. The limit also accommodates most catches on trips using large-mesh trawls and other gears.

Option B is equivalent to the incidental catch limit that the Council chose in Amendment 19 for an in-season accountability measure that represents a level consistent with unavoidable bycatch. During 2018, this alternative would have affected 9.6% of trips that landed southern red hake.

4.2.3.3 Option C – 600 lb. Possession Limit

A year-round possession limit of 600 lb. would restrict landings of southern red hake for all gears and fisheries. When the landings meet or exceed the TAL trigger, the in-season AM would also reduce the possession limit from 600 lb. to 400 lb.

***Rationale*:** Option C would cause less discarding than Options A and B but might not be as effective as reducing southern red hake catch. During 2018, this alternative would have affected 7.3% of trips that landed southern red hake.

4.2.3.4 Option D – 1,000 lb. Possession Limit

A year-round possession limit of 1,000 lb. would restrict landings of southern red hake for all gear and fisheries. When the landings meet or exceed the TAL trigger, the in-season AM would also reduce the possession limit from 1,000 lb. to 400 lb.

***Rationale*:** Option D would cause less discarding than Options A, B, and C but might not be as effective at reducing southern red hake catch. Relative to other options in this alternative, it would cause the minimum reduction in landings and lowest cost option relative to other alternatives. During 2018, this alternative would have affected 6.6% of trips that landed southern red hake.

4.2.4 Alternative 4 – Dual 1,000 lb./600 lb. Year-Round Possession Limit for All Fisheries *(Preferred Alternative)*

This alternative would reduce the southern red hake possession limit year around, unless an in-season AM is put in place which would reduce the possession limit to 400 lb. when the landings meet or exceed the TAL trigger at 40.4% of the ACL. The following possession limits would apply to any vessel fishing in the southern management area or transiting the southern management area without properly stowing fishing gear according to existing regulations with respect to stowage.

Alternative 4 would establish a year-round possession limit of 600 lb. for trips using standard small-mesh trawls, less than 5.5 inches square or diamond mesh. Other trips using large-mesh trawls, trips using small-mesh selective trawls, and trips using gears other than trawls would have a 1,000 lb. red hake possession limit while fishing in the southern management area. Selective small-mesh trawl gears include raised footrope trawls, large-mesh belly panel trawls, rope trawls, and other selective gears deemed by the Regional Administrator to adequately reduce the catch of red hake.

***Rationale*:** Like Alternative 3, Alternative 4 is intended to reduce landings and catch by lowering the possession limit from 5,000 lb. to 1,000 lb. or less depending on the type of gear in use. It is also intended to incentivize fishermen to use gear and gear configurations that reduce the catch of red hake (i.e., by using more selective gears). During 2018, this alternative would have affected 7.3% of trips that landed southern red hake.

4.3 Considered but Rejected Alternative

4.3.1 Measures to Reduce Bycatch

Various measures could be used improve selectivity of the fishery and reduce bycatch of southern red hake. Potential measures could apply to the whiting fishery, to other small-mesh trawl fisheries, and other fisheries that catch southern red hake. These measures could include seasonal area closures, requiring more selective gears, or restrictions on how and when vessels may fish (e.g. prohibit fishing hours at certain times of day, prohibit fishing in specific depths, or identify “move-on” procedures when high bycatch is encountered).

***Rationale*:** Analysis of observer data has not yet identified specific hotspots, types of gear, or ways of fishing that are potentially viable methods to reduce red hake bycatch. Some ‘selective’ gears exist, but they mainly appear to reduce catches of ‘flatfish’ (i.e. flounders, skates, and monkfish), rather than roundfish (such as red hake). Some of these potential methods may reduce the catches of target species as much as the red hake catch is reduced. Fishermen would likely compensate by fishing for a longer period, reducing the intended effectiveness of the measure. More detailed analysis of observer data and/or gear experiments are needed to identify a viable method to reduce red hake bycatch.

5.0 AFFECTED ENVIRONMENT

5.1 INTRODUCTION

The Affected Environment is described in this action based on valued ecosystem components (VECs), including target species, non-target species, physical environment and Essential Fish Habitat (EFH), protected resources, and human communities. VECs represent the resources, areas and human communities that may be affected by the alternatives under consideration in this amendment. VECs are the focus since they are the "place" where the impacts of management actions occur.

5.2 TARGET SPECIES (RED HAKE)

Red hake is considered the target species in this action because the proposed action only proposes management changes to this species and not all of the whiting species. Therefore, the silver hake and offshore hake species are included under Section 5.3 Non-Target species.

5.2.1 Species Distribution

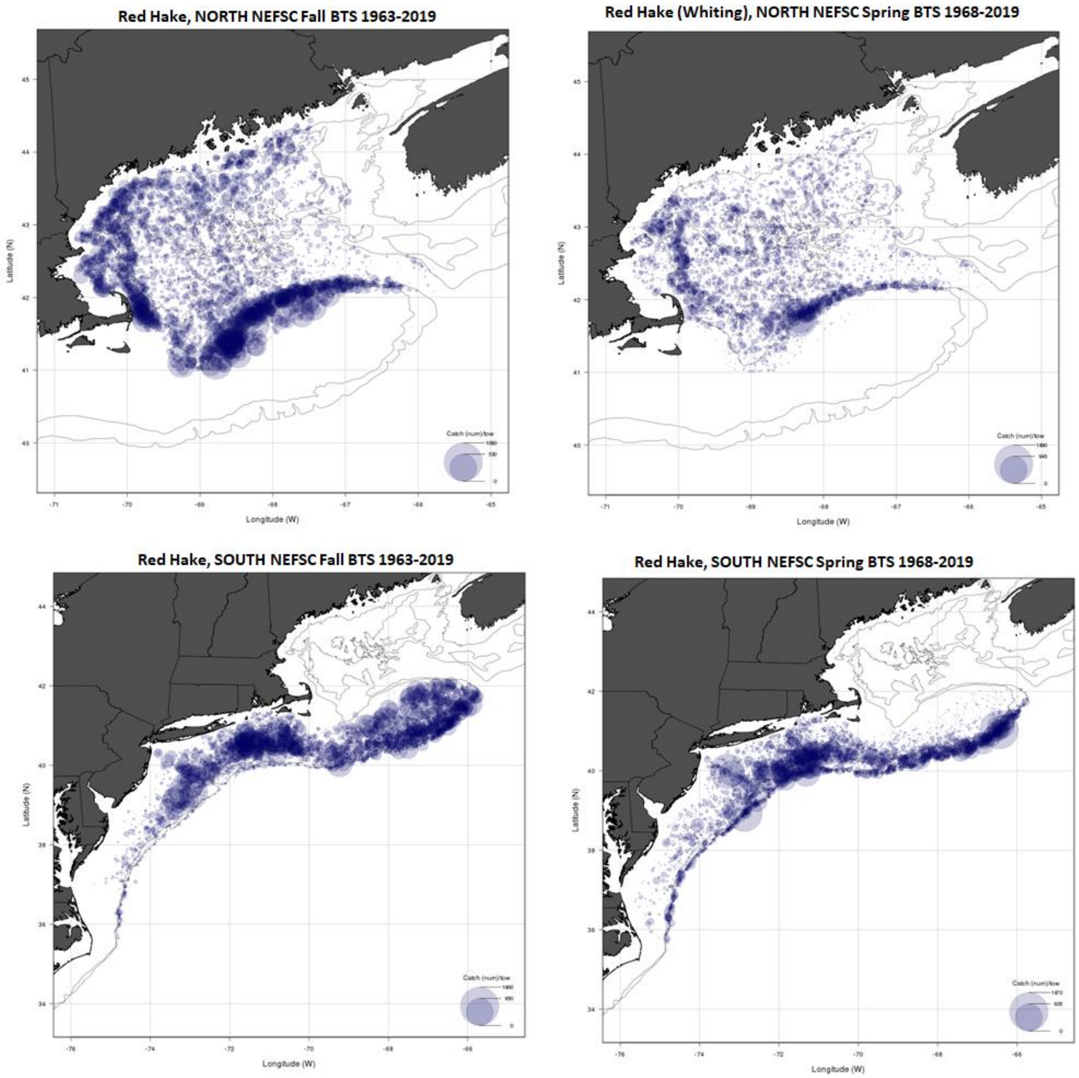
5.2.1.1 Red Hake

Red hake, *Urophycis chuss*, is a demersal gadoid species distributed from the Gulf of St. Lawrence to North Carolina and are most abundant from the western Gulf of Maine through Southern New England waters. Red hake are separated into northern and southern stocks for management purposes. The northern stock is defined as the Gulf of Maine to Northern Georges Bank region, while the southern stock is defined as the Southern Georges Bank to Mid-Atlantic Bight region (Figure 2). Survey distributions indicate that there are higher concentrations of red hake by catch weight (kg) during the NEFSC spring surveys than the NEFSC fall surveys. Less red hake are caught in the middle of Georges Bank in the spring than the fall. They tended to be more in the Gulf of Maine and along the shelf, than in the middle of the bank in the spring (Figure 2).

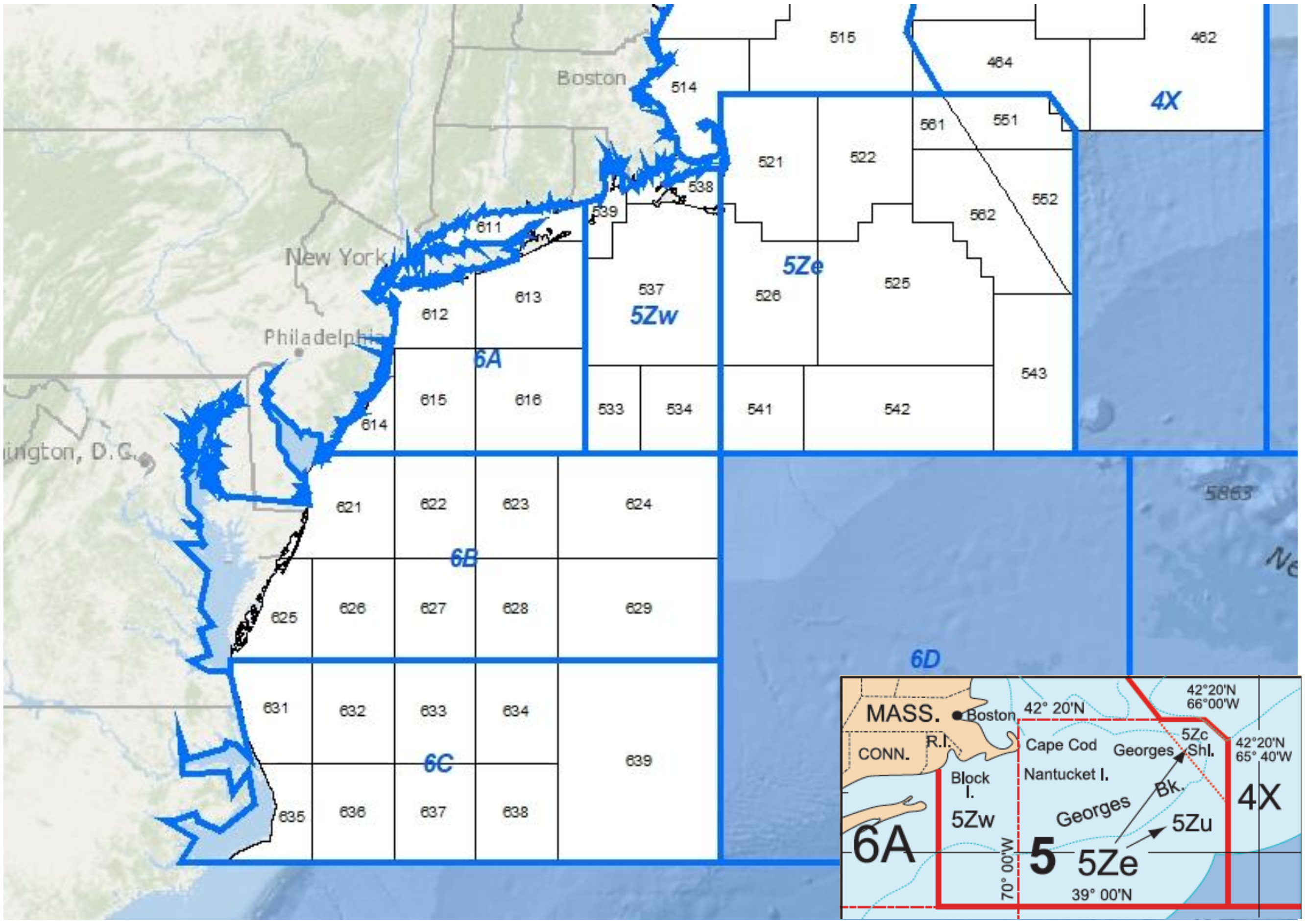
Red hake migrate seasonally, preferring temperatures between 5 and 12° C (41-54° F) (Grosslein and Azarovitz 1982). During the spring and summer months, red hake move into shallower waters to spawn, then move offshore to deep waters in the Gulf of Maine and the edge of the continental shelf along Southern New England and Georges Bank in the winter. Spawning occurs from May through November, with primary spawning grounds on the southwest part of Georges Bank and in the Southern New England area off Montauk Point, Long Island (Colton and Temple 1961).

Red hake prefer soft sand or muddy bottom, and feed primarily on crustaceans such as euphausiids, decapods, and rock crabs as well as fish such as haddock, goosefish, and silver hake (Rountree 1999). As juveniles, red hake seek shelter from predators in scallop beds, and are commonly found in the mantle cavities of (or underneath) sea scallops. In the fall, red hake likely leave the safety of the scallop beds due to their increasing size and to seek warmer temperatures in offshore waters (Steiner et al. 1982)., goosefish, and silver hake (Rountree 1999). As juveniles, red hake seek shelter from predators in scallop beds, and are commonly found in the mantle cavities of (or underneath) sea scallops. In the fall, red hake likely leave the safety of the scallop beds due to their increasing size and to seek warmer temperatures in offshore waters (Steiner et al. 1982).

Figure 2. Fall (left) and spring (right) survey distribution of red hake in the northern stock (Top) and southern stock (Bottom) from the NEFSC bottom trawl surveys, 1963-2019. Spring 2020 is missing due impacts from COVID-19.



Map 2. Fishery statistical zones and NAFO convention sub-divisions.



Note: Blue labels indicate fishery statistical zones and black labels indicate NAFO convention areas including sub-divisions. The insert of 5Ze includes the US portion of the stat area, 5Zu.

Source: Northwest Atlantic Fisheries Organization.

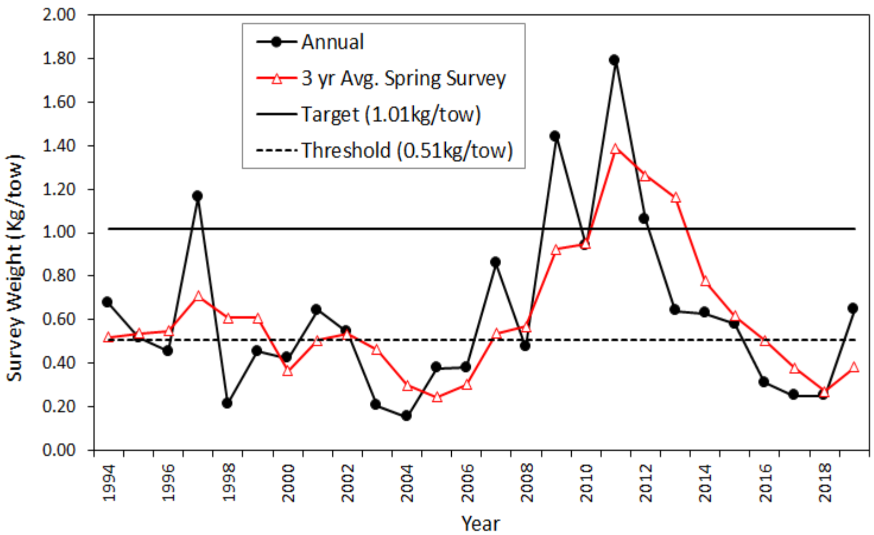
5.2.2 Stock Status (Southern Red Hake)

An update assessment (NEFSC 2017) was performed by the Northeast Fisheries Science Center (NEFSC). This assessment followed the same procedures that were applied in the benchmark assessment using new survey data and catch estimates. Also, scientific uncertainty in these estimates were estimated and the full range of potential ABC values as well as probability of overfishing (ABC>OFL) which was presented to the Scientific and Statistical Committee (SSC) on October 12, 2017 (https://www.nefmc.org/calendar/oct-12-2017-ssc-meeting). These estimates included the ABC at the 40th percentile for red hake, separately for the northern and southern management areas.

The updated survey biomass for southern red hake included survey data from the NEFSC spring bottom trawl survey through 2019, commercial fishing data from vessel trip reports, dealer landings, and on-board fishery observer data through 2018(Figure 3). In the absence of an analytical assessment for red hake, the biological references point for the southern stock is described and specified in the overfishing definition (Section 3.4.1).

The three-year arithmetic mean biomass index (Table 9, Figure 3), based on the NEFSC spring bottom trawl survey for 2017-2019 (0.38 kg/tow) was below both the management threshold (0.51 kg/tow) and the target (1.01 kg/tow). The exploitation index (catch divided by biomass index) for 2018 (7.06 kt/kg) was above the threshold (3.04 kt/kg). Assessment data through 2016 indicated that southern red hake is overfished.

Figure 3. Updated survey biomass trend (stratified mean weight per tow in FSV Albatross units) (TOP) and relative exploitation ratios (BOTTOM) for southern red hake, compared to biological reference points. The horizontal dash line represents the biomass threshold and the solid horizontal line is the biomass target.



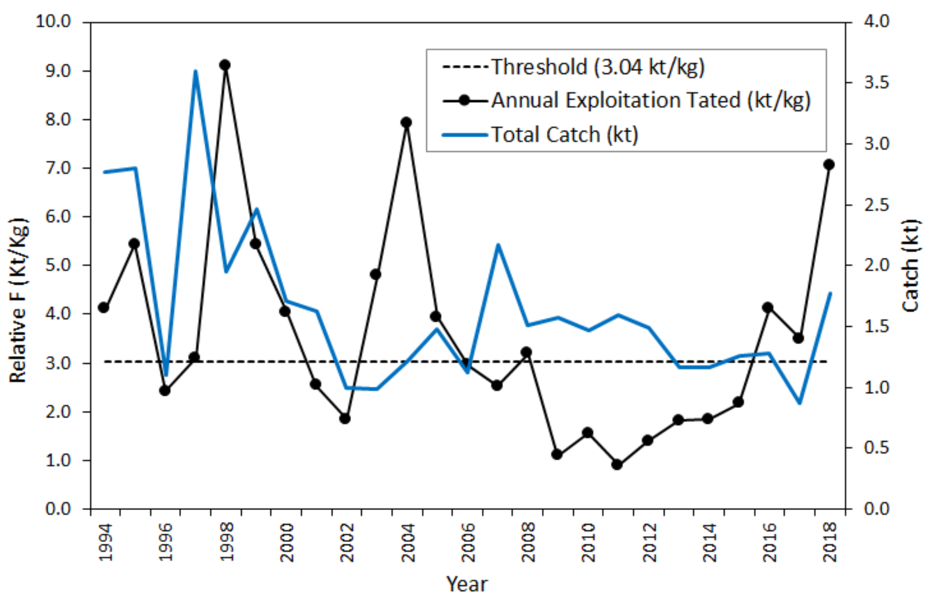
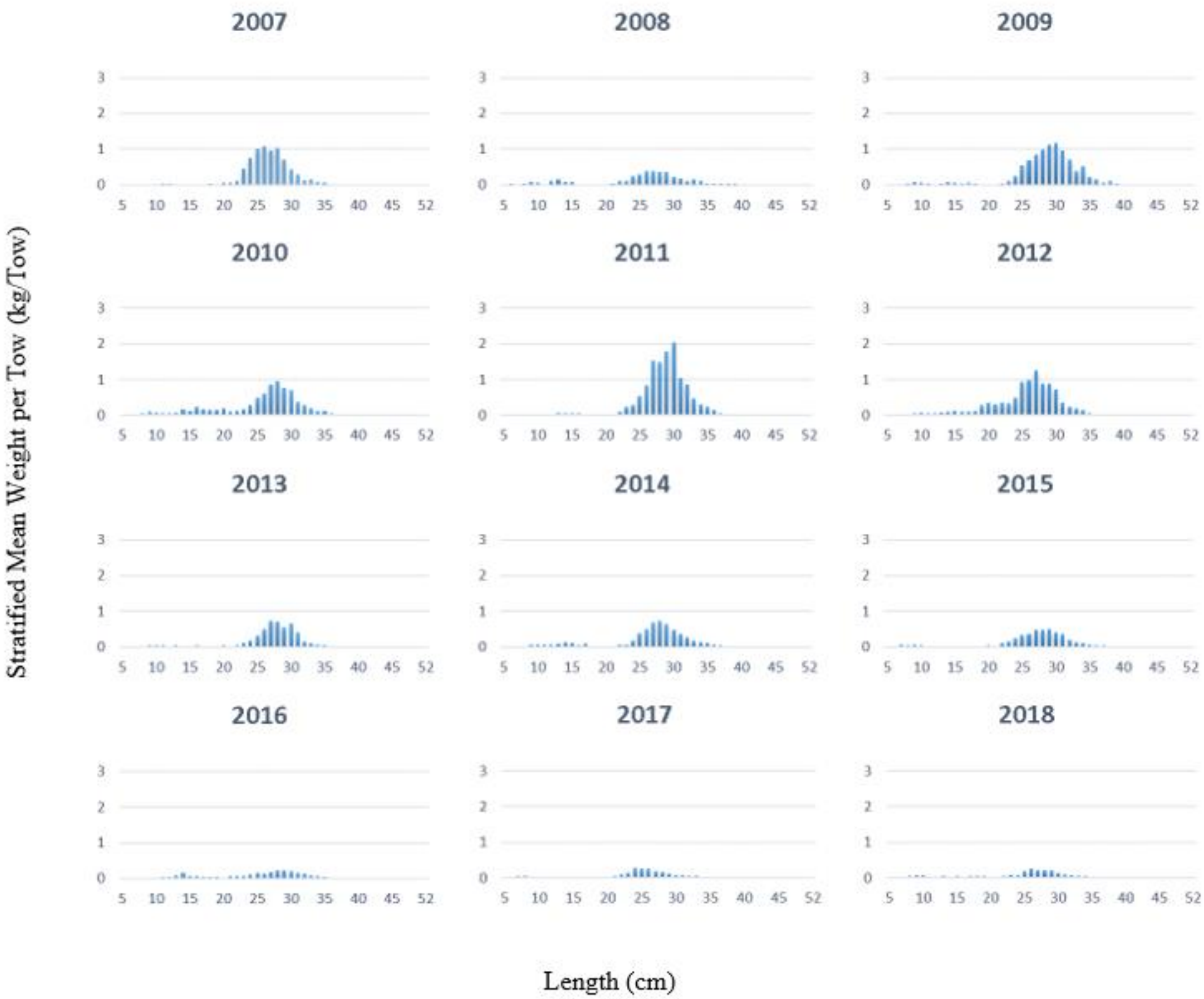


Table 9. Southern red hake NEFSC spring survey biomass in Albatross units (kg/tow), total catch (Kt) and exploitation index (Kt/kg) from 1968-2019.

Year	NEFSC Spring Survey (kg/tow)	3-yr Mean NEFSC Spring Survey (Kg/tow)	Total Catch (000's mt/Kt)	Exploitation Index (catch/Spring Survey) - Kt/Kg
1994	0.68	0.52	2.77	4.11
1995	0.52	0.54	2.80	5.43
1996	0.45	0.55	1.10	2.43
1997	1.16	0.71	3.59	3.10
1998	0.21	0.61	1.95	9.10
1999	0.46	0.61	2.46	5.42
2000	0.42	0.36	1.71	4.04
2001	0.64	0.51	1.63	2.54
2002	0.54	0.54	1.00	1.85
2003	0.21	0.46	0.99	4.79
2004	0.15	0.30	1.22	7.92
2005	0.38	0.25	1.48	3.94
2006	0.38	0.30	1.13	2.96
2007	0.86	0.54	2.17	2.53
2008	0.47	0.57	1.51	3.19
2009	1.44	0.92	1.58	1.10
2010	0.94	0.95	1.47	1.56
2011	1.79	1.39	1.60	0.89
2012	1.06	1.26	1.49	1.40
2013	0.64	1.16	1.16	1.82
2014	0.63	0.78	1.16	1.85
2015	0.58	0.62	1.26	2.17
2016	0.31	0.51	1.28	4.13
2017	0.25	0.38	0.88	3.50
2018	0.25	0.27	1.77	7.06
2019	0.65	0.38	NA	NA

Figure 4. Southern red hake NEFSC spring survey size distribution in stratified mean numbers per tow (Albatross units) from 2007-2018.



5.2.3 Productivity and Mean Generation Time Estimate for Southern Red Hake

Stock forecasting models are not available for red hake and it is therefore not possible to estimate changes in biomass (and its uncertainty) at various levels of future fishing mortality and catch. Thus, it is important to estimate the fecundity of southern red hake and the time it would take for a female spawner to replace itself with another female spawner and a male partner. This estimate could be used as a proxy to evaluate a reasonable period for rebuilding to a target biomass level based on a fraction or multiple of a mean generation.

The mean generation for southern red hake is estimated using published estimates of growth and maturity at age, coupled with accepted assumptions of natural mortality and reasonable assumptions about egg viability at age and fecundity at age (as a proportion of female average weight at age). As explained below, a mean generation time for southern red hake is 4.4 years to replace the mating pair with another mating pair when fishing mortality is zero, i.e. survival is calculated from the assumed natural mortality rate (Table 10). A few sensitivity analyses were used to evaluate the effect of the assumptions on the estimate.

Maturity (the proportion of female fish that are ripe, ripening, or spent) was estimated by O'Brien et. al. (1993). Biomass, or weight per female fish, was estimated as the mean weight of red hake at age that were aged and collected in the NEFSC spring bottom trawl survey from 2011-2019. Adult survival is the proportion of fish at age 1 that survive to subsequent ages, using a natural mortality rate of 0.4 which was used in the recent research track assessment (NEFSC 2020). As a sensitivity analysis, we change the natural mortality rate to 0.2 (a rate that is also assumed for other stocks), which effectively extends the assumed life in the absence of fishing and the age when 50% of lifetime egg production occurs increases to 5.5 years (Table 11). Fecundity (the number of eggs produced by a spawning female) is assumed to increase as a function of female weight at age, but here we assume that over age 3, fecundity increases at a greater rate than biomass. We assume that this relationship increased by five percent each year of life. Although this is a reasonable assumption, a sensitivity analysis shows that the result is not very sensitive to this assumption, the age at which 50% of lifetime egg production occurs declines from 4.4 to 4.2 years. For many fish species, eggs produced by young fish are not as viable as they are for older fish (Heinimaa and Heinimaa 2004). Egg energy content in younger fish are less than they are in older fish (Heinimaa and Heinimaa 2004), implying that this reduced source of nutrition makes larvae less viable before they begin feeding. Thus, for this estimation, we assume that viability of eggs produced by an age 2 female are 20% of the viability of age 5+ fish, 50% for age 3 and 80% for age 4. There is no information about the values that are appropriate for red hake or even that viability of red hake eggs declines for younger spawning red hake. As a sensitivity analysis, we assume that eggs produced by any age female are equally viable. This would increase the production of viable offspring at younger ages, increasing total lifetime egg production, but also reducing the age at which a female has produced 50% of her lifetime egg production. If all eggs are equally viable regardless of the age of the spawner, it would reduce when 50% of lifetime egg production to 3.4 years.

Table 10. Calculation of the age at which a female southern red hake produces 50% of lifetime egg production, a proxy for a mean generation time for a mating pair to replace itself with a mating pair in a subsequent generation.

Age	Maturity	Biomass (mean weight of fish at age)	Adult survival	Fecundity (biomass multiplier)	Egg viability factor	Surviving recruits	Cumulative	Percent of total lifetime fecundity (cumulative percent)	Age @ 50% (interpolated value)
(A)	(B)	(C)	(D)	(E)	(F)	(G)=B*C*D*	(H)=∑G		
1	0.04	19.35	1.00	1.00	-	-	-	0	
2	0.75	26.78	0.67	1.00	0.20	2.69	2.69	0.06	
3	0.99	31.38	0.45	1.00	0.50	6.98	9.67	0.22	
4	1.00	34.13	0.30	1.05	0.80	8.63	18.31	0.42	
5	1.00	35.94	0.20	1.10	1.00	7.98	26.29	0.61	4.41
6	1.00	37.24	0.14	1.15	1.00	5.80	32.08	0.74	
7	1.00	40.06	0.09	1.20	1.00	4.36	36.44	0.85	
8	1.00	41.70	0.06	1.25	1.00	3.17	39.61	0.92	
9	1.00	39.00	0.04	1.30	1.00	2.07	41.68	0.97	
10	1.00	39.00	0.03	1.351	1.00	1.44	43.12	1.00	

Table 11. Sensitivity to assumption analysis.

Factor	Assumption	Age @ 50% lifetime fecundity
M=0.4	0.4	4.41
Fecundity	All ages = 1	4.22
Egg viability	All ages = 1	3.38
M=0.2	0.2	5.47

5.3 NON-TARGET SPECIES

5.3.1 Species Distribution (Other Whiting Species)

5.3.1.1 Silver Hake

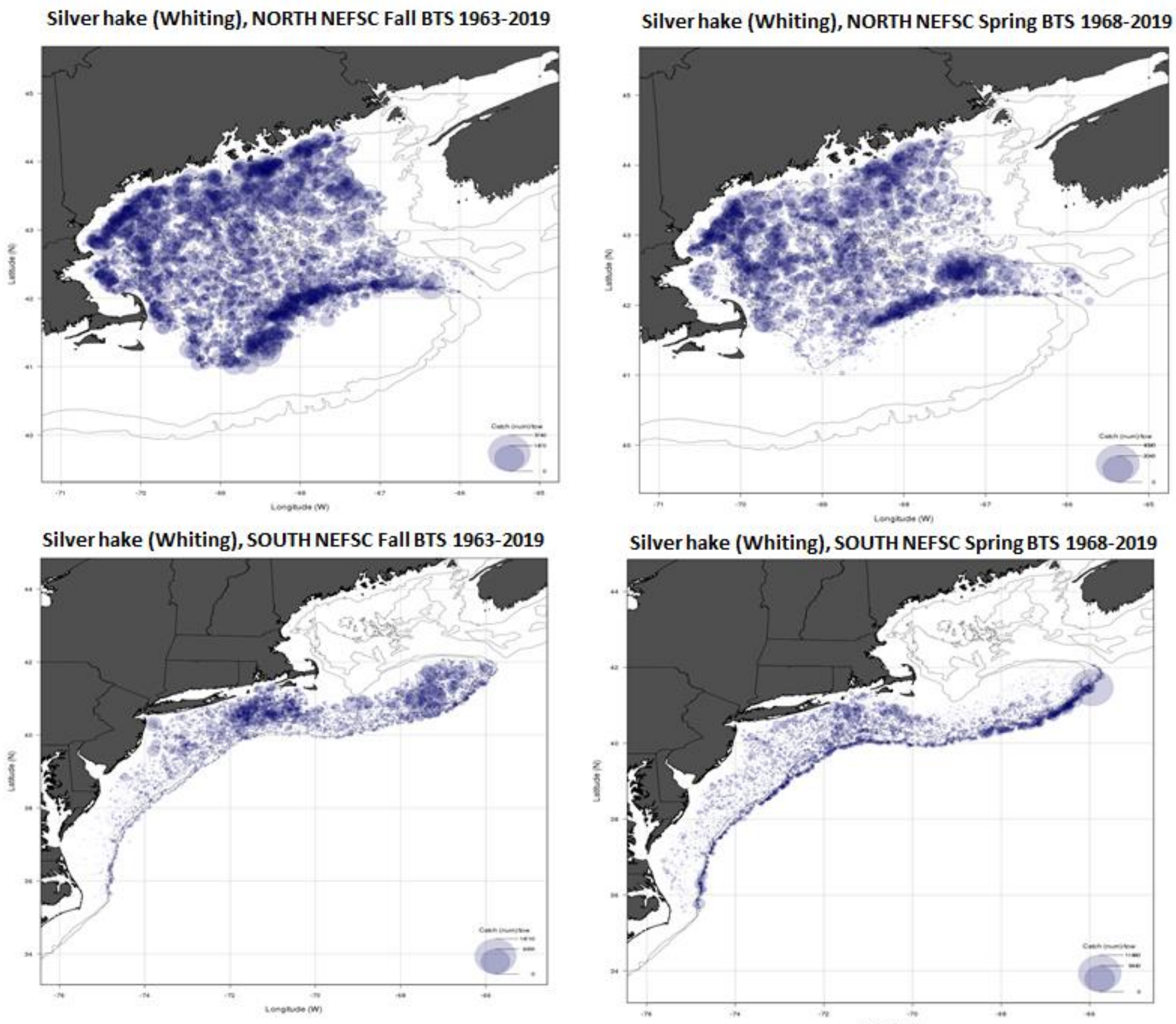
Silver hake, *Merluccius bilinearis*, also known as whiting, range from the Grand Banks of Southern Newfoundland to South Carolina (Brodziak et al. 2001, Lock and Packer 2004). In U.S. waters, two subpopulations of silver hake are assumed to exist within the EEZ based on body and otolith morphometrics (Conover et al. 1967, Almeida 1987, Bolles and Begg 2000) and otolith growth differences and seasonal pattern of distribution (Lock and Packer 2004). Both stocks are not overfished and overfishing is not occurring for either stocks. The northern silver hake stock inhabits the Gulf of Maine to Northern Georges Bank waters, while the southern silver hake stock inhabits Southern Georges Bank to the Mid Atlantic Bight waters (Figure 5). However, Bolles and Begg (2000) reported some mixing of silver hake due to their wide migratory patterns, but the degree of mixing among the management areas is unknown. A re-evaluation of stock structure in the last silver hake benchmark assessment, based on trends in adult biomass, ichthyoplankton survey, growth and maturity analyses, also suggests that there was no strong biological evidence to support either a separate or a single stock structure for silver hake. Thus, the two-stock structure definition remained as the basis for science and management (NEFSC 2010).

Survey distribution suggests that most of the silver hake are in the Gulf of Maine and on Georges Bank in the fall and along the shelf edge in the spring (Figure 5). Silver hake migrate in response to seasonal changes in water temperatures, moving toward shallow, warmer waters in the spring. Silver hake spawn in shallow waters during late spring and early summer and then return to deeper waters in the autumn (Brodziak et al. 2001). The older, larger silver hake especially prefer deeper waters. During the summer, portions of both stocks can be found on Georges Bank. In winter, fish in the northern stock move to deep basins in the Gulf of Maine, while fish in the southern stock move to outer continental shelf and slope waters. Silver hake are widely distributed and have been observed at temperature ranges of 2-17° C (36-63° F) and depth ranges of 11-500 m (36-1,640 ft). However, they are most commonly found between 7-10º C (45-50º F) (Lock and Packer 2004).

Female silver hake are serial spawners, producing and releasing up to three batches of eggs in a single spawning season (Collette and Klein-MacPhee eds. 2002). Major spawning areas include the coastal region of the Gulf of Maine from Cape Cod to Grand Manan Island, southern and southeastern Georges Bank, and the southern New England area south of Martha's Vineyard. Peak spawning occurs earlier in the south (May to June) than in the north (July to August). Over 50 percent of age-2 fish (20 to 30 cm, 8 to 12 in) and virtually all age-3 fish (25 to 35 cm, 10 to 14 in) are sexually mature (O'Brien et al. 1993). Silver hake grow to a maximum length of over 70 cm (28 in) and ages up to 14 years have been observed in U.S. waters, although few fish older than age 6 have been observed in recent years (Brodziak et al.

2001, NEFSC 2010). Silver hake are nocturnal, semi-pelagic predators, moving up in the water column to feed at night, primarily between dusk and midnight and returning to rest on the bottom during the day, preferring sandy, muddy or pebble substrate (Collette and Klein-MacPhee eds. 2002). Silver hake population constitutes an important link in the food web dynamics due to their high prey consumption capacity and as food source for major predators in the northwest Atlantic ecosystem. Consumptive estimates of silver hake indicate that predatory consumption represents a major source of silver hake removals from the system and primarily includes goosefish, bluefish, windowpane, four spot flounder, red hake, cod, silver hake, thorny skate, winter skate, little skate, Pollock and spiny dogfish (Garrison and Link 2000, NEFSC, 2010). Silver hake are generally cannibalistic, but their diet varies by region, size, sex, season, migration, spawning and age (Garrison and Link 2000, Lock and Packer 2004, Link et al. 2011).

Figure 5. Fall (left) and spring (right) survey distribution of silver hake in the northern stock (Top) and southern stock (Bottom) from the NEFSC bottom trawl surveys, 1963-2019. Spring 2020 is missing due impacts from COVID-19.



5.3.1.2 Offshore Hake

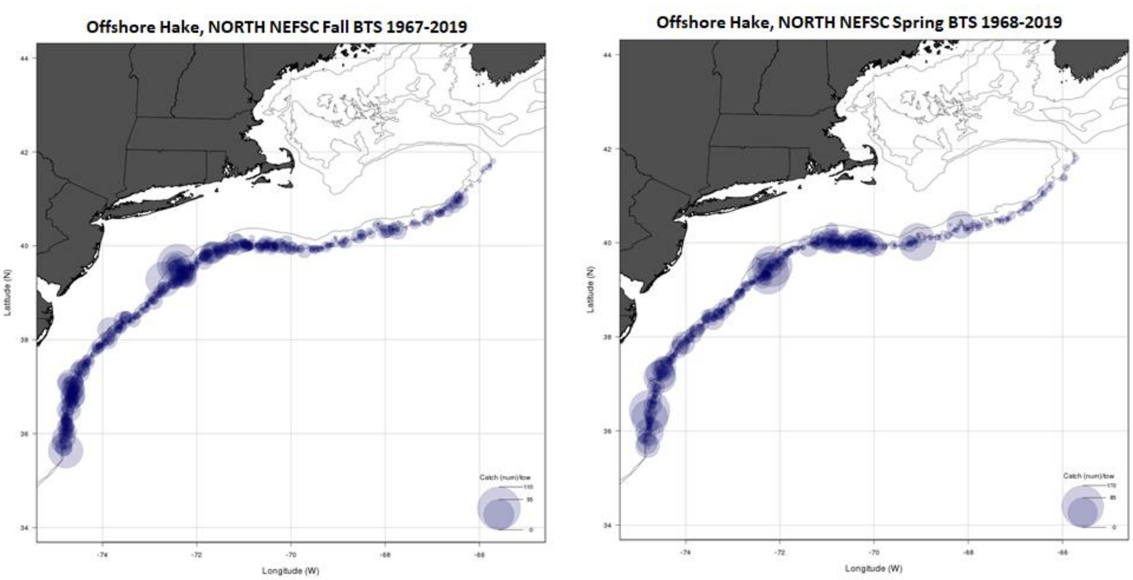
Offshore hake (*Merluccius albidus*) is a data-poor stock and very little is known about its biology and life history. They are commonly distributed from southern Georges Bank through the Mid-Atlantic Bight, at depths of 160-550 meters and temperatures ranging between 11-13℃. They are known to co-occur with silver hake in the outer continental slopes of the Atlantic Ocean and are easily confused with silver hake because of their strong morphological resemblances. There appears to be seasonal differences in the patterns of distribution with concentrations shifting south of Georges Bank in the winter months and extending to the southern flank of Georges Bank and further south in the spring (Figure 6).

The primary source of biological information for offshore hake is the annual fishery independent surveys conducted by the NEFSC. Offshore hake survey catches are generally low and variable relative to other hake species.

Offshore hake are located primarily on the continental shelf and presumably beyond the NEFSC survey area. Offshore hake tend to be concentrated in the southern Georges Bank region in the fall, whereas in the spring, they are found further south in the Mid-Atlantic Bight. However, offshore hake appear to be more abundant during the winter months.

Offshore hake appear to be sexually dimorphic with females slightly larger than males. Females mature at a larger length than males, like other gadoid species (O'Brien et al 1993). Maximum size observed in the survey was approximately 56 cm. Length at 50 percent maturity also differed significantly between sexes with females maturing at larger sizes (28 cm) relative to males (23 cm). Spawning generally occurs between April and July. Maximum observed size was approximately 43 cm for males and 56 cm for female (Traver et al. 2011).

Figure 6. Fall (left) and Spring (right) survey distribution of offshore hake from the NEFSC bottom trawl surveys, 1967- 2019. Spring 2020 is missing due impacts from COVID-19.



5.3.2 Bycatch Species

Haddock, a healthy stock, has comprised the major proportion of groundfish bycatch in the small-mesh multispecies whiting fishery, likely occurring in southern Georges Bank. Haddock bycatch increased considerably in 2014 due to a large 2013-year class becoming vulnerable to fishing in small-mesh exemption areas. Haddock bycatch appears to be slowly declining as the haddock are becoming older.

This decline in bycatch may be the result of haddock separation from silver hake as they age or becoming less vulnerable to capture on small-mesh tows, which are typically shorter than the typical large mesh groundfish tows.

The major component of bycatch in the fishery, i.e., haddock, is likely to remain high in the near term due to recent strong haddock year classes, but unless there are more strong haddock year classes, the bycatch rate is expected to decline slowly over time.

Bycatch in the small-mesh multispecies fishery was estimated by applying the D/K_all ratios from all observed tows (NEFOP and ASM) to landings of all species on trips using small-mesh trawls and landing 2,000 lb. of whiting or 400 lb. of red hake, stratified by year and quarter in the southern management area. All observed tows on NEFOP and ASM were used to calculate the discard ratios.

In the southern area, the top discards were comprised of red hake, spiny dogfish, butterfish, silver hake, little skate, and haddock during 2014-2016 (Table 12). Haddock discards in 2016 declined possibly because haddock may have become separated from the traditional whiting fishing grounds as they aged and grew (Table 13).

Table 12. Total discard (mt) estimates for vessels using small mesh trawls on trips landing more than 2,000 lb. of whiting or 400 lb. of red hake in the southern region. *Source*: D/K_all ratios on NEFOP and ASM small-mesh multispecies trips applied to landings of all species by year and quarter for the southern management area.

Southern			
	Calendar year		
Species	***2014***	***2015***	***2016***
Red hake	657.0	1099.0	1400.6
Haddock	199.9	233.7	76.0
Winter skate	29.7	13.4	285.2
Spiny dogfish	534.9	376.3	130.8
Butterfish	376.5	260.4	161.2
Little skate	140.2	66.6	171.1
Silver hake	619.0	101.5	231.5
Barndoor skate	37.2	51.7	151.9
Atlantic herring	1.5	11.4	0.0
Monkfish	4.4	24.5	135.6
Summer flounder	21.7	129.5	93.4
Yellowtail flounder	1.5	0.0	0.8
Witch flounder	9.6	57.2	9.7
Winter flounder	15.1	0.2	25.6
Ocean pout	58.3	5.2	13.3
American plaice	0.0	0.0	0.1
Cod	0.3	0.0	1.1
Windowpane	2.3	0.0	2.0
White hake	0.0	0.1	1.1
Smooth skate	0.0	0.0	0.0
Thorny skate	0.0	0.0	0.0
Pollock	0.1	0.0	0.5
Redfish	0.0	0.0	0.0
Total	**2709.3**	**2430.9**	**2891.5**

Table 13. Mean bycatch rate (D/K_all) by small-mesh multispecies in the southern management area during 2014-2016 weighted by number of observed hauls.

	Southern	
Species	**Mean D/K_all**	**Rank**
American plaice	0.000	19
Atlantic herring	0.005	13
Barndoor skate	0.030	9
Butterfish	0.088	4
Cod	0.000	18
Haddock	0.039	6
Little skate	0.085	5
Monkfish	0.019	10
Ocean pout	0.006	11
Red hake	0.241	2
Silver hake	0.104	3
Smooth skate	-	20
Spiny dogfish	0.271	1
Summer flounder	0.035	7
Thorny skate	-	20
White hake	0.000	17
Windowpane flounder	0.002	16
Winter flounder	0.004	14
Winter skate	0.031	8
Witch flounder	0.005	12
Yellowtail flounder	0.003	15
All	0.046	

5.4 PROTECTED SPECIES

5.4.1 Species Present in the Area

Numerous protected species inhabit the environment within the Northeast multispecies FMP management unit (Table 14) and have the potential to be impacted by the preferred alternative (i.e., there have been observed/documented interactions in the fishery or with gear type(s) similar to those used in the fishery (bottom trawl or gillnet gear)). These species are under NMFS jurisdiction and are afforded protection under the Endangered Species Act (ESA) of 1973 and/or the Marine Mammal Protection Act (MMPA) of 1972.

Table 14. Species protected under the ESA and/or MMPA that may occur in the affected environment of the small-mesh multispecies fishery. Marine mammal species (cetaceans and pinnipeds) italicized and in bold are considered MMPA strategic stocks.[1]

Species	Status[2]	Potentially impacted by this action?
Cetaceans		
North Atlantic right whale (Eubalaena glacialis)	***Endangered***	***No***
Humpback whale, West Indies DPS (*Megaptera novaeangliae*)[3]	Protected (MMPA)	No
Fin whale (Balaenoptera physalus)	***Endangered***	***No***
Sei whale (Balaenoptera borealis)	***Endangered***	***No***
Blue whale (Balaenoptera musculus)	***Endangered***	***No***
Sperm whale (Physeter microcephalus)	***Endangered***	***No***
Minke whale (*Balaenoptera acutorostrata*)	Protected (MMPA)	Yes
Pilot whale (Globicephala spp.)[3]	Protected (MMPA)	Yes
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
Spotted dolphin (*Stenella frontalis*)	Protected (MMPA)	No
Bottlenose dolphin (Tursiops truncatus)[4]	***Protected (MMPA)***	***Yes***
Harbor porpoise (*Phocoena phocoena*)	Protected (MMPA)	Yes
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		
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered	No
Atlantic salmon (*Salmo salar*)	Endangered	Yes
Oceanic whitetip shark (*Carcharhinus longimanus)*	Threatened	No
Giant Manta Ray (*Manta birostris)*	Threatened	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
Pinnipeds		
Harbor seal (*Phoca vitulina*)	Protected (MMPA)	Yes
Gray seal (*Halichoerus grypus*)	Protected (MMPA)	Yes
Harp seal (*Phoca groenlandicus*)	Protected (MMPA)	Yes
Hooded seal (*Cystophora cristata*)	Protected (MMPA)	Yes
Critical Habitat		
North Atlantic Right Whale	ESA (Protected)	No
Northwest Atlantic DPS of Loggerhead Sea Turtle	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, 1972). Refer to the most recent stock assessment report for the current information on the status and therefore, management, of MMPA protected species (i.e., Hayes et al. 2020).
[2] The status of the species is defined by whether the species is listed under the ESA as endangered (species are at risk of extinction) or threatened (species at risk of endangerment) or protected under the MMPA. Note, marine mammals listed under the ESA are also protected under the MMPA. Candidate species are those species in which ESA listing may be warranted.
[3] There are two 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 just referred to as *Globicephala spp*.

[4] This includes the following Stocks of Bottlenose Dolphins: Western North Atlantic Offshore, Northern Migratory Coastal (strategic stock), and Southern Migratory Coastal (strategic stock).

Cusk 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. Thus, this species will not be discussed further in this action; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on candidate species from any preferred alternative. Additional information on cusk is at: https://www.fisheries.noaa.gov/endangered-species-conservation/candidate-species-under-endangered-species-act.

5.4.2 Species and Critical Habitat Not Likely Impacted (via interactions with gear or destruction of essential features of critical habitat) by the proposed action

Based on available information, it has been determined that this action is not likely to impact multiple ESA listed and/or marine mammal protected species or any designated critical habitat (Table 14). 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 (i.e., small mesh bottom otter trawl) used to prosecute the small-mesh multispecies fishery (see Marine Mammal Stock Assessment Reports (SARS) for the Atlantic Region: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; MMPA List of Fisheries (LOF): https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries; NMFS Observer Program, unpublished data; NMFS NEFSC reference documents (marine mammal serious injury and mortality reports): https://apps-nefsc.fisheries.noaa.gov/rcb/publications/center-reference-documents.html). In the case of critical habitat, this determination has been made because the action will not impact 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 2015 a, b).

5.4.3 Species Potentially Impacted by the Proposed Action

Table 13 provides a list of protected species of sea turtle, marine mammal, and fish species present in the affected environment of the small-mesh multispecies fishery, and that may also be impacted 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 impacted by the action, the MMPA List of Fisheries (LOF), and marine mammal stock assessment and serious injury and mortality reports were referenced (see Marine Mammal SARS for the Atlantic Region: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; MMPA LOF: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries; NMFS Observer Program, unpublished data; NMFS NEFSC reference documents (marine mammal serious injury and mortality reports): https://apps-nefsc.fisheries.noaa.gov/rcb/publications/center-reference-documents.html).

To help identify ESA listed species potentially impacted by the action, the most recent 10 years of observer data (i.e., 2010-2019; NMFS Observer Program, unpublished data), as well as the 2013 Biological Opinion issued by NMFS on the operation of seven commercial fisheries, including the multispecies (small-mesh fishery included) FMP, was referenced (NMFS 2013). 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.

New information indicates that North Atlantic right whale abundance has been in decline since 2010 (Pace et al. 2017). This new information is different from that considered and analyzed in the 2013 Opinion and therefore, reveals effects from this fishery that were not previously considered. As a result, per an October 17, 2017, ESA 7(a)(2)/7(d) memorandum issued by NMFS, the 2013 Opinion, as well as several other fishery Opinions, has been reinitiated. However, the October 17, 2017, ESA 7(a)(2)/7(d) memorandum issued by NMFS, determined ".....For the consultations being reinitiated..…. Allowing these fisheries to continue during the reinitiation period will not increase the likelihood of interactions with these species above the amount that would otherwise occur if consultation had not been reinitiated, because allowing these fisheries to continue does not entail making any changes to any fishery during the reinitiation period that would cause an increase in interactions with whales, sea turtles, sturgeon, or Atlantic salmon. Because of this, the continuation of these fisheries during the reinitiation period would not be likely to jeopardize the continued existence of any whale, sea turtle, Atlantic salmon, or sturgeon species." Until replaced, the small-mesh multispecies fishery is currently covered by the October 17, 2017, memorandum.

The following provides the status/trend of MMPA and/or ESA listed species that have the potential to be impacted by the small-mesh multispecies fishery:

Sea Turtles (loggerhead (Northwest Atlantic Ocean DPS), Kemp's ridley, green (North Atlantic DPS), and leatherback)

Four sea turtle species have the potential to be impacted by the proposed action: Northwest Atlantic Ocean DPS of loggerhead, Kemp's ridley, North Atlantic DPS of green, and leatherback sea turtles (Table 13). Nest counts inform population trends for sea turtle species. For the Northwest Atlantic Ocean DPS of loggerhead sea turtles, there are five unique recovery units that comprise the DPS. Nesting trends for each of these recovery units are variable; however, recent data from Florida index nesting beaches, which comprise most of the nesting in the DPS, indicate a 19% increase in nesting from 1989 to 2018 (https://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/). Overall, short-term trends for loggerhead sea turtles (Northwest Atlantic Ocean DPS) have shown increases; however, over the long-term the DPS is considered stable. For Kemp's ridley sea turtles, from 1980 through 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased 15 percent annually (Heppell et al. 2005); however, due to recent declines in nest counts, decreased survival of immature and adult sea turtles, and updated population modeling, this rate is not expected to continue and therefore, the overall trend is unclear (NMFS and USFWS 2015; Caillouett et al. 2018). The North Atlantic DPS of green sea turtle is showing a positive trend in nesting; however, increases in nester abundance for the North Atlantic DPS in recent years must be viewed cautiously as the datasets represent a fraction of a green sea turtle generation which is between 30 and 40 years (Seminoff et al. 2015). Leatherback turtle nesting in the Northwest Atlantic is showing an overall negative trend, with the most notable decrease occurring during the most recent time frame of 2008 to 2017 (NW Atlantic Leatherback Working Group 2018).

Large Whales (minke)

Minke whales are identified as having the potential to be impacted by the proposed action (Table 13). Review of the most recent NMFS Marine Mammal Stock Assessments (Hayes et al. 2020) indicates that, as a trend analysis has not been conducted, the population trajectory for minke whales is unknown.[3]

Small Cetaceans

Risso's white-sided, short beaked common, and bottlenose dolphins (Western North Atlantic Offshore, Northern Migratory Coastal, and Southern Migratory Coastal stocks); long and short –finned pilot whales; and, harbor porpoise are identified as having the potential to be impacted by the proposed action (Table 13). Review of the most recent stock assessment (Hayes et al. 2020) indicates that as a trend analysis has not been conducted for Risso's, white-sided, short-beaked common dolphins; long-finned pilot whales; or harbor porpoise, the population trajectory for these species is unknown. For short-finned pilot whales a generalized linear model indicated no significant trend in these abundance estimates (Hayes et al 2020). For the Western North Atlantic Offshore stock, review of the most recent information on the stock shows no statistically significant trend in population size for this species; however, the high level of uncertainty in the estimates limits the ability to detect a statistically significant trend (Hayes et al. 2020). In regards to the Northern and Southern Migratory Coastal stocks (both considered a strategic stock under the MMPA), the most recent analysis of trends in abundance suggests a probable decline in stock size between 2010– 2011 and 2016, concurrent with a large UME in the area; however, there is limited power to evaluate trends given uncertainty in stock distribution, lack of precision in abundance estimates, and a limited number of surveys (Hayes et al. 2018).

Pinnipeds

Harbor, gray, harp and hooded seals are identified as having the potential to be impacted by the proposed action (Table 13). Review of the most recent stock assessment (Hayes et al. 2020) indicates that as a trend analysis has not been conducted for harbor seals, the population trajectory for this species is unknown. The status of the gray, harp, and hooded seal population relative to optimum sustainable population (OSP)[4] in U.S. Atlantic EEZ waters is unknown; however, gray seal stock's abundance appears to be

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[3] *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region*

[4] OSP is "the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element." 16 U.S.C. § 1362(9).

increasing in Canadian and U.S. waters, harp seal **stock** abundance appears to have stabilized, and hooded seal stock abundance is uncertain (Hayes et al. 2019; Hayes et al. 2020).

Atlantic sturgeon

Atlantic sturgeon, from any DPS, are identified as having the potential to be impacted by the proposed action (Table 13). The ASMFC released a new benchmark stock assessment for Atlantic sturgeon in October 2017 (ASMFC 2017). Based on historic removals and estimated effective population size, the 2017 stock assessment concluded that all five Atlantic sturgeon DPSs are depleted relative to historical levels. However, the 2017 stock assessment does provide some evidence of population recovery at the coastwide scale, and mixed population recovery at the DPS scale (ASMFC 2017). The 2017 stock assessment also concluded that a variety of factors (i.e., bycatch, habitat loss, and ship strikes) continue to impede the recovery rate of Atlantic sturgeon (ASMFC 2017).

Atlantic Salmon (GOM DPS)

Atlantic salmon (GOM DPS) are identified as having the potential to be impacted by the proposed action (Table 13). The GOM DPS of Atlantic salmon currently exhibits critically low spawner abundance and poor marine survival (USASAC 2020). The abundance of GOM DPS Atlantic salmon has been low and either stable or declining over the past several decades and the proportion of fish that are of natural origin is small and displays no sign of growth (USASAC 2020).

Giant Manta Rays

Giant Manta Rays may be impacted by the proposed action (Table 13). While there is considerable uncertainty regarding the species' current abundance throughout its range, the best available information indicates that the species has experienced population declines of potentially significant magnitude within areas of the Indo-Pacific and eastern Pacific portions of its range (Miller and Klimovich 2017). Yet, larger subpopulations of the species still exist, including off Mozambique, Ecuador, and potentially Thailand. While we assume that declining populations within the Indo-Pacific and eastern Pacific will likely translate to overall declines in the species throughout its entire range, there is very little information on the abundance, and thus, population trends in the Atlantic portion of its range (Miller and Klimovich 2017).

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, to understand the potential risk of an interaction. Information on species occurrence in the affected environment of the small-mesh multispecies fishery is provided below; information on protected species interactions with gear used in the small mesh multispecies fishery (i.e., small mesh bottom otter trawl) is provided in Section 5.4.4.

5.4.3.1 Sea Turtles

This section contains a brief summary of the occurrence and distribution of leatherback and hard-shelled sea turtles (i.e., green (North Atlantic DPS), loggerhead (Northwest Atlantic Ocean DPS), Kemp's ridley) in the affected environment of the small-mesh multispecies fishery. Three of the four species are considered hard-shelled turtles (i.e., green, loggerhead, and Kemp's ridley). Additional background information on the range-wide status of sea turtles, as well as a description and life history of the species, is in several published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; Conant et al. 2009; NMFS and USFWS 2013; NMFS and USFWS 2015; Seminoff et al. 2015), and recovery plans for the loggerhead sea turtle (Northwest Atlantic DPS; NMFS and USFWS 2008), leatherback sea turtle (NMFS and USFWS 1992), Kemp's ridley sea turtle (NMFS et al. 2011), and green sea turtle (NMFS and USFWS 1991).

Hard-Shelled Sea Turtles

In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, Massachusetts, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly et al. 1995a, 1995b; Braun and Epperly 1996; Mitchell et al. 2003; Braun-McNeill et al. 2008; TEWG 2009). While hard-shelled turtles are most common south of Cape Cod, MA, they are known to occur in the Gulf of Maine. Loggerheads, the most common hard-shelled sea turtle in the Greater Atlantic Region, feed as far north as southern Canada. Loggerheads have been observed in waters with surface temperatures of 7 °C to 30 °C, but water temperatures ≥11 °C are most favorable (Shoop and Kenney 1992; Epperly et al. 1995b). Sea turtle presence in U.S. Atlantic waters is also influenced by water depth. While hard-shelled turtles occur in waters from the beach to beyond the continental shelf, they are most commonly found in neritic waters of the inner continental shelf (Mitchell et al. 2003; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Blumenthal et al. 2006; Hawkes et al. 2006; McClellan and Read 2007; Mansfield et al. 2009; Hawkes et al. 2011; Griffin et al. 2013).

Hard-shelled sea turtles occur year-round in waters off Cape Hatteras, North Carolina and south. 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 (Epperly et al. 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Griffin et al. 2013), occurring in Virginia foraging areas as early as late April and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by September, but some remain in Mid-Atlantic and Northeast areas until late fall. By December, sea turtles have migrated south to waters offshore of NC, particularly south of Cape Hatteras, and further south (Shoop and Kenney 1992; Epperly et al. 1995b; Hawkes et al. 2011; Griffin et al. 2013).

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 2013b; 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).

5.4.3.2 Marine Mammals

5.4.3.2.1 Large Whales

Multiple species of whales occur in the Northwest Atlantic, with the minke whale being the only whale species potentially impacted by the proposed action (Table 13). Minke whales are widely distributed throughout the U.S. EEZ. From spring to the fall, minke whales are most abundant in New England continental shelf waters; however, from late fall through the winter, there is high occurrence in deep-ocean waters throughout most of the western North Atlantic (Hayes et al. 2020). In addition, like many other species of large whales in the Northwest Atlantic, minke whales can undertake seasonal migrations. Generally speaking, large whales follow an annual pattern of migration between low latitude (south of 35ºN) wintering/calving grounds and high latitude spring/summer/fall foraging grounds (primarily north of 41ºN; see marine mammal stock assessment reports: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). This is a simplification of whale movements, particularly as it relates to winter movements. It is unknown if all individuals of a population migrate to low latitudes in the winter, although increasing evidence suggests that for some species, some portion of the population remains in higher latitudes throughout the winter (Clapham et al. 1993; Davis et at. 2017; Davis et al. 2020; Hayes et al. 2020; 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 occurrence of large whales in low latitude foraging grounds in the spring/summer/fall is well understood. Large whales consistently return to these foraging areas each year, therefore these areas can be considered important areas for whales (Davis et al. 2017; Davis et al. 2020; Hayes et al. 2020; Payne et al. 1986; Payne et al. 1990; Schilling et al. 1992). For additional information on the biology, status, and range wide distribution of minke whales, see the marine mammal stock assessment reports provided at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.

5.4.3.2.2 Small Cetaceans

Atlantic white sided dolphins, short and long finned pilot whales, Risso's dolphins, short beaked common dolphins, harbor porpoise, and several stocks of bottlenose dolphins are found throughout the year in the Northwest Atlantic Ocean (see Marine Mammal Stock Assessment Resports at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). Within this range, however, there are seasonal shifts in species distribution and abundance. To further assist in understanding how fisheries may overlap in time and space with the occurrence of small cetaceans, a general overview of species occurrence and distribution in the area of operation for the small-mesh multispecies fishery is in Table 15. For additional information on the biology, status, and range wide distribution of each species refer to: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.

Table 15. Small cetacean occurrence in the area of operation of the small-mesh multispecies fishery.

Species	Prevalence and Month of Occurrence
Atlantic White Sided Dolphin	• Distributed throughout the continental shelf waters (primarily to 100 m) of the Mid-Atlantic (north of 35ºN), SNE, GB, and GOM; however, most common in continental shelf waters from Hudson Canyon (~ 39ºN) to GB, and into the GOM. • **January-May**: low densities found from GB to Jeffreys Ledge. • **June-September**: Large densities found from GB, through the GOM. • **October-December**: intermediate densities found from southern GB to southern GOM. • South of GB (SNE and Mid-Atlantic), particularly around Hudson Canyon, low densities found year-round, • Virginia (VA) and North Carolina (NC) waters represent southern extent of species range during winter months.
Short Beaked Common Dolphin	• Regularly found throughout the continental shelf-edge-slope waters (primarily between the 100-2,000 m isobaths) of the Mid-Atlantic, SNE, and GB (esp. in Oceanographer, Hydrographer, Block, and Hudson Canyons).

Species	Prevalence and Month of Occurrence
	• Less common south of Cape Hatteras, NC, although schools have been reported as far south as the Georgia/South Carolina border. • **January-May**: occur from waters off Cape Hatteras, NC, to GB (35º to 42ºN). • **Mid-summer-autumn**: Occur in the GOM and on GB; Peak abundance found on GB in the autumn.
Risso's Dolphin	• **Spring through fall**: Distributed along the continental shelf edge from Cape Hatteras, NC, to GB. • **Winter**: distributed in the Mid-Atlantic Bight, extending into oceanic waters. • Rarely seen in the GOM; primarily a Mid-Atlantic continental shelf edge species (can be found year-round).
Harbor Porpoise	• Distributed throughout the continental shelf waters of the Mid-Atlantic, SNE, GB, and GOM. • **July-September**: Concentrated in the northern GOM (waters <150 meters); low numbers can be found on GB. • **October-December**: widely dispersed in waters from New Jersey (NJ) to Maine (ME); seen from the coastline to deep waters (>1,800 meters). • **January-March**: intermediate densities in waters off NJ to NC; low densities found in waters off New York (NY) to GOM. • **April-June**: widely dispersed from NJ to ME; seen from the coastline to deep waters (>1,800 meters).
Bottlenose Dolphin	**<u>Western North Atlantic Offshore Stock</u>** • Distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic from GB to Florida (FL). • Depths of occurrence: ≥40 meters **<u>Western North Atlantic Northern Migratory Coastal Stock</u>** • Most common in coastal waters <20 m deep. • Warm water months (e.g., July-August): distributed from the coastal waters from the shoreline to about the 25- meter isobaths between the mouth of the Chesapeake Bay and Long Island, NY. • Cold water months (e.g., January-March): stock occupies coastal waters from Cape Lookout, NC, to the NC/VA border. **<u>Western North Atlantic Southern Migratory Coastal Stock</u>** • Most common in coastal waters <20 m deep. • **October-December**: appears stock occupies waters of southern NC (south of Cape Lookout)

Species	Prevalence and Month of Occurrence
	• **January-March**: appears stock moves as far south as northern FL. • **April-June**: stock moves north to waters of NC. • **July-August**: stock is presumed to occupy coastal waters north of Cape Lookout, NC, to the eastern shore of VA (as far north as Assateague).
Pilot Whales: Short- and Long-Finned	**Short- Finned Pilot Whales** • Except for area of overlap (see below), primarily occur south of 40°N (Mid-Atlantic and SNE waters); although low numbers have been found along the southern flank of GB, but no further than 41°N. • May through December (about): distributed primarily near the continental shelf break of the Mid-Atlantic and SNE (i.e., off Nantucket Shoals); individuals begin shifting to southern waters (i.e., 35°N and south) beginning in the fall. **Long-Finned Pilot Whales** • Except for area of overlap (see below), primarily occur north of 42°N. • Winter to early spring (November - April): primarily distributed along the continental shelf edge-slope of the Mid-Atlantic, SNE, and GB. • Late spring through fall (May - October): movements and distribution shift onto/within GB, the Great South Channel, and the GOM. **Area of Species Overlap:** between approximately 38°N and 40°N.
***Notes*:** Information is representative of small cetacean occurrence in the Northwest Atlantic continental shelf waters out to 2,000 m depth ***Sources*:** Hayes et al. 2017; Hayes et al. 2018; Hayes et al. 2019; Hayes et al. 2020; Payne and Heinemann 1993; Payne et al. 1984; Jefferson et al. 2009.	

5.4.3.2.3 Pinnipeds

Harbor, gray, harp, and hooded seals will occur in the affected environment of the small-mesh multispecies fishery (Table 16). Specifically, pinnipeds are found in the nearshore, coastal waters of the Northwest Atlantic Ocean. They 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, North Carolina (35°N) (Waring et al. 2007; Hayes et al. 2019). To help understand how the small-mesh multispecies fishery may overlap in time and space with the occurrence of pinnipeds, a general overview of species occurrence and distribution in the area of operation of the multispecies fishery is provided in the following table (Table 16). Waring et al. (2007), and Hayes et al. (2019) have additional information on the biology, status, and range wide distribution of each species.

Table 16. Pinniped occurrence in the area of operation of the small-mesh multispecies fishery.

Species	Prevalence
Harbor Seal	• Primarily distributed in waters from New Jersey to Maine; however, increasing evidence indicates that their range is extending into waters as far south as Cape Hatteras, NC (35°N). • **Year Round**: Waters north of 42.5 °N • **September-May**: Waters from MA to NJ.
Gray Seal	• **Year Round**: Waters from Maine to just south of Cape Cod, MA. • **September-May**: Waters from southern MA to NJ. • Stranding records: Southern NJ to Cape Hatteras, NC
Harp Seal	• Winter-Spring (approx. January-May): Waters from New Jersey to Maine.
Hooded Seal	• Winter-Spring (approx. January-May): Waters of New England.
Sources: Waring et al. 2007 (for hooded seals); Hayes et al. 2019; Hayes et al. 2020.	

5.4.3.3 Atlantic Sturgeon

Table 14 lists the 5 DPSs of Atlantic sturgeon that occur in the affected environment of the small-mesh multispecies fishery and that may be impacted by the operation of this fishery. 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; in fact, results from genetic studies show that, regardless of location, multiple DPSs can be found at any one location along the Northwest Atlantic coast (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; Dunton et al. 2012; Dunton et al. 2015; Erickson et al. 2011; Wirgin et al. 2012; O'Leary et al. 2014; Waldman et al. 2013; 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 some Atlantic sturgeon may undertake seasonal movements along the coast (Erickson et al. 2011; Dunton et al. 2010; 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.

Within the marine range of Atlantic sturgeon, several marine aggregation areas have been identified adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard (i.e., waters off North Carolina, Chesapeake Bay; Delaware Bay; New York Bight; Massachusetts Bay; Long Island Sound; and Connecticut and Kennebec River Estuaries); depths in these areas are generally no greater than 25 meters (Bain et al. 2000; Savoy and Pacileo 2003; Stein et al. 2004a; Laney et al. 2007; Dunton et al. 2010; Erickson et al. 2011; Oliver et al. 2013; Waldman et al. 2013; O'Leary et al. 2014; Wipplehauser 2012; Wipplehauser and Squiers 2015). Although additional studies are still needed to clarify why these sites are chosen by Atlantic sturgeon, there is some indication that they may serve as thermal refuge, wintering sites, or marine foraging areas (Stein et al. 2004a; Dunton et al. 2010; Erickson et al. 2011).

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).

5.4.3.4 Atlantic Salmon (Gulf of Maine DPS)

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 GOM DPS extends from the GOM (primarily northern portion of the GOM), to the coast of Greenland (Fay et al. 2006; NMFS & USFWS 2005, 2016). In general, smolts, post- smolts, and adult Atlantic salmon may be present in the GOM 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; Hyvarinen et al. 2006; Lacroix & Knox 2005; Lacroix & McCurdy 1996; Lacroix et al. 2004; NMFS & USFWS 2005; Reddin 1985; Reddin & Friedland 1993; Reddin & Short 1991). For additional information on the on the biology, status, and range wide distribution of the GOM DPS of Atlantic salmon, refer to NMFS and USFWS (2005, 2016); and Fay et al. (2006). Thus, as the multispecies fishery operates throughout the year, and operates in the GOM, the fishery could overlap in time and space with Atlantic salmon migrating northeasterly between U.S. and Canadian waters.

5.4.4 Interactions Between Gear and Protected Species

Protected species are at risk of interacting with various types of fishing gear, with interaction risks associated with gear type, quantity, soak or tow duration, and degree of overlap between gear and protected species. Information on observed or documented interactions between gear and protected species is available from as early as 1989 (Marine Mammal Stock Assessment Reports: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; NMFS Observer Program, unpublished data). As the distribution and occurrence of protected species and the operation of fisheries (and, thus, risk to protected species) have changed over the last 30 years, we use the most recent 10 years of available information to best capture the current risk to protected species from fishing gear. For marine mammals protected under the MMPA, this primarily covers the period from 2008-2017[5]; however, the Greater Atlantic Region (GAR) Marine Animal Incident Database (unpublished data) contains large whale entanglement reports through 2018. For ESA listed species, the most recent 10 years of data on observed or documented interactions is available from 2010-2019 (ASMFC 2017; GAR Marine Animal Incident Database, unpublished data; Kocik et al. 2014; Miller and Shepard 2011; Murray 2015; Murray 2020; NMFS Observer Program, unpublished data). The sections to follow are not a comprehensive review of all fishing gear types known to interact with a given

[5] Waring et al. 2015a; Waring et al. 2016; Hayes et al. 2017; Hayes et al. 2018; Hayes et al. 2019; Hayes et al. 2020; MMPA List of Fisheries (LOF): https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries; NMFS NEFSC reference documents (marine mammal serious injury and mortality reports): https://nefsc.noaa.gov/publications/crd/.

species; emphasis is only being placed on the primary gear types used to prosecute the small-mesh multispecies fishery (i.e., small-mesh bottom trawl gear).

5.4.4.1 Marine Mammals

Depending on species, marine mammals have been observed seriously injured or killed in bottom 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, MMPA LOF's have categorized bottom trawl fisheries (Northeast or Mid-Atlantic) as Category II fisheries (see: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries).

5.4.4.1.1 Large Whales

With the exception of minke whales, there have been no observed interactions with large whales and bottom trawl gear (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; https://www.nefsc.noaa.gov/fsb/take_reports/nefop.html; https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries; https://www.nefsc.noaa.gov/publications/crd/). In 2008, several minke whales were observed dead in bottom trawl gear attributed to the northeast bottom trawl fishery; estimated annual mortality attributed to this fishery in 2008 was 7.8 minke whales (Waring et al. 2015a). Since 2008, serious injury and mortality records for minke whales in U.S. waters have shown zero interactions with bottom trawl (northeast or Mid-Atlantic) gear.[6] Based on this information, large whale interactions with bottom trawl gear are expected to be rare to nonexistent.

5.4.4.1.2 Small Cetaceans and Pinnipeds

Small cetaceans and pinnipeds are vulnerable to interactions with bottom trawl gear.[7]
Reviewing marine mammal stock assessment and serious injury reports that cover the most recent 10 years data (i.e., 2008-2017), as well as the MMPA LOF's covering this time frame (i.e., issued between 2016 and 2020), Table 17 provides a list of species that have been observed (incidentally) seriously injured and/or killed by MMPA LOF Category Category II (occasional interactions) bottom trawl fisheries that operate in the affected environment of the small-mesh multispecies fishery.[8]

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[6] Refer to: Greater Atlantic Region Marine Animal Incident Database (unpublished data); Waring et al. 2016; Hayes et al. 2017; Hayes et al. 2018; Hayes et al. 2019; Hayes et al. 2020; Cole and Henry 2013; and, Henry et al. 2014, 2015, 2016, 2017, 2019.

[7] For additional information on small cetacean and pinniped interactions, see: Chavez-Rosales et al. 2017; Josephson et al. 2017; Josephson et al. 2019; Lyssikatos 2015; Lyssikatos et al. 2020; Waring et al. 2015b; https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region, as well as the MMPA LOF at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries.

[8] For MMPA LOFs issued between 2016 and 2020, see https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries.

Table 17. Small cetacean and pinniped species observed seriously injured and/or killed by Category II bottom trawl fisheries in the affected environment of the small-mesh multispecies fishery.

Fishery	Category	Species Observed or reported Injured/Killed
Northeast Bottom Trawl	II	Harp seal
		Harbor seal
		Gray seal
		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 seal
		Harbor seal

Source: MMPA 2016-2020 LOFs at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries

Due to the incidental mortality and serious injury of small cetaceans, incidental to bottom and midwater trawl fisheries operating in both the Northeast and Mid- Atlantic regions, the Atlantic Trawl Gear Take Reduction Strategy (ATGTRS) was implemented. Additional information on the Strategy is at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/atlantic-trawl-take-reduction-team.

5.4.4.2 Sea Turtles

Bottom trawl gear poses an injury and mortality risk to sea turtles (Sasso and Epperly 2006; NMFS Observer Program, unpublished data). Sea turtle interactions with trawl gear have been observed in the Gulf of Maine, Georges Bank, and/or the Mid-Atlantic; however, most of the observed interactions have been observed south of the Gulf of Maine (Murray 2015; Murray 2020; NMFS Observer Program, unpublished data). As few sea turtle interactions have been observed in the Gulf of Maine, there is insufficient data available to conduct a robust model-based analysis and bycatch estimate of sea turtle interactions with trawl gear in this region. As a result, the bycatch estimates and discussion below are for trawl gear in the Mid-Atlantic and Georges Bank.

Murray (2020) provided information on sea turtle interaction rates from 2014-2018. Interaction rates were stratified by region, latitude zone, season, and depth. The highest loggerhead interaction rate (0.43 turtles/day fished) was in waters south of 37º N during November to June in waters greater than 50 meters deep. The greatest number of estimated interactions occurred in the Mid-Atlantic region north of 39º N, during July to October in waters less than 50 meters deep, due to a greater amount of commercial effort in this stratum compared to those farther south. Within each stratum, interaction rates for non-loggerhead species were lower than rates for loggerheads.

Based on Murray (2020), from 2014-2018 (the most recent five-year period that has been statistically analyzed for trawls), 571 loggerheads (CV=0.29, 95% CI=318-997) were estimated to have interacted with bottom trawl gear in the U.S. Mid-Atlantic, while 12 loggerheads (CV=0.70, 95% CI=0-31) were estimated to have interacted with bottom trawls on Georges Bank. Of these interactions, Murray (2020) estimated 272 loggerhead sea turtles died from these interactions. In the Mid-Atlantic, 38 loggerheads were estimated to have been excluded by Turtle Excluder Devices (TEDs). In regard to non-loggerhead species, from 2014-2018, Murray (2020) estimated that a total of 46 Kemp's ridley (CV=0.45, 95% CI=10-88) and 16 green (CV=0.73, 95% CI=0-44) sea turtles interacted with bottom trawl gear in the Mid-Atlantic, of which 23 and eight resulted in mortality, respectively. Murray (2020) also estimated that 20 (CV=0.72, 95% CI = 0-50) and six (CV=1.0, 95% CI=0-20) leatherback interactions with bottom trawl gear occurred in the Mid-Atlantic and on Georges Bank, respectively; these interactions resulted in 13 total leatherback mortalities. No Kemp's ridley, green, and leatherback sea turtles were estimated to have been excluded by TEDs.

5.4.4.3 Atlantic Sturgeon

Atlantic sturgeon interactions (i.e., bycatch) with bottom trawl gear have been observed throughout the Northwest Atlantic Ocean, with interactions often resulting in injury or mortality to the animal (ASMFC 2017; Miller and Shepard 2011; NMFS Observer Program, unpublished data). Atlantic sturgeon have been observed bycaught in trawl gear with small (< 5.5 inches) and large (≥ 5.5 inches) mesh sizes (Miller and Shepard 2011), with most sturgeon captured falling within the 100-200 cm total length range, although both larger and smaller individuals have been observed captured (ASMFC 2017; NMFS Observer Program, unpublished data). In addition, for otter trawl fisheries, the highest incidence of Atlantic sturgeon bycatch was associated with depths less than 30 meters (ASMFC 2007).

The ASMFC (2017) Atlantic sturgeon benchmark stock assessment represents the most accurate predictor of annual Atlantic sturgeon interactions in fishing gear (e.g., otter trawl, gillnet). The stock assessment analyzes fishery observer and VTR data to estimate Atlantic sturgeon interactions in fishing gear in the Mid-Atlantic and New England regions from 2000-2015, the timeframe which included the most recent, complete data at the time of the report. Focusing on the most recent five-year period of data provided in the stock assessment report[9], the estimated average annual bycatch of Atlantic sturgeon in bottom otter trawl gear during 2011-2015 is 777.4 individuals.

5.4.4.4 Atlantic Salmon

Adult Atlantic salmon may be present throughout the water column and could interact with bottom trawl gear. All observed takes of Atlantic salmon that have been recorded by the NEFOP and ASM programs since 1989 have occurred in bottom trawls (or gillnets). Review of NEFOP and ASM observer records over the most recent ten-year timeframe of 2010-2019[10], reveals that there were no reported takes in

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[9] The period of 2011-2015 was chosen as it is the period within the stock assessment that most accurately resembles the current trawl fisheries in the region.

[10] The timeframe of 2010-2019 was chosen as those years most accurately reflect current effort trends and gear use in the fisheries operating in the Greater Atlantic Region, the current biological environment in the affected environment, and encompass years following the "regime shift" of low marine survival for Atlantic salmon that began in the early 1990s and has persisted to date.

bottom trawl gear. However, prior to 2010 there were four incidental takes that occurred in bottom trawl gear (one in 1992, one in 2004, and two in 2005).

Given the very low number of observed Atlantic salmon interactions in bottom trawl gear as reported in the NEFOP database (which includes ASM data) suggests that interactions with this gear type are rare events in the Greater Atlantic Region.

5.4.4.5 Giant Manta Ray

Review of the most recent 10 years of NEFOP data showed that between 2010-2019, two Giant Manta Rays were captured in bottom trawl gear (NMFS Observer Program, unpublished data). Available records of all observed captures in U.S fisheries indicate that the vast majority of giant manta rays are released alive (C. Horn, pers. comm. December 3, 2018). However, details about specific conditions such as injuries, damage, time out of water, how the animal was moved or released, or behavior on release was not always recorded. As a result, currently there is no information available on post-release survival. Based on the best available information, interactions between Giant Manta Rays and bottom trawl gear are likely rare events.

5.5 PHYSICAL ENVIRONMENT AND ESSENTIAL FISH HABITAT

5.5.1 Essential Fish Habitat

Essential Fish Habitat (EFH) includes those waters and substrate necessary for spawning, breeding, feeding, and growth to maturity. The 1998 Omnibus Essential Fish Habitat Amendment 1 (NEFMC 1998; also as Amendment 11 to the Northeast Multispecies FMP) addressed all elements required by the EFH provisions of the 1996 Sustainable Fisheries Act. These include the description and identification of EFH for silver and red hake, the identification of threats to EFH from fishing and non-fishing activities, and the development of conservation and enhancement measures to protect EFH. EFH for offshore hake was described and identified in Amendment 12 to the Northeast Multispecies FMP in 2000. Amendment 13 to the Northeast Multispecies FMP (NEFMC 2004) updated the EFH conservation measures in the plan, but not the designations themselves.

An update to the EFH Amendment, Omnibus EFH Amendment 2 (OHA2, NEFMC 2016), was approved by the Council in June 2015. OHA2 revised EFH designations for all the species managed by the Council, assessed fishing and non-fishing impacts for all the gears used in NEFMC-managed fisheries, and updated management measures to conserve EFH. The new EFH designations and management measures were implemented in April 2018. Hake EFH includes both inshore and offshore areas, typically with soft sediments and some sort of structure such as biogenic depressions or sand waves. Depending on the life stage, hakes may occur on the seabed, or in the water column. The new EFH maps for silver and red hake are based on state and NEFSC trawl survey data through 2005 and data inventories for fourteen estuaries, with juvenile distributions used as a proxy for the egg and larval life stages. Offshore hake EFH for eggs and larvae are based on egg and larval survey data, and the combined juvenile and adult designation map includes areas with high catch rates in the trawl survey. Hake EFH designations also include the continental slope to a depth of 400 m (juvenile and adult silver hake) or 750 m (adult red hake, juvenile and adult offshore hake), beyond the depth covered by the trawl survey.

Interactive maps of EFH for each species and life stage are available on NOAA EFH Mapper https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper. Additional details are provided in Volume 2 (designations), Appendix A (designation methods), and Appendix B (supplementary information) of Omnibus Habitat Amendment 2 (http://www.nefmc.org/library/omnibus-habitat-amendment-2). EFH information is also summarize on the Council's habitat page at https://www.nefmc.org/library/essential-fish-habitat-efh-information.

The area that may potentially be affected by the preferred alternative has been identified as EFH for various species that are managed under the Fishery Management Plans for Northeast Multispecies; Atlantic Sea Scallop; Monkfish; Deep-Sea Red Crab[11]; Northeast Skate Complex; Atlantic Herring; Summer Flounder, Scup, and Black Sea Bass; Tilefish; Atlantic Mackerel, Squid, and Butterfish; Bluefish; Spiny Dogfish; and Atlantic Surfclam and Ocean Quahog. EFH for many of the species managed under these FMPs includes a wide variety of benthic habitats in state and federal waters throughout the Northeast U.S. Shelf Ecosystem. For more information on the geographic area, depth, and EFH description for each applicable life stage of these species, the reader is referred to OHA2 for New England-managed species, and various Mid-Atlantic FMPs for summer flounder/scup/black sea bass, tilefish, mackerel/squid/butterfish, spiny dogfish, and clams.[12]

5.5.2 Gear Impacts from the Small-Mesh Multispecies Fishery

The small-mesh multispecies fishery is primarily a trawl fishery. Omnibus EFH Amendment 2 and previous Council actions have found that bottom trawls can cause adverse, i.e. more than minimal and not temporary, impacts to EFH. Specifically, Omnibus EFH Amendment 1 (NEFMC 1999) found that "bottom-tending mobile gears (otter trawls, scallop dredges, beam trawls, and hydraulic clam dredges) are most likely to be associated with adverse impacts to habitat". These findings were confirmed by the adverse effects' assessment for Omnibus EFH Amendment 2 (NEFMC 2017).

The Omnibus EFH Amendment 2 approach to evaluating adverse effects to EFH was based on two principles: (1) seabed habitat vulnerability to fishing effects varies spatially, due to variations in seabed substrates, energy regimes, living and non-living seabed structural features, etc., between areas and (2) the magnitude of habitat impacts is based on the amount of time that fishing gear spends in contact with the seabed. This seabed area swept (seabed contact time) is grossly related to the amount of time spent fishing, although it will of course vary depending on catch efficiency, gear type used, and other factors.

It is important to keep in mind that whiting fishing is spatially concentrated relative to some other fisheries, restricted by exemption area regulations and by availability of commercial concentrations of fish. It is likely that any changes in fishing effort associated with red hake rebuilding measures will occur in the same general areas that are currently fished. It is not likely that fishing will expand into new areas in the absence of other changes to the management program, specifically new or spatially expanded exemption areas.

Use of small-mesh trawls to target whiting and red hake are restricted to specific exemption areas and seasons, mostly to minimize the bycatch of regulated, large-mesh multispecies. Raised footropes are required on the bottom trawls used in the following exemption areas: GOM Grate Raised Footrope, Small Mesh Area 1, Small Mesh Area 2, and the two Raised Footrope Trawl Exempted Whiting Fishery Areas. Raised footropes are not required in the Cultivator Shoals Exemption Area, or in the Southern New England or Mid-Atlantic Regulated Mesh Areas. These raised footrope trawls minimize catches of flatfish (flounders, monkfish, and skates). As compared to bottom trawls outfitted with rollers or rockhoppers

[11] The OHA2 designations for red crab have a minimum depth of 320 m, such that red crab EFH is outside the depths typically targeted by the whiting fishery.

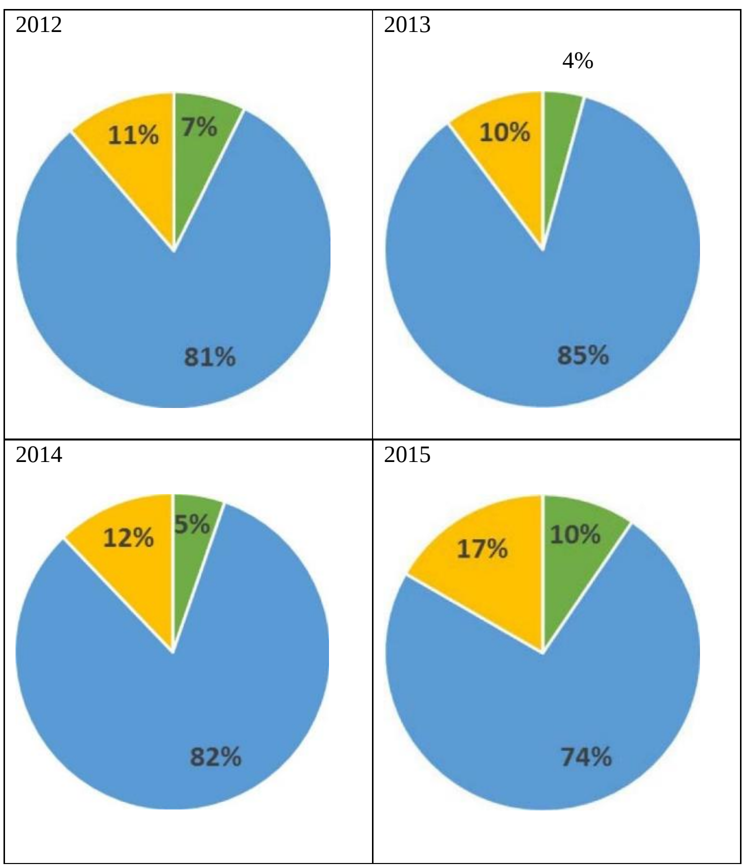
[12] Summer Flounder, Scup, and Black Seabass Amendment 12 (MAFMC 1998a), Golden Tilefish Amendment 1 (MAFMC 2008), Atlantic Mackerel, Squid and Butterfish Amendment 11 (MAFMC 2011), Atlantic Surfclam and Ocean Quahog Amendment 12 (MAFMC 1998b), Spiny Dogfish Amendment 3 (MAFMC 2014); Bluefish Amendment 1 (MAFMC 1998c).

along the footrope, raised footrope trawls have less contact with the seabed along the sweep, and therefore have lower impacts to the seafloor. Even within the exemption areas, small-mesh multispecies fishing is usually confined to a specific area where whiting and red hake are most abundant, often over sand and muddy sand bottoms. Thus, gear impacts on EFH in the small-mesh multispecies fishery are likely to be considerably less problematic than for trawl fisheries operating in other areas to target groundfish, skates, and monkfish.

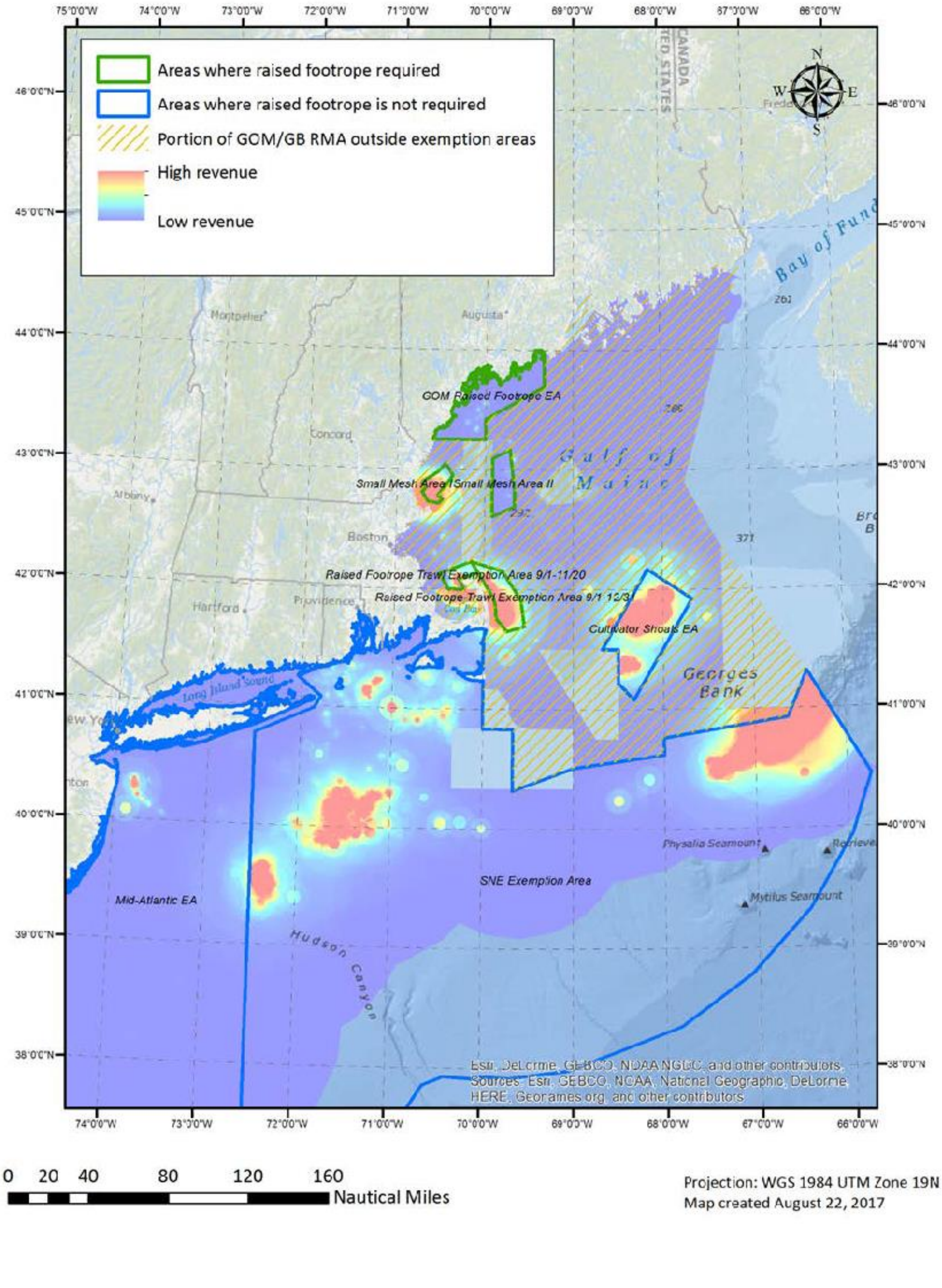
During the 2012-2015 period, most whiting revenues, and by extension, most whiting fishing effort and swept area, are from areas that do not require a raised footrope trawl (Figure 7). This conclusion was reached by summing fishery revenue within groups of exemption areas and regulated mesh areas using the Zonal Statistics by Table tool in the Spatial Analyst extension to ArcMap 10.5. Whiting revenues were attributed spatially according to a statistical model that combines vessel trip report positions with information about the spatial footprint of each trip, derived from at sea observer data (DePiper 2014). Vessel trip reports in the whiting fishery, as in other fisheries, report an average fishing location for each trip, and do not report fishing according to exemption area. Because these VTR positions are uncertain, and the statistical model is only an estimate, between 10-17% of annual revenues do not overlap any whiting exemption areas.

Map 3 shows 2015 revenues relative to exemption areas as an example.

Figure 7. Whiting revenues from areas where raised footrope trawls are required (green), vs. not required (blue), calendar years 2012-2015. Some effort was not attributed to any exemption areas (yellow). See text for explanation of methods.



Map 3. Whiting revenue and small mesh exemption areas, calendar year 2015. Revenue approaches zero in the dark blue shaded areas. Exemption areas are color-coded by requirement for raised footrope trawl. *Source*: calendar year 2015 vessel trip report data.

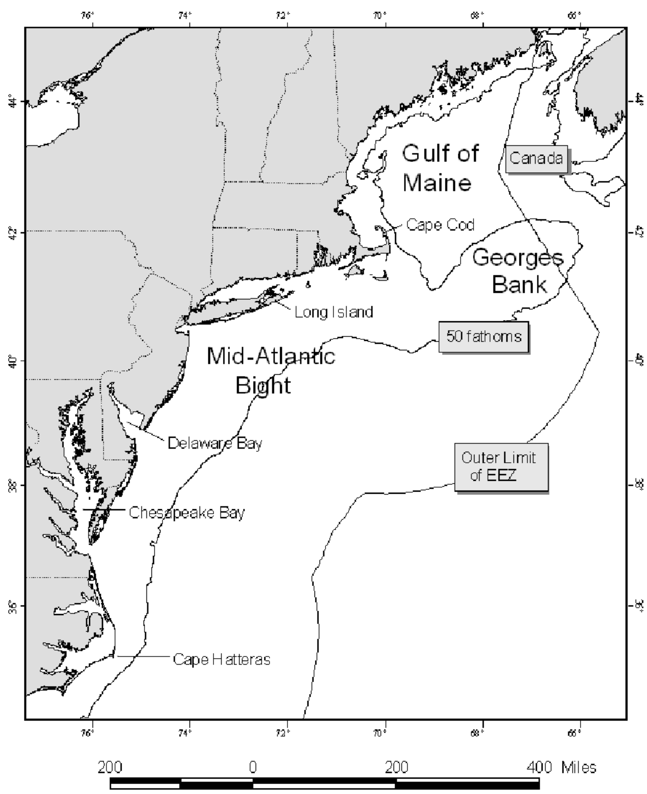


5.5.3 Physical Environment

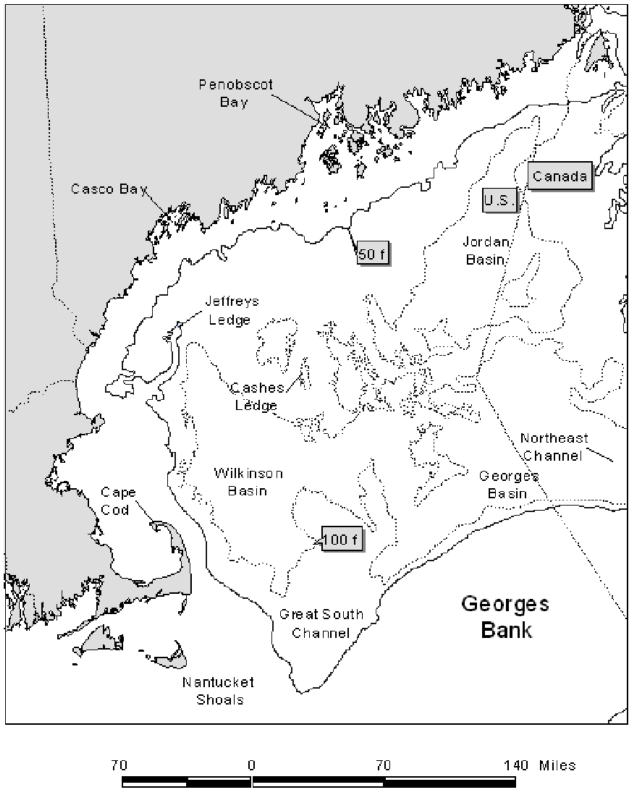
The Northeast U.S. Shelf Ecosystem includes the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, encompassing the slope sea offshore to the Gulf Stream. The continental slope includes the area east of the shelf, out to a depth of 2,000 m. Four distinct sub-regions comprise the NOAA Fisheries Northeast Region: the Gulf of Maine, Georges Bank, the Mid-Atlantic Bight, and the continental slope (Map 4, Map 5).

The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of 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 strong currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, NC. The continental slope begins at the continental shelf break and continues eastward with increasing depth until it becomes the continental rise. It is homogenous, with exceptions at the shelf break, some of the canyons, the Hudson Shelf Valley, and in areas of glacially rafted hard bottom. Pertinent physical characteristics of the sub-regions that could potentially be affected by this action are described in this section. Information in this document is from Stevenson et al. (2004).

Map 4. Northeast shelf ecosystem.



Map 5. Gulf of Maine.



Gulf of Maine

The Gulf of Maine (GOM) is bounded on the east by Browns Bank, on the north by the Nova Scotian (Scotian) Shelf, on the west by the New England states, and on the south by Cape Cod and Georges Bank. The GOM was glacially derived, and is characterized by a system of deep basins, moraines and rocky protrusions with limited access to the open ocean. This geomorphology influences complex oceanographic processes that result in a rich biological community.

The GOM is topographically unlike any other part of the continental border along the U.S. Atlantic coast. The GOM's geologic features, when coupled with the vertical variation in water properties, result in a great diversity of habitat types. It has twenty-one distinct basins separated by ridges, banks, and swells. The three largest basins are Wilkinson, Georges, and Jordan. Depths in the basins exceed 250 m, with a maximum depth of 350 m in Georges Basin, just north of Georges Bank. The Northeast Channel between Georges Bank and Browns Bank leads into Georges Basin, and is one of the primary avenues for exchange of water between the GOM and the North Atlantic Ocean.

High points within the Gulf include irregular ridges, such as Cashes Ledge, which peaks at 9 m below the surface, as well as lower flat-topped banks and gentle swells. Some of these rises are remnants of the sedimentary shelf that was left after most of it was removed by the glaciers. Others are glacial moraines and a few, like Cashes Ledge, are outcroppings of bedrock. Very fine sediment particles created and eroded by the glaciers have collected in thick deposits over much of the GOM, particularly in its deep basins. These mud deposits blanket and obscure the irregularities of the underlying bedrock, forming topographically smooth terrains. Some shallower basins are covered with mud as well, including some in coastal waters. In the rises between the basins, other materials are usually at the surface. Unsorted glacial till covers some morainal areas, as on Sewell Ridge to the north of Georges Basin and on Truxton Swell to the south of Jordan Basin. Sand predominates on some high areas and gravel, sometimes with boulders, predominates on others.

Coastal sediments exhibit a high degree of small-scale variability. Bedrock is the predominant substrate along the western edge of the GOM north of Cape Cod in a narrow band out to a depth of about 60 m. Rocky areas become less common with increasing depth, but some rock outcrops poke through the mud covering the deeper sea floor. Mud is the second most common substrate on the inner continental shelf. Mud predominates in coastal valleys and basins that often abruptly border rocky substrates. Many of these basins extend without interruption into deeper water. Gravel, often mixed with shell, is common adjacent to bedrock outcrops and in fractures in the rock. Large expanses of gravel are not common but do occur near reworked glacial moraines and in areas where the seabed has been scoured by bottom currents. Gravel is most abundant at depths of 20 - 40 m, except in eastern Maine where a gravel-covered plain exists to depths of at least 100 m. Bottom currents are stronger in eastern Maine where the mean tidal range exceeds 5 m. Sandy areas are relatively rare along the inner shelf of the western GOM, but are more common south of Casco Bay, especially offshore of sandy beaches.

Georges Bank

Georges Bank is a shallow (3 - 150 m depth), elongate (161 km wide by 322 km long) extension of the continental shelf that was formed by the Wisconsinian glacial episode. It is characterized by a steep slope on its northern edge and a broad, flat, gently sloping southern flank. The Great South Channel lies to the west. Natural processes continue to erode and rework the sediments on Georges Bank. Erosion and reworking of sediments will likely reduce the amount of sand available to the sand sheets and cause an overall coarsening of the bottom sediments (Valentine & Lough 1991).

Glacial retreat during the late Pleistocene deposited the bottom sediments currently observed on the eastern section of Georges Bank, and the sediments have been continuously reworked and redistributed by the action of rising sea level, and by tidal, storm and other currents. The strong, erosive currents affect the character of the biological community. Bottom topography on eastern Georges Bank is characterized by linear ridges in the western shoal areas; a relatively smooth, gently dipping sea floor on the deeper, easternmost part; a highly energetic peak in the north with sand ridges up to 30 m high and extensive gravel pavement; and steeper and smoother topography incised by submarine canyons on the southeastern margin.

The central region of the Bank is shallow, and the bottom is characterized by shoals and troughs, with sand dunes superimposed upon them. The two most prominent elevations on the ridge and trough area are Cultivator and Georges Shoals. This shoal and trough area is a region of strong currents, with average flood and ebb tidal currents greater than 4 km/h, and as high as 7 km/h. The dunes migrate at variable rates, and the ridges may also move. In an area that lies between the central part and Northeast Peak, Almeida et al. (2000) identified high-energy areas as between 35 - 65 m deep, where sand is transported daily by tidal currents, and a low-energy area at depths > 65 m that is affected only by storm currents.

The Great South Channel separates the main part of Georges Bank from Nantucket Shoals. Nantucket Shoals is similar in nature to the central region of the Bank. Currents in these areas are strongest where water depth is shallower than 50 m. This type of traveling dune and swale morphology is also found in the Mid-Atlantic Bight, and further described below. Sediments in this region include gravel pavement and mounds, some scattered boulders, sand with storm generated ripples, and scattered shell and mussel beds. Tidal and storm currents range from moderate to strong, depending upon location and storm activity (Valentine, pers. comm.).

Mid-Atlantic Bight

The Mid-Atlantic Bight includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream. Like the rest of the continental shelf, the topography of the Mid-Atlantic

Bight was shaped largely by sea level fluctuations caused by past ice ages. The shelf's basic morphology and sediments derive from the retreat of the last ice sheet, and the subsequent rise in sea level. Since that time, currents and waves have modified this basic structure.

Shelf and slope waters of the Mid-Atlantic Bight have a slow southwestward flow that is occasionally interrupted by warm core rings or meanders from the Gulf Stream. On average, shelf water moves parallel to bathymetry isobars at speeds of 5 - 10 cm/s at the surface and 2 cm/s or less at the bottom. Storm events can cause much more energetic variations in flow. Tidal currents on the inner shelf have a higher flow rate of 20 cm/s that increases to 100 cm/s near inlets.

The shelf slopes gently from shore out to between 100 and 200 km offshore where it transforms to the slope (100 - 200 m water depth and deeper) at the shelf break. In both the Mid-Atlantic and on Georges Bank, numerous canyons incise the slope, and some cut up onto the shelf itself. The primary morphological features of the shelf include shelf valleys and channels, shoal massifs, scarps, and sand ridges and swales. Most of these structures are relic except for some sand ridges and smaller sand-formed features. Shelf valleys and slope canyons were formed by rivers of glacier outwash that deposited sediments on the outer shelf edge as they entered the ocean. Most valleys cut about 10 m into the shelf, except for the Hudson Shelf Valley that is about 35 m deep. The valleys were partially filled as the glacier melted and retreated across the shelf. The glacier also left behind a lengthy scarp near the shelf break from Chesapeake Bay north to the eastern end of Long Island. Shoal retreat massifs were produced by extensive deposition at a cape or estuary mouth. Massifs were also formed as estuaries retreated across the shelf.

Some sand ridges are more modern in origin than the shelf's glaciated morphology. Their formation is not well understood; however, they appear to develop from the sediments that erode from the shore face. They maintain their shape, so it is assumed that they are in equilibrium with modern current and storm regimes. They are usually grouped, with heights of about 10 m, lengths of 10 - 50 km and spacing of 2 km. Ridges are usually oriented at a slight angle towards shore, running in length from northeast to southwest. The seaward face usually has the steepest slope. Sand ridges are often covered with smaller similar forms such as sand waves, megaripples, and ripples. Swales occur between sand ridges. Since ridges are higher than the adjacent swales, they are exposed to more energy from water currents, and experience more sediment mobility than swales. Ridges tend to contain less fine sand, silt and clay while relatively sheltered swales contain more of the finer particles. Swales have greater benthic macrofaunal density, species richness and biomass, due in part to the increased abundance of detrital food and the physically less rigorous conditions.

Sand waves are usually found in patches of 5 - 10 with heights of about 2 m, lengths of 50 - 100 m and 1 - 2 km between patches. Sand waves are primarily found on the inner shelf, and often observed on sides of sand ridges. They may remain intact over several seasons. Megaripples occur on sand waves or separately on the inner or central shelf. During the winter storm season, they may cover as much as 15% of the inner shelf. They tend to form in large patches and usually have lengths of 3 - 5 m with heights of 0.5 - 1 m. Megaripples tend to survive for less than a season. They can form during a storm and reshape the upper 50 - 100 cm of the sediments within a few hours. Ripples are also found everywhere on the shelf, and appear or disappear within hours or days, depending upon storms and currents. Ripples usually have lengths of about 1 - 150 cm and heights of a few centimeters.

Sediments are uniformly distributed over the shelf in this region. A sheet of sand and gravel varying in thickness from 0 - 10 m covers most of the shelf. The mean bottom flow from the constant southwesterly current is not fast enough to move sand, so sediment transport must be episodic. Net sediment movement is in the same southwesterly direction as the current. The sands are mostly medium to coarse grains, with finer sand in the Hudson Shelf Valley and on the outer shelf. Mud is rare over most of the shelf but is common in the Hudson Shelf Valley. Occasionally relic estuarine mud deposits are re-exposed in the swales between sand ridges. Fine sediment content increases rapidly at the shelf break, which is sometimes called the "mud line," and sediments are 70 - 100% fines on the slope. On the slope, silty sand, silt, and clay predominate.

The northern portion of the Mid-Atlantic Bight is sometimes referred to as southern New England. Most of this area was discussed under Georges Bank; however, one other formation of this region deserves note. The mud patch is located just southwest of Nantucket Shoals and southeast of Long Island and Rhode Island. Tidal currents in this area slow significantly, which allows silts and clays to settle out. The mud is mixed with sand and is occasionally resuspended by large storms. This habitat is an anomaly of the outer continental shelf.

Artificial reefs are another significant Mid-Atlantic habitat, formed much more recently on the geologic time scale than other regional habitat types. These localized areas of hard structure have been formed by shipwrecks, lost cargoes, disposed solid materials, shoreline jetties and groins, submerged pipelines, cables, and other materials (Steimle & Zetlin 2000). While some of materials have been deposited specifically for use as fish habitat, most have an alternative primary purpose; however, they have all become an integral part of the coastal and shelf ecosystem. It is expected that the increase in these materials has had an impact on living marine resources and fisheries, but these effects are not well known. In general, reefs are important for attachment sites, shelter, and food for many species, and fish predators such as tunas may be attracted by prey aggregations or may be behaviorally attracted to the reef structure.

5.6 Human Communities

This action evaluates the effect management alternatives may have on the economy, way of life, and traditions of human communities. These social and economic impacts may be driven by changes in fishery flexibility, opportunity, stability, certainty, safety, and/or other factors. While social and economic impacts could be solely experienced by individuals, it is more likely that impacts would be experienced across communities, gear types, and/or vessel size classes. Summarized here are the fisheries and human communities most likely to be impacted by the Alternatives under Consideration (Section 4.0). Social, economic and fishery information herein helps describe the response of the fishery to past management actions and predicting how the Framework Adjustment 62 alternatives may affect human communities. Also, this section establishes a descriptive baseline to compare predicted and actual changes resulting from management.

MSA Section 402(b), 16 U.S.C. 1881a(b) states that no information gathered in compliance with the Act can be disclosed, unless aggregated to a level that conceals the identity of individual submitters. Information in this section is provided consistent with this requirement.

5.6.1 Commercial Whiting Fishery

Red Hake

Over one-half of northern red hake catches were on groundfish trips and squid/whiting trips. The groundfish fishery catches were almost all discards while the squid/whiting catches were about two-thirds landings and one-third discards. Almost three-quarters of southern red hake was caught on squid, scallop, and squid/whiting trips. Most of the squid fishery catch was discards, all of the scallop fishery catch was discards, and most of the squid/whiting catch was landings. Red hake is part of the Bycatch Reduction Program (http://www.squidtrawlnetwork.com/red-hake-latest-high-avoidan/) which is a Cornell Cooperative Extension Marine Program funded by NOAA Fisheries and National Fish and Wildlife Foundation designed to develop innovative solutions to reduce bycatch through bycatch reduction devices and modifications to gear.

The three-year moving average of red hake discard rates has been variable over time; however, the most recent fishing years show the discard rates have generally been increasing. From FY17 to FY18, northern red hake discards increased from 59.4% to 63.2% and for southern red hake, discards increased from 67.1% to 76.4% (Table 18 and Table 19). In FY2018, discards accounted for 2.5 million lb. Most of this bycatch is associated with the small-mesh fishery that targets whiting and squid, and the scallop fishery.

The in-season AM was put in place on December 26, 2018 and also on February 3, 2020 for southern red hake, reducing the possession limit from 5,000 lb. to 400 lb. for the duration of the fishing year to prevent the southern red hake total allowable landing limit from being exceeded.

Table 18. Estimated FY 2017 catches of red hake by management area, compared to specifications. Data current as of July 20, 2018.

	Pounds	Metric tons	Percent of ACL (471 mt)	Percent of total catch
Northern red hake commercial landings	188,247	85	18.1%	40.6%
Northern red hake state-permitted only vessel landings	6	0	0%	0%
Northern red hake estimated discard	275,627	125	26.5%	59.4%
Northern red hake recreational catch (MRIP)	40,987	18.6	n/a	n/a
Northern red hake catch*	463,880	210	44.7%	100.0%
	Pounds	Metric tons	Percent of ACL (1631 mt)	Percent of total catch
Southern red hake landings	720,171	327	20.0%	31.9%
Southern red hake state-permitted only vessel landings	23,650	11	0.7%	1.0%
Southern red hake estimated discard	1,514,678	687	42.1%	67.1%
Southern red hake recreational catch (MRIP)	288,818	131	n/a	n/a
Southern red hake catch*	2,258,499	1,024	62.8%	100.0%

Table 19. Fishing year 2018 red hake landings and discards by stock area.

	Pounds	Metric tons	Percent of ACL (685 mt)	Percent of total catch
Northern red hake commercial landings	232,923	106	15.4%	36.7%
Northern red hake state-permitted only vessel landings	599	0	0%	0%
Northern red hake research catch outside of Magnuson	333	0	0%	0%
Northern red hake estimated discard	401,015	182	26.6%	63.2%
Northern red hake recreational catch (MRIP)	8,634	3.9	n/a	n/a
Northern red hake catch*	634,869	288	42.0%	100.0%
	Pounds	Metric tons	Percent of ACL (1,007 mt)	Percent of total catch
Southern red hake landings	762,178	346	34.3%	22.9%
Southern red hake state-permitted only vessel landings	23,026	10	1.0%	0.7%
Southern red hake research catch outside of Magnuson	303	0	0.0%	0.0%
Southern red hake estimated discard	2,535,990	1,150	114.2%	76.4%
Southern red hake recreational catch (MRIP)	340,891	155	n/a	n/a
Southern red hake catch*	3,321,497	1,507	149.6%	100.0%

Silver Hake

Over 70% of northern silver hake catches occurred on squid/whiting trips and another 10% were caught on groundfish trips. The discard rate for silver hake is typically lower than it is for red hake, presumably because of more market demand and better tolerance of shipping and handling. Nominal discards in the northern stock area were variable, peaking at 750 mt in 2007, and have been steadily declining but variable and currently estimated at 217 mt in 2018 (Table 21). Much of this variability in discards appears to be related to market demand. These peaks in discards resulted in the discard rate spiking to 43% in 2008 and 32% in 2010 (Section 5.2).

Over 80% of the southern whiting catches were from squid and squid/whiting trips, fairly evenly split between them. From FY17 to FY18, southern whiting estimated discards increased by about 1.54 million lb. (185%) from about 830,000 lb. to about 2.37 M lb. (Table 20 and Table 21). 90% of that increase was due to increased discards in the southern small mesh trawl strata. Total commercial landings in those strata increased 14.7%, thus the remaining ~170% increase was due to increases in discard rates. The silver hake discard rate in the southern stock area is typically even lower, under 20% throughout the time series (Section 5.2). The proportion discard in the southern area appears to be varying without trend. Discards were estimated to be only 150 mt in 2007, but increased to 1800 mt in 2011, before declining to 290 mt in 2015 and increasing to 1,076 mt in 2018 (Table 21).

Table 20. Estimated FY 2017 catches of whiting (silver and offshore hakes) by management area, compared to specifications. Data current as of July 20, 2018.

	Pounds	Metric tons	Percent of ACL (23,161 mt)	Percent of total catch
Northern silver hake commercial landings	5,885,728	2,670	11.5%	91.4%
Northern silver hake state-permitted only vessel landings	122,458	56	0%	2%
Northern silver hake estimated discard	433,154	196	0.8%	6.7%
Northern silver hake recreational catch (MRIP)	n/a	n/a	n/a	n/a
Northern silver hake catch*	6,441,340	2,922	12.6%	100.0%
	Pounds	Metric tons	Percent of ACL (29,621 mt)	Percent of total catch
Southern whiting landings	5,991,459	2,718	9.2%	87.3%
Southern whiting state-permitted only vessel landings	39,675	18	0.1%	0.6%
Southern whiting estimated discard	831,848	377	1.3%	12.1%
Southern whiting hake recreational catch (MRIP)	n/a	n/a	n/a	n/a
Southern whiting catch*	6,862,981	3,113	10.5%	100.0%

Table 21. Fishing year 2018 whiting (silver and offshore hake) landings and discards by stock area.

	Pounds	Metric tons	Percent of ACL (29,475 mt)	Percent of total catch
Northern silver hake commercial landings	4,116,496	1,867	6.3%	88.3%
Northern silver hake state-permitted only vessel landings	58,535	27	0%	1%
Northern silver hake research catch outside of Magnuson	5,121	2	0%	0%
Northern silver hake estimated discard	479,421	217	0.7%	10.3%
Northern silver hake recreational catch (MRIP)	121,420	55	n/a	n/a
Northern silver hake catch*	4,659,573	2,114	7.2%	100.0%
	Pounds	Metric tons	Percent of ACL (18,425 mt)	Percent of total catch
Southern whiting landings	7,429,249	3,370	18.3%	74.8%
Southern whiting state-permitted only vessel landings	128,972	59	0.3%	1.3%
Southern whiting research catch outside of Magnuson	277	0	0.0%	0.0%
Southern whiting estimated discard	2,372,686	1,076	5.8%	23.9%
Southern whiting hake recreational catch (MRIP)	419	0	n/a	n/a
Southern whiting catch*	9,931,183	4,505	24.4%	100.0%

5.6.1.1 Commercial Small-Mesh Multispecies Permits and Vessels

Vessels fishing for small-mesh multispecies in an exemption program must possess either an open access (Category K) or limited access (Categories A-F) NE multispecies permit. Small-mesh multispecies fishermen hold a range of other federal permits. A K-permit or groundfish permit (A-F) is required to land small-mesh multispecies.

The number of such permits issued in a year reflects the number of vessels potentially landing small-mesh multispecies. Since 2007, the number of open access (Category K) permits issued each year has ranged between 589 and 774, with 632 K permits issued in 2018 (Table 22). The number of groundfish permits (A to F) issued during the same time period ranged between 1,230 to 1,761 permits, with 1,238 groundfish permits issued in 2018.

Table 22. Number of permits held by small-mesh multispecies fisheries (active and latent).

CALENDAR_YEAR	K_Permit	Groundfish (A to F) Permit	Groundfish(A-F) or K Permits
2007	764	1008	1761
2008	774	941	1704
2009	736	887	1621
2010	721	850	1562
2011	651	751	1398
2012	645	718	1354
2013	597	692	1287
2014	589	685	1268
2015	594	642	1233
2016	607	635	1234
2017	605	629	1230
2018	632	612	1238

Note: K or Groundfish (A-F) is required to land small-mesh multispecies.
Source: GARFO/APSD April 9, 2020.

5.6.1.2 Landings and Discards

Catch rates of southern red hake have varied over time but has declined from 340 lb./trip in 2012 to 237 lb./trip in 2018 for all trips that caught red hake (Table 23). Although effort has increased slightly in recent years, total landings of southern red hake has been declining since 2014 (Table 24). Red hake landings decreased by 10.7% from 439 mt in 2013 to 392 mt in 2016. Commercial landings for red hake has averaged around 377 mt/yr (327-559 mt) and continues to be dominated by vessels fishing with the trawl gear, with less than 10% of the landings contributed by other fleets (Figure 8 and Table 24).

Total discards for red hake in both the north and the south have increased since 2013. The estimated discards of red hake in the south increased by 31% from 580 mt in 2013 to 920 mt in 2018 (Table 25). Since 2000, the relative contribution of discarded red hake to the total removals (landings and discards) has ranged between 8 –72%. The three-year average proportion of discarded red hake to the total removals is approximately 56% and also has been dominated by the trawl fleet (Figure 10). While discard of red hake by selected major gears show that the trawl gear remains the primary source of discarding, the small-mesh fleet is much more pronounced, contributing to approximately 90% of the total discards across all the fleets in the south. Reasons for red hake discard include limited market demand, poor quality, minimum retention size (too small) and filled quota.

Table 23. Southern red hake LPUEs (pounds/trip) on trips that caught red hake from 2012-2018.

Year	LPUE (pounds/trip)
2012	340
2013	216
2014	271
2015	279
2016	269
2017	320
2018	237

Figure 8. Southern red hake effort and VTR commercial landings (lb.) for all trips that caught red hake.

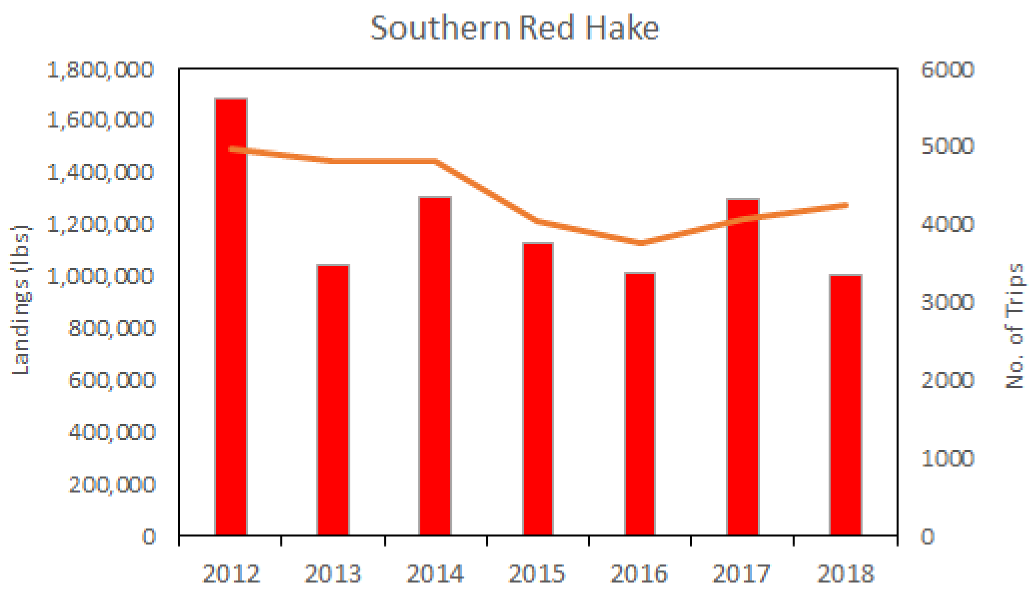


Figure 9. Total catch of southern red hake from 1994 –2018.

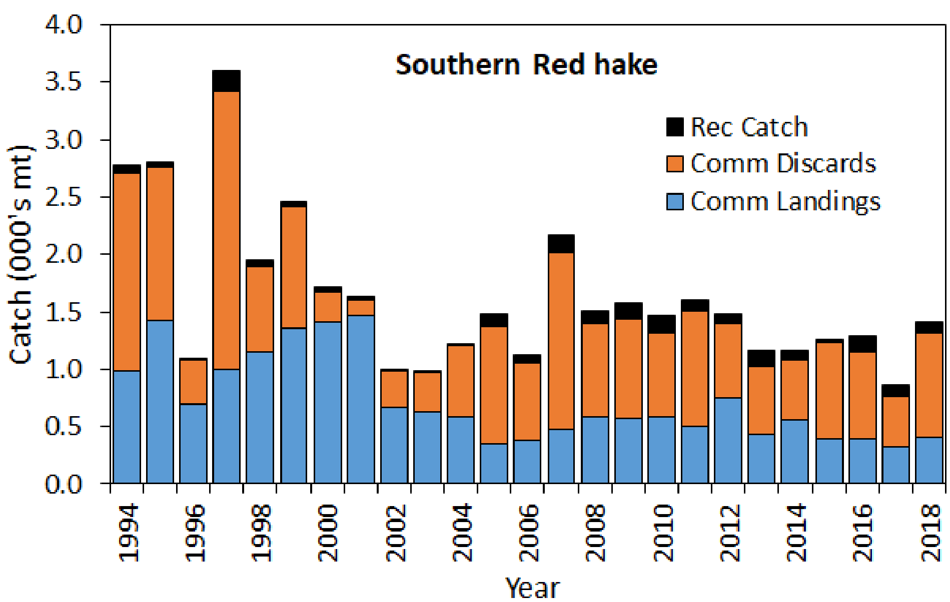


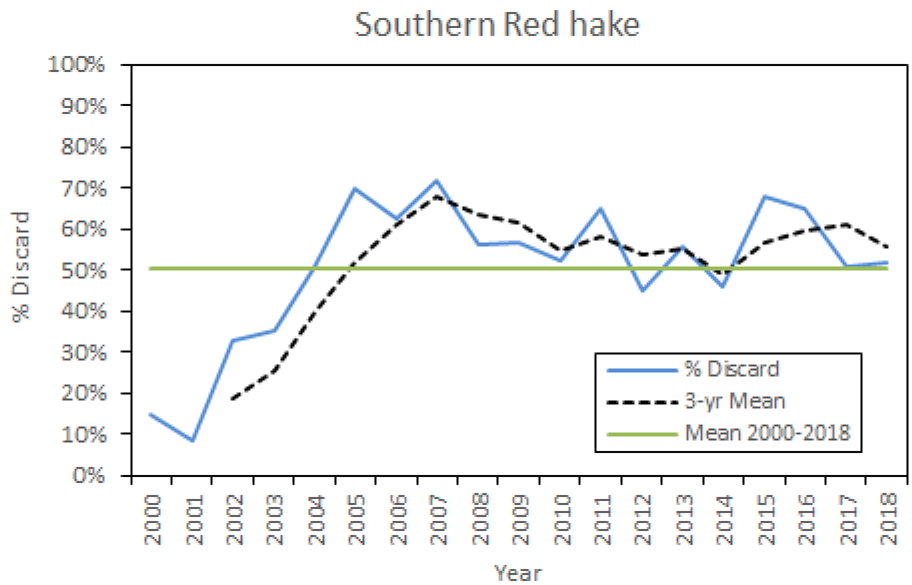
Table 24. Southern red hake landings by gear category in metric tons from 1994-2018.

Year	Trawl	Scallop Dredge	Other	Total
1994	851		132	983
1995	987	0	436	1423
1996	694		5	700
1997	982		17	999
1998	1142		12	1154
1999	1337		14	1351
2000	1398		17	1415
2001	1437	0	26	1463
2002	653		10	663
2003	619		3	623
2004	568	0	19	587
2005	340	1	15	356
2006	363	2	11	375
2007	453	6	12	472
2008	477	0	102	580
2009	531	1	48	579
2010	528	0	24	553
2011	476	0	19	495
2012	722	0	28	751
2013	421	0	17	439
2014	539	0	20	559
2015	375	0	13	388
2016	376	0	15	392
2017	314		13	327
2018	383	0	16	399

Table 25. Southern red hake discards by gear category in metric tons derived from Standardized Bycatch Methodology (SBRM) from 1989-2018.

Year	Otter Trawl Lg Mesh	Otter Trawl Small mesh	Shrimp Trawl	Scallop Trawl	Sink Gillnet	Longline	SBRM Total
1989	688.63	4324.38		0.00	0.00	0.00	5013.01
1990	1340.07	3510.82		0.00	0.00	0.00	4850.89
1991	360.09	2288.21		4.68	0.00	1.80	2654.78
1992	714.82	5681.03		20.36	0.18	0.00	6416.39
1993	7765.35	6904.39		18.09	0.18	0.00	14688.02
1994	728.69	3147.69		44.05	0.01	0.00	3920.44
1995	98.97	1303.54		27.11	0.01	0.00	1429.63
1996	394.36	284.24		18.92	0.00	0.00	697.52
1997	1620.26	524.56		58.84	0.07	0.00	2203.72
1998	6524.09	739.92		4.19	0.01	0.00	7268.22
1999	3673.35	348.60		43.79	0.17	0.00	4065.90
2000	4078.11	131.28		113.31	0.03	0.00	4322.73
2001	2423.41	334.24		34.38	0.10	0.00	2792.13
2002	13.31	234.35		25.73	0.17	0.00	273.57
2003	17.99	227.00		10.53	0.00	0.00	255.51
2004	180.28	431.60		29.56	0.00	0.00	641.45
2005	143.23	779.61		73.65	0.00	0.03	996.52
2006	100.18	442.06		98.18	0.00	0.11	640.53
2007	162.95	1147.99		20.83	0.00	0.03	1331.80
2008	148.63	513.83		52.87	0.00	25.24	740.57
2009	127.84	597.74		76.04	0.00	0.00	801.63
2010	74.91	591.10		55.04	0.01	0.00	721.06
2011	23.17	916.01		71.46	0.08	0.00	1010.72
2012	18.64	586.36		84.62	0.03	0.00	689.65
2013	7.43	523.54		44.57	0.00	0.00	575.54
2014	54.57	394.40		59.75	0.00	0.06	508.79
2015	23.80	817.53		58.26	0.02	0.30	899.91
2016	16.01	707.21		40.58	0.01	0.31	764.12
2017	12.67	355.17		74.65	0.00	0.07	442.56
2018	15.36	657.58		245.82	0.01	0.19	918.96

Figure 10. Southern red hake percent discards, 2000 – 2018.



5.6.1.3 Economic Characteristics of the Southern Red Hake Fishery

In FY2018, fishing in southern area landed about 759,299 pounds red hake exceeding annual southern red hake quota of 672,410 pounds specified in the 3-year specification period (FY2018-2020). Characteristics of southern red hake are analyzed in terms of its landing volumes by fishing zones (clustered statistical areas), co-occurrence with other species, types of gear and mesh, and trip lengths that largely occur in landing the species.

Area clusters are based on Northwest Atlantic Fisheries Organization (NAFO) division alpha numeric codes (Map 2). Southern management is divided into five major clusters as in the Table 26. The clusters are based on sea environmental similarities, such as water column depth, distance from shore, etc.

Table 26. Southern management statistical areas and area clusters.

Mgmt. Area	NAFODIV	NAFODVCD	Statistical Areas	Area Names
Southern	5ZU	52	525 to 526, 541,543, and 562	Southern George Bank
	5ZW	53	533 to 534, 537 to 539	Southern New England
	6A	61	611 to 616	Inshore New York
	6B	62	621 to 623, 625 to 628	Mid-Atlantic
	6C	63	631 to 638	Other
Northern			511 to 522, and 561	Northern Gulf of Maine

Co-Occurrences of Southern Red Hake with Other Species and Their Landings

Red hake is largely landed as a bycatch species rather than targeted one. There are few species that are observed to have been landed together with red hake in various amount.

Table 27 summarizes co-occurrences of southern red hake with other key species by area. Majority of landed red hake came from the area clusters 5ZW and 6A. Although 5ZU appears to have abundance of red hake from the sea sampling observations, but the catches from this area may not have been landed due to distance and relatively high perishable nature of the species. Trip level data indicates co-occurrence species with red hake are primarily silver hake, squid loligo, angler, butterfish, summer flounder, mackerel, scup, and black sea. About two-thirds of the red hake landings occurred on trips with red hake over 400 pounds on a trip. Likewise, bottom trawl gear and smaller mesh sizes attributed to majority of red hake landings in the southern management during FY2018.

Table 27. Co-occurrence of red hake with other species on trips with >=1 lb. red hake by area (South/FY2018).

Co-occurrence Species	Landings (lb.) by Areas				
	5ZU	5ZW	6A	6B	6C
012 (Angler)	206,473	1,787,308	1,985,159	136,330	-
051 (Butterfish)	92,367	581,347	880,598	132,416	2,782
121 (Summer Flounder)	7,279	619,117	1,415,801	203,553	3,171
152 (Red Hake)	3,317	330,156	358,217	2,716	48
212 (Mackerel)	2,167	150,396	230,265	28,665	449
329 (Scup)	24,033	3,354,415	3,167,334	18,307	5
335 (Black Sea Bass)	804	333,622	996,317	314,911	68,736
365 (Skates)	62,655	6,246,461	4,875,313	154,202	54
509 (Silver Hake)	885,443	2,549,048	707,740	25,554	-
801 (Squid loligo)	63,050	4,109,886	8,583,559	2,598,712	349

Table 28 further details the landings for the co-occurrence species with red hake by area clusters into different trip lengths ranging from one-day trip to multi-days trips. Large volume of red hake landings is associated with one-day trip rather than in multi-days fishing trips. The area 5ZU is largely Southern George Bank area and is a distant fishery. There appears negligible amount of red hake landing on multi-days trips to this area although silver hake landings from this area was high. On the other hand, the area cluster 5ZW is nearshore Southern New England area and one-day trips landed large volume of red hake from this zone. Likewise, the area cluster 6A is largely inshore NY and red hake is landed in large volume from this area on one-day trips. Red hake landings from 6B (Mid-Atlantic) and other areas have been much less whether on a one-day or multi-days trips.

Table 28. Co-occurrence of red hake w/ other species on trips with red hake landing >=1 lb. by area & trip length (South/FY2018).

Co-occurrence Species and their landings lb.	**Trip Length catg.**	**Landings (lb.) by Area**				
		5ZU	**5ZW**	**6A**	**6B**	**6C**
012 Angler	1 day	2,885	1,084,796	1,657,544	126,097	
	2 day	14,051	610,411	270,067	884	
	3 day	3,117	58,608	9,001	207	
	4 day	1,675	20,310	18,104	386	
	GT 4	184,745	13,183	30,443	8,756	
051 Butterfish	1 day	-	429,281	237,474	1,181	1,866
	2 day	-	38,469	26,614	390	40
	3 day	5,952	21,190	15,366	2,835	601
	4 day	3,880	18,814	8,421	1,335	70
	GT 4	82,535	73,593	592,723	126,675	205
121 Summer Flounder	1 day	1,467	403,673	504,409	30,091	301
	2 day	108	31,915	210,134	7,859	
	3 day	312	22,766	95,091	10,831	5
	4 day	435	42,801	86,548	40,421	43
	GT 4	4,957	117,962	519,619	114,351	2,822
152 Red Hake	1 day	406	233,549	284,479	1,152	48
	2 day	-	41,047	23,778	241	
	3 day	1	12,971	6,964	28	
	4 day	415	19,043	11,899	-	
	GT 4	2,495	23,546	31,097	1,295	
509 Silver Hake	1 day	30	1604869	412141	133	
	2 day	2	150055	27750	37	
	3 day	69603	139721	34897	495	
	4 day	151015	183739	63301	269	
	GT 4	664793	470663	169652	24620	

Co-occurrence Species and their landings lb.	**Trip Length catg.**	**Landings (lb.) by Area**				
		5ZU	**5ZW**	**6A**	**6B**	**6C**
212 Mackerel	1 day	17	92100	147259	76	434
	2 day	100	15747	44669	-	
	3 day	10	21656	1874	45	
	4 day	-	6300	6968	1530	
	GT4	2040	14593	29495	27014	15
329 Scup	1 day	33	2031120	2104709	1760	5
	2 day	-	264613	554480	13500	
	3 day	24000	312727	186389	12	
	4 day	-	367333	102079	5	
	GT 4	-	378622	219678	3030	
335 Black Sea Bass	1 day	620	263024	432811	262622	68186
	2 day	-	11109	169429	15269	
	3 day	81	2715	92612	3200	
	4 day	10	3725	21980	4223	
	GT 4	93	53049	279485	29597	550
365 Skates	1 day	18100	5190657	3905747	153389	
	2 day	5300	821796	888639	800	
	3 day	120	198668	44439	-	54
	4 day	350	11910	12695	-	
	GT 4	38785	23430	23793	13	
801 Squid loligo	1 day	-	1202255	1494466	120	
	2 day	25	232200	237590	14325	
	3 day	1290	254570	608565	73315	
	4 day	850	451277	728418	31939	45
	GT 4	60885	1969584	5514521	2479013	304

Table 29 provides a ratio of red hake landings with each of the co-occurrence species at different trip lengths. The ratios are derived from the preceding Table 28. This ratio at different combination of species, trip length and area zones may be helpful in the estimation of red hake discards from distant fisheries.

Table 29. Ratios of red hake to co-occurrence species landings by area & trip length (South/FY2018).

Co-occurrence Species	**Trip Length catg.**	**Landings (lb.) by Area**					**Co-occurrence Species**	**Trip Length catg.**	**Landings (lb.) by Area**				
		5ZU	**5ZW**	**6A**	**6B**	**6C**			**5ZU**	**5ZW**	**6A**	**6B**	**6C**
012 Angler	1 day	0.1407	0.2153	0.1716	0.0091		212 Mackerel	1 day	23.8824	2.5358	1.9318	15.1579	0.1106
	2 day	0	0.0672	0.088	0.2726			2 day	0	2.6067	0.5323		
	3 day	0.0003	0.2213	0.7737	0.1353			3 day	0.1	0.599	3.7161	0.6222	
	4 day	0.2478	0.9376	0.6573	0			4 day		3.0227	1.7077	0	
	GT 4	0.0135	1.7861	1.0215	0.1479			GT4	1.223	1.6135	1.0543	0.0479	
051 Butterfish	1 day	0	1.8381	0.8348	1.0252	38.87	329 Scup	1 day	12.303	0.115	0.1352	0.6545	9.6
	2 day		0.9372	1.1193	1.6183			2 day		0.1551	0.0429	0.0179	
	3 day	5952	1.6336	2.2065	101.25			3 day	0	0.0415	0.0374	2.3333	
	4 day	9.3494	0.988	0.7077				4 day		0.0518	0.1166	0	
	GT 4	33.0802	3.1255	19.0605	97.8185			GT 4		0.0622	0.1416	0.4274	
121 Summer Flounder	1 day	3.6133	1.7284	1.7731	26.1207	6.27	335 Black Sea Bass	1 day	0.6548	0.8879	0.6573	0.0044	0.0007
	2 day		0.7775	8.8373	32.61			2 day		3.6949	0.1403	0.0158	
	3 day	312	1.7551	13.6547	386.8214			3 day	0.0123	4.7784	0.0752	0.0088	
	4 day	1.0482	2.2476	7.2736				4 day	41.5	5.1122	0.5414	0	
	GT 4	1.9868	5.0098	16.7096	88.3019			GT 4	26.973	0.4439	0.1113	0.0438	
152 Red Hake	1 day						365 Skates	1 day	0.0224	0.045	0.0728	0.0075	
	2 day							2 day	0	0.0499	0.0268	0.3013	
	3 day							3 day	0.0083	0.0653	0.1567		
	4 day							4 day	1.1857	1.5989	0.9373		
	GT 4							GT 4	0.0643	1.0049	1.307	99.6154	
509 Silver Hake	1 day	13.5333	0.1455	0.6902	8.6617		801 Squid loligo	1 day		0.1943	0.1904	9.6	
	2 day	0	0.2735	0.8569	6.5135			2 day	0	0.1768	0.1001	0.0168	
	3 day	0	0.0928	0.1996	0.0566			3 day	0.0008	0.051	0.0114	0.0004	
	4 day	0.0027	0.1036	0.188	0			4 day	0.4882	0.0422	0.0163	0	
	GT 4	0.0038	0.05	0.1833	0.0526			GT 4	0.041	0.012	0.0056	0.0005	

Fishermen are required to declare fishing activity declaration code when they fish in federal waters and land the fishes. The activity code summarizes the area, gear, and any other boundaries associated with the fishing activity. The analysis identifies the major fishing activity code associated with the highest amount of red hake landings in southern area in FY2018.

Table 30 presents the co-occurrence of red hake other species and their landings by fishing activity declaration codes. The activity code **DOF-CML-XXXWXX** (open area commercial fishery using bottom trawl gear) has the highest amount of red hake landings in south as it attributes to 55.1 percent of red hake landings in the southern management during FY2018. Also notable is bottom trawl gear (W) associated to landings of most red hakes and silver hakes along with other co-occurrence species. The last column in Table 30 indicates that about 68.97 percent of southern silver hake landings had some amount of red hake at different volumes.[13] Likewise, about 16.85 percent of squid loligo landings is associated with some level of red hake landings.

[13] Of the total 4.167 mil pounds of silver hake landed in southern management, about 2.874 mil pounds of silver hake landing was associated to red hake landings as well. Therefore, about 69 percent of silver hake landings is associated to some exposure to red hake landings. However, actual ratio of red hake landing to co-occurrence species landing varies by trip length and area fished among other factors (Table 29).

Table 30. Co-occurrence of red hake with other species and their landings (lb.) by fishing activity declaration code (FY2018 /Southern Area).

Species	Unknown Activity Codes	DOF-CML-XXXWXX	NMS-COM-OPAWXD	SMB-SLM-OPXWXX	SMB-SLM-OPXXXX	SMB-SQL-OPXWXX	SMB-SQL-OPXXXX	Other Activity Codes	Total Species Landing with Southern Red Hake	Total Species Landings (South)	% Total Species Landings with Southern Red Hake
	Missing activity code	*Declare out of fishery commercial bottom trawl*	*NMS common pool*	*Squid mackrl btrfsh long fin sqd w/ mackrl open area*	*Squid mackrl btrfsh long fin sqd bottom trawl*	*Squid mackrl btrfsh long fin sqd open area bottom trawl*	*Squid mackrl btrfsh long fin sqd open area*				
Red Hake (152)	206,763	382,662	7,155	16,098	26,344	18,782	16,981	19,668	694,453	694,454	100%
Silver Hake (509)	383,949	1,961,401	4,463	51,688	98,452	90,038	248,326	36,090	2,874,406	4,167,785	68.97%
Butterfish (051)	181,525	331,125	2,088	6,548	27,105	22,246	61,430	7,034	639,101	1,689,510	37.83%
Winter Flounder (120)	2,455	36	22,828	-	-	-	-	57,269	82,588	264,549	31.22%
Summer Flounder (121)	58,073	138,636	11,358	13,024	4,662	8,088	5,492	22,011	261,345	2,248,921	11.62%
Mackerel (212)	13,463	63,496	4	4,307	2,093	3,966	7,727	703	95,759	411,942	23.25%
Scup (329)	605,517	874,486	25,870	40,501	90,880	102,300	58,365	82,434	1,880,352	6,564,094	28.65%
Black Sea Bass (335)	193,331	52,911	2,293	996	2,320	8,388	2,045	9,277	271,560	1,714,389	15.84%
Skates (365)	54,748	1,029,916	647,377	11,284	5,281	7,267	6,227	1,294,421	3,057,061	11,338,685	26.96%
Squid loligo (801)	255,361	185,129	6,154	195,524	400,401	506,418	938,523	99,360	2,586,870	15,355,557	16.85%
% Red Hake	**29.77%**	**55.10%**	**1.03%**	**2.32%**	**3.79%**	**2.70%**	**2.45%**	**2.83%**			
Trips (distinct)	**2,394**	**846**	**81**	**49**	**79**	**81**	**90**	**NA**			
Permits (distinct)				**11**	**12**	**27**	**25**	**NA**			

Fishing efforts and vessel sizes in landing southern red hake (Table 31) provides different sizes of vessels associated to red hake landings by fishing areas. In FY2018, there were 184 permits with around 4,000 trips that landed red hake in the south (Table 31 and Table 32). About 95 percent of fishing trips that landed red hake occurred in 5ZW and 6A areas. Throughout the fishing area, the vessel sizes ranged between 20 feet and 117 feet with an overall average vessel length of 58 feet associated to red hake landings. Relatively larger vessels were in the area 5ZU, i.e., average vessel length 77 feet.

Table 31. Distribution of southern red hake landings and fishing effort (vessel length and trips by area) in FY2018.

Areas or Zones							
NAFODIV	**NAFODVCD**	**Sum of southern red hake landings (pounds)**	**Avg. length**	**Max length**	**Min length**	**Std Dev of length**	**Count of trips**
5ZU	52	3,967	77	90	55.9	9.4	18
5ZW	53	310,643	60	117.4	31.7	10.8	1340
6A	61	376,708	58	106	20	15.97	2459
6B	62	3,001	49	92.3	27	14.21	172
6C	63	48	39	40.1	27	3.78	12
Grand Total or Mean		**694,367**	**58**	**117.4**	**20**	**14.57**	**4,001**

Revenue from Red Hake and Its Distribution at Trip and Permit Level

Fishing revenue from red hake accounted for less than one percent of annual permit or vessel value in for both southern and northern management areas in FY2018. Table 32 presents income from fishing for the vessels (or permits) that landed some amount of red hake at least in one trip during the FY2018. Red hake represented 0.33 percent of annual permit or vessel value in the South, but 0.69 percent in North. Majority of the red hake landings were in South, i.e., 76 percent. The average annual fishing revenue for those landing red hake was nearly $500,000 in both management zones.

Table 32. Permit or vessel value from key fish species for those landing red hake (South/ FY2018).

Mgmt. Area	**No. of Permits or Vessels***	**Revenues****	**Revenues (in nominal dollars) from**			**Annual fleet total vessel or permit value that landed red hake**	**Avg. Annual value per vessel or permit**
			All other species	**Red hake**	**Whiting**		
All	205	Revenue	$97,950,104	$379,589	$8,678,907	$107,008,600	$521,993
		% Revenue	88.61	0.35	11.04		
South	184	Revenue	$82,284,522	$289,587	$5,531,194	$88,105,303	$478,833
		% Revenue	93.40	0.33	6.27		
North	27	Revenue	$10,143,979	$89,985	$2,872,199	$13,106,163	$485,413
		% Revenue	77.39	0.69	21.92		

*Permit value is the annual value of fishes associated with a permit.
**Revenues were estimated using weighted average price of $0.42 per pound for FY2018.

Table 33 and Table 34 provide frequency distribution of red hake revenue at trip and permit levels in the southern management during FY2018. The average per trip revenue from red hake was about $64 with a range from $1 to $2,545 in a trip with red hake. About two-thirds of the trips with red hake had a revenue less than $50 with an average $10 per trip. Likewise, the average annual revenue from red hake was $1,574 per vessel with a range from $1 to $21,380 for the permits that landed red hake. More than half of the vessels had annual revenue from red hake less than $500 with an average per boat revenue of $101. Therefore, revenue from red hake constitutes a small share towards income from fishing.

Table 33. Frequency distribution of revenue from southern red hake at the trip level (South/FY2018).

Revenue Range (2018$)	No. of Trips	Sum Revenue $	Cumulative Trips	Cumulative Revenue	Cumulative Trips %	Cumulative Revenue %	Avg $ per Trip
<$50	3,280	$34,021	3,280	$34,021	72.9%	11.7%	$10.37
$50-$100	439	$31,044	3,719	$65,065	82.7%	22.5%	$70.72
$100-$200	363	$52,028	4,082	$117,093	90.7%	40.4%	$143.33
$200-$500	334	$99,045	4,416	$216,138	98.2%	74.6%	$296.54
$500-$1,000	61	$40,841	4,477	$256,979	99.5%	88.7%	$669.52
$1,000-$2,600	22	$32,608	4,499	$289,587	100.0%	100.0%	$1,482.18
Sum or Average	**4,499**	**$289,587**					**$64.37**

Table 34. Frequency distribution of revenue from southern red hake at the permit level (South/FY2018).

Revenue Range (2018$)	No. of Permits or Boats	Sum Revenue $	Cumulative Boats	Cumulative Revenue	Cumulative Boats %	Cumulative Revenue %	Annual Average revenue $ per Boat
< $500	103	$10,368	103	$10,368	56.0%	3.6%	$101
$500-$1,000	19	$12,623	122	$22,991	66.3%	7.9%	$664
$1,000-$1,500	15	$17,615	137	$40,606	74.5%	14.0%	$1,174
$1,500-$2,000	5	$8,342	142	$48,948	77.2%	16.9%	$1,668
$2,000-$2,500	7	$15,016	149	$63,964	81.0%	22.1%	$2,145
$2,500-$3,000	7	$19,192	156	$83,156	84.8%	28.7%	$2,742
$3,000-$3,500	6	$19,579	162	$102,735	88.0%	35.5%	$1,630
$3,500-$7,000	11	$50,122	173	$152,857	94.0%	52.8%	$5,651
>$7,000	11	$136,730	184	$289,587	100.0%	100.0%	$14,136
Sum or Average	**184**	**$289,587**					**$1,574**

Table 35. Southern red hake effort, landings (lb.), and revenue by sub-division and mesh size in FY2018.

Sub-division	Mesh size	Southern red hake landings (lb.)	Southern red hake revenue ($)	Number of trips
5Ze	Blank	2,561	1,063	10
	SM	755	313	5
5Zw	LM	11,275	4,679	230
	MM	36,693	15,228	250
	NA	6,390	2,652	73
	SM	247,197	102,587	630
6A	LM	8,688	3,606	137
	MM	40,182	16,676	339
	NA	146,030	60,602	1,125
	SM	145,419	60,349	513
6B	MM	670	278	
	NA	823	342	74
	SM	650	270	2
6C	NA	37	15	6
	GRAND TOTAL	**647,370**	**268,660**	**3,394**
		Sub-total lb.	**Sub-total revenue ($)**	**Sub-total # trips**
	Large Mesh	19,963 (3%)	8,285	367 (11%)
	Medium Mesh	77,545 (12%)	32,181	589 (18%)
	Small Mesh	394,021 (61%)	163,519	1,150 (36%)
	NA/blank/unknown	155,841 (24%)	64,674	1,113 (35%)

Note: Data with missing sub-divisions were removed from this table. Revenues were estimated using weighted average price of $0.42 per pound for FY2018.

Table 36. Southern red hake landings in large mesh by 50 permits in FY2020.

Trip lb. range	No of Large Mesh trips	Sum LB.	% of Large Mesh Trips	% of Large Mesh LB.
1 to 50	484	5,532	81.8%	24.4%
50-100	60	4,025	10.1%	17.8%
100-200	23	3,346	3.9%	14.8%
200-300	12	2,532	2.0%	11.2%
300-400	6	1,953	1.0%	8.6%
400-500	2	880	0.3%	3.9%
500-600	2	1,115	0.3%	4.9%
600-700	0	0	0.0%	0.0%
700-800	0	0	0.0%	0.0%
800-900	0	0	0.0%	0.0%
900-1,000	2	1,975	0.3%	8.7%
>1,000	1	1,285	0.2%	5.7%
N=50 permits	**592**	**22,643**		

5.6.2 Recreational Catch and Other Landings

Recreational catch of southern red hake by recreational fishermen and by commercial vessels fishing in state waters, generally within 3 miles of shore, is very minor portion of the total catch (Table 18 - Table 21 and Table 37).

State-permitted only vessel landings account for minor northern and southern silver hake landings and minor northern and southern red hake landings relative to total whiting catch in FY2017 and FY2018. Northern red hake landings account for the least of the state-permitted only vessel landings while Northern silver hake stock in FY2017 and Southern silver hake stock in FY2018 account for the highest state-permitted only vessel landings (Table 37).

Table 37. Recreational and state-permitted catch (lb. and mt) by whiting stock in FY2017 and FY2018.

Fishing Year	Recreational and state-permitted catch by stock	Pounds	Metric tons
FY2017	Northern silver hake recreational catch (MRIP)	n/a	n/a
	Northern silver hake state-permitted only vessel landings	122,458	56
	Southern silver hake recreational catch (MRIP)	n/a	n/a
	Southern silver hake state-permitted only vessel landings	39,675	18
	Northern red hake recreational catch (MRIP)	40,987	18.6
	Northern red hake state-permitted only vessels landings	6	0
	Southern red hake recreational catch (MRIP)	288,818	131
	Southern red hake state-permitted only vessels landings	23,650	11
FY2018	Northern silver hake recreational catch (MRIP)	121,420	55
	Northern silver hake state-permitted only vessel landings	58,535	27
	Southern silver hake recreational catch (MRIP)	419	0
	Southern silver hake state-permitted only vessel landings	128,972	59
	Northern red hake recreational catch (MRIP)	8,634	3.9
	Northern red hake state-permitted only vessels landings	599	0
	Southern red hake recreational catch (MRIP)	340,891	155
	Southern red hake state-permitted only vessels landings	23,026	10

5.6.3 Fishing Communities

Consideration of the economic and social impacts on fishing communities from proposed fishery regulations is required under the National Environmental Policy Act (NEPA) and the Magnuson Stevens Fishery Conservation and Management Act, particularly, National Standard 8 which defines a “fishing community” as “a community which is substantially dependent on or substantially engaged in the harvesting or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community” (16 U.S.C. § 1802(17)).

Determining which fishing communities are “substantially dependent” on, and “substantially engaged” in, the small-mesh multispecies fishery can be difficult. Although it is useful to narrow the focus to individual communities in the analysis of fishing dependence, there are several potential issues with the confidential nature of the information. There are privacy concerns with presenting the data in such a way that proprietary information (landings, revenue, etc.) can be attributed to an individual vessel or a small group of vessels. This is particularly difficult when presenting information on ports that may only have a small number of active vessels.

To gain a better perspective on the nature of the small-mesh multispecies fishery and the character of the affected human environment, a broader interpretation of fishing community has been applied to include almost all communities with a substantial involvement in or dependence on the small-mesh multispecies fishery. In terms of National Standard 8 (NS 8), some of the communities identified in this section may not fit the strict interpretation of the criteria for substantial dependence on fishing. The fishing communities that meet the legal definition (as promulgated through NS 8) are likely to be considered a subset of the broader group of communities of interest that are engaged in the small-mesh multispecies fishery and identified in this document.

National Standard 8 requires the Council to consider the importance of fishery resources to affected communities and provide those communities with continuing access to fishery resources, but it does not allow the Council to compromise the conservation objectives of the management measures. “Sustained participation" is interpreted as continued access to the fishery within the constraints of the condition of the resource.

5.6.3.1 Small-Mesh Multispecies Fishery

There have been over 238 port communities that have been a homeport or landing port to one or more active small-mesh multispecies vessels since 1996. These ports primarily occur from Maine to New Jersey. The level of activity in the small-mesh multispecies fishery has varied across time. This section identifies the communities for which whiting and red hake are particularly important. Clay et al. (2007) has a detailed profile of each port, including important social and demographic information. While these data describe a community's dependence on the small-mesh multispecies fishery, it is important to remember that at least some of the individual vessels therein are even more dependent on the fishery. In some cases, groups of communities identified above have been disaggregated so that information specific to certain communities can be provided and so that important details about individual communities are not lost.

Community of Interest Criteria. There are 19 Communities of Interest for the small-mesh multispecies fishery, which meet at least one of the following criteria (Table 38):

- Cumulative whiting and red hake landings of at least 5M pounds (2,300 mt) between 1996-2016.
- Whiting and red hake landings of at least 200,000 pounds (91 mt) in 2016.

Table 38. Communities of Interest in the small-mesh multispecies fishery.

State	Community	Landings				
		≥5M lb., 1996-2016	≥200K lb., 2016	≥500K lb., 2016	≥1M lb., 2016	≥3M lb., 2016
ME	Portland	√				
NH	Seabrook	√	√			
MA	Gloucester	√	√	√	√	√
	Boston		√			
	Provincetown	√	√			
	New Bedford	√	√	√	√	√
RI	Newport	√				
	Point Judith	√	√	√	√	√
CT	Stonington	√				
	New London	√	√	√		
NY	Greenport	√				
	Montauk	√	√	√	√	
	Shinnecock	√				
	Hampton Bay	√				
	Point Lookout	√				
	New York City	√	√	√		
NJ	Belford	√				
	Point Pleasant	√				

5.6.3.2 Community Characteristics

Table 38 presents some economic characteristics of top nine ports in landing small-mesh multispecies in 2016 – a subset of the Communities of Interest. The value of small-mesh multispecies to total value of all fish landed in those ports range between 1 to 90%. Gloucester (MA) had the largest number of trips (n=339 trips) whose revenues were >50% from whiting. The top port for landing whiting, New Bedford (MA) had about 1.1% of total port value of landing from hake species; Point Judith and Gloucester had 4% of fish value from small-mesh multispecies; Montauk had 7.6% of fish value from small-mesh multispecies; and New London had 15% of fish value from small-mesh multispecies.

Table 39 and Table 40 show participation of fishermen in terms of number of trips landing 2,000 lb. or more small-mesh multispecies at various ports in 1996 and 2016. Many ports had begun to have few trips landed after 2011. Fishermen participation in landing silver hake in major ports have declined significantly over the past two decades, as only three ports in 2016 against nine in 1996 had over 100 trips that landed 2,000 lb. or more silver hake. While many ports with trips 2,000 pounds or more have declined significantly in trip landings, only New Bedford, MA experienced a rise of trips with landing volumes of 2,000 lb. or more. While many ports had begun to have few landed small-mesh multispecies trips as early as 1997, about 25% of the ports have maintained relatively stable number of trips landing one or more pounds throughout 1996-2016 due to the port's participation in other fisheries with incidental small-mesh multispecies landings.

Table 39. Top nine ports for landing whiting and their economic characteristics in 2016.

ST	Top Ports in 2016	Dealers	Whiting Live LB.	Red Hake Live LB.	Whiting Value	Red Hake Value	Whiting Target Trips	Whiting Trips	Sum of Landing Events, all trips	Landing Live LB. (All Fish)	Total Value (All Fish)	Ratio
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(E+F)/ (K)
MA	New Bedford	86	3,789,176	65,357	$3,461,340	$38,829	125	294	10,834	410,820,837	$326,329,306	0.011
RI	Point Judith	50	3,669,765	391,709	$2,065,797	$138,336	117	2,558	23,823	58,789,078	$55,731,437	0.040
MA	Gloucester	74	2,980,214	172,797	$2,028,907	$54,072	339	1,750	21,753	66,414,851	$52,854,591	0.039
NY	Montauk	42	1,186,498	218,359	$1,169,698	$130,414	122	878	10,369	12,601,398	$17,068,995	0.076
CT	New London	19	678,790	81,412	$664,795	$65,422	115	242	1,626	9,072,205	$4,881,024	0.150
NY	New York City	6	483,810	12,425	$310,474	$6,478	36	36	139	534,226	$349,813	0.906
NH	Seabrook	4	302,998	22,248	$250,985	$10,189	118	387	2,871	1,689,660	$2,725,660	0.096
MA	Provincetown	22	217,325	268	$80,425	$116	39	43	3,475	7,587,021	$8,187,669	0.010
MA	Boston	18	216,497	-	$170,223	$0	18	201	2,578	12,810,968	$16,961,715	0.010

Source: NMFS dealer data, accessed 2017.

Table 40. Trips landing ≥ 2,000 pounds of small-mesh multispecies in Communities of Interest, 1996-2016.

Landed Port		1996		2016		Notes
		trips	rank	trips	rank	
ME	Portland	453	2	<100	>3	Peak in 1996; generally declined trend since 1996; minimal since 2008.
NH	Seabrook	<100	>9	<100	>3	Fluctuating; peak in 2012.
	Rye	<100	>9	<100	>3	None or minimal until 2009; peak in 2012.
MA	Gloucester	409	3	230	1	Peak in 1996; fluctuated, but generally declining trend.
	Boston	<100	>9	<100	>3	None until 1998; fluctuating since; peak in 2015.
	Provincetown	110	9	<100	>3	Peak in 2001; declining since 2011.
	New Bedford	<100	>9	145	3	Peak in 2003; generally increasing trend.
RI	Newport	<100	>9	<100	>3	Peak in 2001; decreasing trend; zero since 2012.
	Point Judith	801	1	179	2	Peak in 1998; decreasing trend.
CT	Stonington	<100	>9	<100	>3	Peak in 2001; fluctuating trend.
	New London	159	8	<100	>3	Peak in 1996; declining trend.
NY	Greenport	201	6	<100	>3	Peak in 1996; declining trend; zero since 2012.
	Montauk	217	4	<100	>3	Peak in 1998; generally declining trend.
	Shinnecock	205	5	<100	>3	Peak in 1998; generally declining trend.
	Hampton Bay	<100	>9	<100	>3	Peak in 1997; declining trend.
	New York	<100	>9	<100	>3	None or minimal until 2011, then increasing.
NJ	Belford	<100	>9	<100	>3	Peak in 2009; fluctuating trend.
	Point Pleasant	174	7	<100	>3	Peak in 1997; declining trend.
Total		**2,967**		**563**		

Source: NEFSC VTR data, accessed 2017.

Table 41. Trips landing ≥ 1 pound of small-mesh multispecies in landing ports, 1996-2016.

Landed Ports		1996		2016		Notes
		Trips	Rank	Trips	Rank	
ME	Portland	793	3	175	7	Peak in 1996; generally decreasing.
NH	Portsmouth	566	5	<100	>11	Peak in 1996; generally decreasing.
	Rye	201	14	<100	>11	Peak in 1997; fluctuating
	Hampton	287	11	<100	>11	Peak in 1996, generally decreasing
	Seabrook	282	9	311	4	Peak in 2001; fluctuating.
MA	Newburyport	233	12	<100	>11	Peak in 1996, generally decreasing
	Gloucester	1,225	2	807	2	Peak in 1999; generally decreasing.
	Marblehead	164	19	<100	>11	Generally decreasing.
	Boston	<100	>21	150	9	Generally increasing.
	Scituate	195	16	159	8	Peak in 2012; fluctuating.
	Chatham	195	17	<100	>11	Peak in 1997, generally decreasing.
	Provincetown	220	13	<100	>11	Peak in 2001; decreasing since 2011.
	New Bedford	<100	>21	274	6	Increasing trend.
RI	Point Judith	1,736	1	1,735	1	Fluctuating; peak in 2013
	Newport	157	20	<100	>11	Decreasing trend.
CT	Stonington	196	15	277	5	Peak in 1999; fluctuating.
	New London	182	18	<100	>11	Peak in 1996; fluctuating.
NY	Greenport	251	10	<100	>11	Peak in 1996; minimal to none since
	Montauk	562	6	325	3	Peak in 2012; fluctuating trend.
	Shinnecock	516	7	<100	>11	Peak in 1998; generally decreasing.
	New York City	<100	>21	<100	>11	Fluctuating, generally low.
NJ	Brielle	<100	>21	<100	>11	Peak in 1997; fluctuating.
	Point Pleasant	629	4	109	11	Peak in 1997; generally decreasing.
	Belford	360	8	112	10	Peak in 1997; generally decreasing.
	Cape May	147	21	<100	>11	Peak in 1997, generally decreasing.
Total		10,360		5,498		

Source: NEFSC VTR data, accessed 2017.

Table 42 presents cumulative landings of silver hake and red hake in major ports along with their share of landings to state's total landing of the species. Nearly all (>95%) silver and red hake landings in Connecticut are landed in New London and Stonington . 95% of hake landed in Rhode Island is landed in Point Judith. New Bedford and Gloucester account for about 90% of hake landings in Massachusetts.

Table 42. Major ports with cumulative silver hake and red hake landings and port's share landings to its corresponding state's landings for the species, 1996-2016.

State	Top Ports	Silver Hake (pounds)	Red Hake (pounds)	Percent of state landings	
				Silver hake	Red hake
ME	Portland	6,386,607	734,870	88%	79%
NH	Seabrook	4,233,393	1,233,921	73%	57%
MA	Gloucester	30,939,948	5,048,852	25%	54%
	New Bedford	77,886,117	3,071,112	64%	33%
	Provincetown	9,890,996	874,476	8%	9%
RI	Point Judith	91,435,748	11,851,279	95%	94%
	Newport	4,567,301	717,226	5%	6%
CT	New London	47,070,546	5,355,055	77%	78%
	Stonington	14,326,964	1,499,982	23%	22%
NY	Montauk	53,384,130	6,436,360	53%	65%
	Greenport	16,994,122	544,673	17%	6%
	Shinnecock	14,508,418	1,248,954	15%	13%
	Point Lookout	4,421,630	1,002,001	4%	10%
	Hampton Bay	9,119,913	223,728	9%	2%
NJ	Belford	4,776,479	1,076,711	34%	20%
	Point Pleasant	8,416,347	2,778,971	60%	52%

Source: NEFSC VTR data, accessed 2017.

5.6.3.2.1 Small-Mesh Multispecies Permits by State and Port

In Maine, there has been an 81% decrease in the number of permits with landings of small-mesh multispecies, from 113 in 1996 to 21 in 2016 (Table 43). There has also been a decrease in the number of ports landing small-mesh multispecies, from 14 in 1996 to 3 in 2016. Portland has been the most active port in Maine throughout the time series, though it had a 78% decline in the number of active permits, 86 to 19. Most other ports in Maine landing small-mesh multispecies had <4 permits landing.

In New Hampshire, there has been a 73% decrease in the number of permits with landings of small-mesh multispecies, from 67 in 1996 to 18 in 2016 (Table 43). Portsmouth had the greatest number of permits landing in 1996, at 36, but that port has had under four permits landing since 2014. Hampton, Seabrook, and Rye have had active ports through most of the time series, and in 2016, Seabrook had the highest number of active permits landing small-mesh multispecies, at 14.

In Massachusetts, there has been a 39% decrease in the number of permits with landings of small-mesh multispecies, from 338 in 1996 to 207 in 2016 (Table 43). Apart from a few years in the mid-2000s, Massachusetts has been the state with the highest number of active permits. The number of ports landing small-mesh multispecies has fluctuated between 8 and 18 through the time series and was in 14 in 2016. Provincetown and Gloucester had declines in the number of permits landing small-mesh multispecies, but that number increased in New Bedford and Boston during the time series.

In Rhode Island, there has been a 36% decrease in the number of permits with landings of small-mesh multispecies, from 261 in 1996 to 166 in 2016 (Table 43). The number of ports landing small-mesh multispecies, has fluctuated between three and ten through the time series, and was three in 2016. The number of permits landing in Point Judith declined by about 25%; while there was a 91% decline in the number of permits reporting landings of these species in Newport that period.

In Connecticut, there has been a steady increase in the number of permits with landings of small-mesh multispecies, from 3 in 1996 to 51 in 2016 (Table 43) – in contrast to other states. The number of ports landing small-mesh multispecies has fluctuated between two and seven through the time series and was five in 2016. Stonington (CT) had a near eight-fold increase in the number of permits reporting landing of small-mesh multispecies and the number of active permits in New London increased dramatically as well.

In New York, there has been a 48% decrease in the number of permits with landings of small-mesh multispecies, from 235 in 1996 to 123 in 2016 (Table 43). The number of ports landing small-mesh multispecies has fluctuated between eight and 18 through the time series and was twelve in 2016. Montauk has had a stable number of permits landing small-mesh multispecies but Hampton Bays experienced declines of 64% during 1996-2016.

In New Jersey, there has been a 41% decrease in the number of permits with landings of small-mesh multispecies, from 170 in 1996 to 101 in 2016 (Table 43). The number of ports landing small-mesh multispecies has fluctuated between four and 14 through the time series and was nine in 2016. There were declines in permits landing small-mesh multispecies in Belford (40%) and Cape Bay (64%). However, the number of active permits in Barnegat and Point Pleasant have been fairly steady.

Table 43. Number of unique permits landing silver hake, offshore hake, or red hake in each key port and state, 1996-2016.

ME Port	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maine	**113**	**103**	**59**	**65**	**79**	**80**	**58**	**23**	**20**	**10**	**14**	**19**	**12**	**18**	**16**	**23**	**32**	**30**	**27**	**26**	**21**
Portland	86	82	37	46	59	63	42	14	10	5	10	14	12	13	11	14	21	23	21	24	19
New Hampshire	**67**	**74**	**67**	**69**	**84**	**103**	**91**	**64**	**75**	**42**	**37**	**43**	**42**	**68**	**30**	**32**	**40**	**29**	**30**	**22**	**18**
Hampton/Seabrook	17	25	22	18	24	23	33	23	29	17	16	18	21	28	16	13	19	16	25	18	14
Massachusetts	**338**	**326**	**401**	**413**	**406**	**350**	**338**	**299**	**215**	**145**	**110**	**153**	**178**	**218**	**182**	**181**	**200**	**200**	**192**	**190**	**207**
Gloucester	144	139	183	195	190	159	141	122	95	75	49	67	88	101	74	76	85	85	86	75	81
Boston	7	8	3	5	5	7	9	12	7	4	7	5	9	10	4	7	11	9	17	18	20
Provincetown	42	42	41	38	42	42	38	20	11	c	**c**	10	11	13	14	17	12	12	4	5	4
New Bedford	30	20	42	46	44	42	44	58	49	35	36	28	33	43	52	43	33	39	41	41	67
Rhode Island	**261**	**232**	**295**	**286**	**294**	**253**	**265**	**231**	**192**	**182**	**200**	**180**	**188**	**177**	**168**	**177**	**181**	**182**	**176**	**161**	**166**
Newport	52	37	64	61	78	64	53	49	31	20	24	18	16	16	10	8	7	6	3	6	4
Point Judith	203	186	201	197	183	182	195	179	159	154	167	150	161	154	149	158	156	163	165	152	160
Connecticut	**3**	**9**	**7**	**8**	**8**	**12**	**7**	**10**	**5**	**7**	**7**	**35**	**42**	**45**	**49**	**58**	**61**	**52**	**51**	**52**	**51**
Stonington	c	c	4	4	5	4	c	4	c	c	c	22	31	29	31	30	34	30	27	28	31
New London	c	c	c	c	c	c	c	c	c	c	c	7	4	4	c	8	12	13	13	10	12
New York	**235**	**272**	**250**	**285**	**238**	**238**	**223**	**159**	**150**	**120**	**141**	**159**	**168**	**161**	**156**	**133**	**157**	**151**	**140**	**120**	**123**
Greenport	32	35	28	35	17	16	8	8	3	5	c	4	5	c	5	c	c	c	c	c	c
Montauk	65	71	89	101	98	78	78	59	60	50	54	57	59	59	65	62	75	72	69	63	71
Shinnecock	c	c	c	c	c	c	c	c	c	5	4	8	10	11	6	8	12	14	18	9	6
Hampton Bay	87	111	94	97	94	103	94	65	56	41	54	56	54	49	48	34	42	40	33	29	32
Point Lookout	c	c	c	c	c	c	c	c	5	5	8	11	9	12	11	9	11	9	6	3	c
New York City	c	c	c	c	c	c	c	c	12	6	6	6	4	c	5	c	c	c	c	c	c
New Jersey	**170**	**175**	**168**	**162**	**151**	**149**	**100**	**99**	**82**	**66**	**91**	**87**	**107**	**103**	**98**	**95**	**78**	**93**	**100**	**80**	**101**
Belford	45	39	34	38	35	33	35	23	27	22	34	31	25	23	16	22	21	17	18	15	27
Point Pleasant	35	52	52	50	41	53	35	39	33	32	44	33	51	43	52	44	36	44	48	34	33

Source: NMFS permit data. c = confidential (<= 3 permits)
State totals include other small ports.

5.6.3.2.2 Small-Mesh Multispecies Landings by State and Port

The information provided in this section serves only as background information to help describe fishing communities. Table 44 lists silver hake and red hake landings by state for 1996-2016 and the percentage of those landings compared to the state's entire fish landings. For the most part, silver hake is a small percentage of each state's fish landings. CT, RI, and NY are among the states with the largest proportion of silver hake landings when compared to the state's total landings. Silver hake landings in CT and NY have ranged from 2 to 16% of the state's total fish landings. The silver hake landings in RI have been 2-7% of the state's total fish landings. The proportion of silver hake landings to total fish landings in ME/NH/NJ combined has consistently been low. It dropped significantly since 1997 and the proportion has remained very low. The magnitude of silver hake landings is less in recent years than it had been during 1996-97. Red hake compromise an even smaller proportion of the state's landings for these states.

The proportion of silver hake to total landings has fluctuated much in all states over the past two decades. While landings in the last ten years have been some of the lowest amount of silver hake landings, this is apparent across all fisheries.

Table 44. Annual red and silver hake landings by state as percentage of total state landings.

State	Year	Landings (Live Pounds)			Percent of State Total	
		Red Hake	Silver Hake	State Total Fish	Red Hake	Silver Hake
ME, NH, NJ	1996	135,076	5,249,751	874,677,955	0.02%	0.60%
	1997	234,848	3,745,832	859,779,353	0.03%	0.44%
	1998	246,350	1,830,383	795,036,844	0.03%	0.23%
	1999	249,588	1,125,683	837,303,964	0.03%	0.13%
	2000	339,025	1,038,951	895,261,391	0.04%	0.12%
	2001	321,433	1,123,444	940,590,695	0.03%	0.12%
	2002	134,680	1,144,930	903,729,481	0.01%	0.13%
	2003	31,556	329,882	938,699,230	0.00%	0.04%
	2004	40,172	367,538	927,710,553	0.00%	0.04%
	2005	51,397	425,378	785,054,539	0.01%	0.05%
	2006	42,013	280,482	765,114,290	0.01%	0.04%
	2007	116,029	1,207,332	753,321,013	0.02%	0.16%
	2008	104,308	861,589	804,047,717	0.01%	0.11%
	2009	178,427	1,719,911	738,939,031	0.02%	0.23%
	2010	159,716	845,000	724,326,230	0.02%	0.12%
	2011	108,975	1,158,514	816,659,549	0.01%	0.14%
	2012	237,185	1,740,202	817,117,337	0.03%	0.21%
	2013	82,291	622,591	677,975,485	0.01%	0.09%
	2014	115,633	1,149,013	709,632,634	0.02%	0.16%
	2015	94,595	536,251	695,232,826	0.01%	0.08%
	2016	57,744	437,875	712,529,460	0.01%	0.06%
MA	1996	866,296	2,718,402	437,694,432	0.20%	0.62%
	1997	692,388	2,850,467	436,569,212	0.16%	0.65%
	1998	316,177	2,620,755	445,667,453	0.07%	0.59%
	1999	406,408	4,242,107	412,662,329	0.10%	1.03%
	2000	433,028	5,056,069	401,464,250	0.11%	1.26%
	2001	382,844	5,712,744	488,096,446	0.08%	1.17%
	2002	505,862	5,006,098	543,455,839	0.09%	0.92%

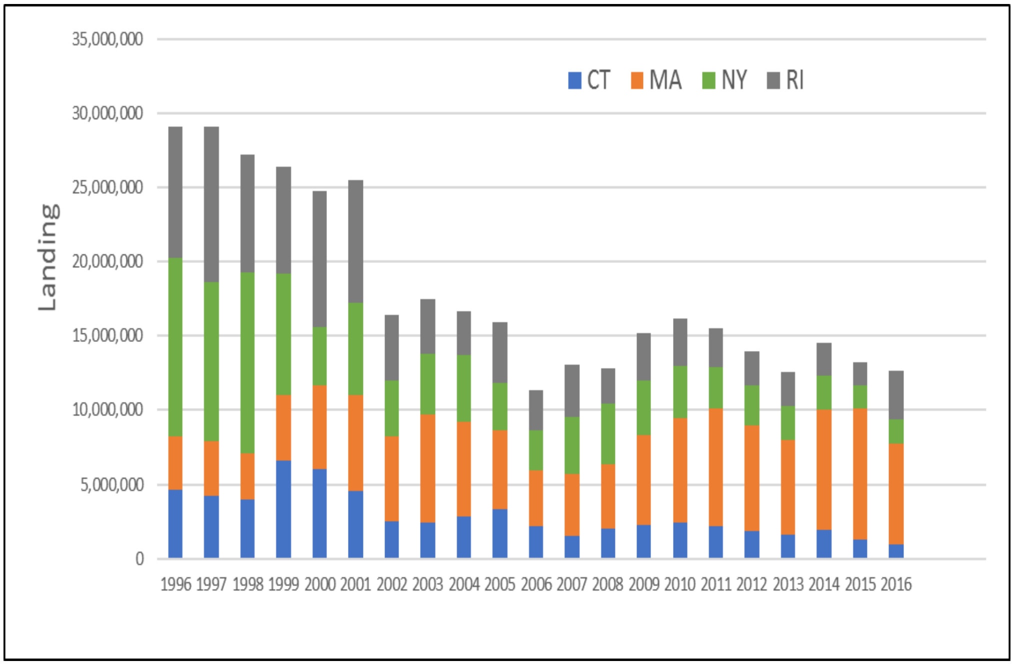
State	Year	Landings (Live Pounds)			Percent of State Total	
		Red Hake	Silver Hake	State Total Fish	Red Hake	Silver Hake
	2003	496,829	6,212,761	590,580,698	0.08%	1.05%
	2004	376,522	6,201,313	667,681,141	0.06%	0.93%
	2005	209,881	6,008,479	686,117,675	0.03%	0.88%
	2006	291,271	4,423,374	766,942,263	0.04%	0.58%
	2007	247,470	4,084,017	718,888,598	0.03%	0.57%
	2008	85,983	3,163,937	692,490,083	0.01%	0.46%
	2009	218,855	5,366,663	747,915,509	0.03%	0.72%
	2010	235,327	7,050,482	681,559,004	0.03%	1.03%
	2011	364,798	8,261,589	665,552,010	0.05%	1.24%
	2012	333,412	7,389,038	767,407,139	0.04%	0.96%
	2013	366,448	6,582,898	694,668,266	0.05%	0.95%
	2014	204,376	8,472,619	638,449,479	0.03%	1.33%
	2015	196,747	9,198,240	629,361,765	0.03%	1.46%
	2016	239,619	7,264,092	616,006,485	0.04%	1.18%
RI	1996	744,133	9,329,477	191,244,757	0.39%	4.88%
	1997	959,739	11,565,667	170,785,329	0.56%	6.77%
	1998	1,221,017	10,296,455	155,605,358	0.78%	6.62%
	1999	1,438,523	9,659,665	147,846,035	0.97%	6.53%
	2000	1,506,980	10,507,740	146,530,244	1.03%	7.17%
	2001	1,605,988	9,228,049	139,556,119	1.15%	6.61%
	2002	640,317	5,082,864	125,858,969	0.51%	4.04%
	2003	624,242	5,778,354	120,261,536	0.52%	4.80%
	2004	462,267	4,129,054	128,383,259	0.36%	3.22%
	2005	231,526	4,171,490	130,513,144	0.18%	3.20%
	2006	402,422	3,400,300	152,670,717	0.26%	2.23%
	2007	396,712	4,432,277	104,698,822	0.38%	4.23%
	2008	614,489	3,236,910	91,113,603	0.67%	3.55%
	2009	434,415	3,642,164	103,830,756	0.42%	3.51%
	2010	497,804	3,406,122	120,597,244	0.41%	2.82%
	2011	407,585	2,606,598	100,911,617	0.40%	2.58%
	2012	481,323	2,481,765	99,756,391	0.48%	2.49%
	2013	367,454	2,424,220	110,517,610	0.33%	2.19%
	2014	712,830	2,212,634	105,060,581	0.68%	2.11%
	2015	467,042	1,659,042	86,768,524	0.54%	1.91%
	2016	392,703	3,673,503	94,359,483	0.42%	3.89%
CT	1996	232,126	5,643,448	85,067,279	0.27%	6.63%
	1997	385,297	4,164,057	61,897,420	0.62%	6.73%
	1998	265,713	3,971,948	50,330,151	0.53%	7.89%
	1999	373,721	7,851,123	54,343,035	0.69%	14.45%
	2000	404,612	6,606,446	61,017,170	0.66%	10.83%
	2001	349,622	5,260,402	58,301,355	0.60%	9.02%
	2002	333,601	2,533,091	53,857,239	0.62%	4.70%
	2003	417,843	2,453,756	60,774,902	0.69%	4.04%
	2004	418,881	2,935,966	79,898,571	0.52%	3.67%

State	Year	Landings (Live Pounds)			Percent of State Total	
		Red Hake	Silver Hake	State Total Fish	Red Hake	Silver Hake
	2005	380,358	3,299,686	41,209,999	0.92%	8.01%
	2006	263,810	2,347,952	38,457,651	0.69%	6.11%
	2007	266,201	1,565,724	40,339,168	0.66%	3.88%
	2008	285,490	2,190,464	17,864,505	1.60%	12.26%
	2009	310,643	1,939,943	17,531,952	1.77%	11.07%
	2010	175,778	1,972,970	14,902,918	1.18%	13.24%
	2011	158,253	2,057,084	17,362,506	0.91%	11.85%
	2012	185,253	1,864,659	18,340,626	1.01%	10.17%
	2013	177,810	1,718,854	13,115,071	1.36%	13.11%
	2014	168,323	2,037,547	12,630,240	1.33%	16.13%
	2015	146,018	1,319,823	13,791,691	1.06%	9.57%
	2016	162,038	947,483	16,798,259	0.96%	5.64%
NY	1996	433,037	12,720,370	144,469,529	0.30%	8.80%
	1997	628,466	11,980,906	123,627,785	0.51%	9.69%
	1998	880,759	14,171,904	93,646,869	0.94%	15.13%
	1999	973,566	9,579,998	89,908,773	1.08%	10.66%
	2000	878,327	4,520,382	87,495,947	1.00%	5.17%
	2001	1,016,436	7,391,041	92,246,961	1.10%	8.01%
	2002	422,114	3,966,327	93,193,534	0.45%	4.26%
	2003	278,451	4,478,835	113,447,276	0.25%	3.95%
	2004	251,545	5,166,029	79,147,489	0.32%	6.53%
	2005	126,725	3,344,856	108,785,956	0.12%	3.07%
	2006	53,621	2,557,158	82,776,536	0.06%	3.09%
	2007	169,576	3,580,224	75,444,712	0.22%	4.75%
	2008	204,007	4,150,457	78,704,124	0.26%	5.27%
	2009	203,124	4,279,781	81,915,430	0.25%	5.22%
	2010	288,932	4,540,136	67,197,542	0.43%	6.76%
	2011	273,037	3,038,093	65,468,355	0.42%	4.64%
	2012	589,864	2,819,259	71,267,447	0.83%	3.96%
	2013	172,077	2,390,477	68,336,855	0.25%	3.50%
	2014	189,918	2,311,198	58,571,518	0.32%	3.95%
	2015	132,026	1,501,678	62,274,871	0.21%	2.41%
	2016	239,171	1,719,347	52,336,902	0.46%	3.29%

Source: NMFS dealer data, accessed 2017.

Figure 11 presents silver hake landings for four major states CT, MA, NY, and RI during 1996-2016. Landings have declined significantly for CT, NY, and RI but have increased in MA over the past two decades.

Figure 11. Annual silver hake landings (lb.) for major states, 1996-2016.



Source: NEFSC VTR data.

Table 44 presents cumulative landings of silver hake and red hake as well as landings of all fishes by those who landed small-mesh multispecies. Over the past two decades, the seven major states for small-mesh multispecies had ex-vessel revenue of about $330 M cumulatively from silver and red hakes. They cumulatively landed 404 M lb. of silver hake and 46 M pounds of red hake during 1996-2016. The states of CT, MA, and NY had relatively higher share of silver hake to total volume of all fishes. The share of silver hake to total landed ranged between 13 and 59% for silver hake but it ranged between 3 and 7% for red hake.

Table 45. Small-mesh multispecies landings to total landed fish and real revenues from small-mesh multispecies during 1996-2016.

State Landed	Cumulative total landings (pounds), 1996 to 2016			Silver hake %	Red hake %	Cumulative total small-mesh multispecies revenue (in 2016$), 1996-2016
	Silver hake	Red hake	All fishes			
ME	7,222,442	928,770	36,431,971	20%	3%	$5,938,482
NH	5,785,746	2,173,208	43,283,055	13%	5%	$5,437,524
MA	122,158,823	9,414,785	299,480,845	41%	3%	$97,445,985
RI	96,181,561	12,582,948	380,917,239	25%	3%	$79,185,109
CT	61,400,882	6,887,390	103,385,398	59%	7%	$50,005,370
NY	99,872,171	9,901,463	245,856,488	41%	4%	$80,717,251
NJ	14,120,902	5,344,644	79,484,874	18%	7%	$13,290,361

Source: NEFSC VTR data, accessed 2017.

Table 45 summarizes real revenue (in 2016$) from silver and red hake and total revenue from all fishes per state. The proportion of total revenue that is made of silver hake and red hake is also displayed. In ME, there was ~$1.8 million in revenue from silver hake. These revenues comprised much less than 0.50% of total state revenues. In 1996, silver hake landings made up ~0.46% of total state revenue. After 1996, there has been a steady decline in revenue from silver hake landings; the revenue from red hake landings is only nominal. In NH during the period 1996-2016, revenue from silver hake was < $266,000 comprising less than 0.29-1.09% of total state fishing revenue. Revenue from red hake landings were $0 - $11,000 during the past two decades. The greatest proportion of NH's revenue from silver hake was in 2012, at 1.09%. In 2016, the largest revenue from silver hake landings was about $265,000, representing ~0.79% of total state fishing revenues. Revenue from red hake landings are negligible.

Real revenue from silver hake landings in MA was $1.4 million to $6.6 million in 1996-2016; this was less than 1.25% of total state fishing revenues over the same time period. Revenue from red hake landings was $37,000 to $293,000 but this was <0.10% of total MA fishing revenue. The largest revenue from silver hake on record in MA occurred in 2015, while the greatest revenue from red hake landings occurred in 1006. Real revenue from silver hake landings in CT were $900,000 – 5.3 M, ~1-11% of total state fishing revenue. The state has more dependency on silver hake than other states.

Revenue from red hake was <1% of total state fishing revenue. Revenue from silver hake was $1.0-6.7 million from 1996-2016 in RI, while revenue from red hake landings was $105,000-409,000 during this same period. Revenue from silver hake ranged between 0.40% and 1.25% of total state fishing revenue while revenue from red hake was 0.01-0.08% of total RI revenue for 1996-2016. In 1997, revenue of silver hake was the highest in this time period, $6.7 million, representing !5.74% of total state fishing revenues. In NJ during this same time period, revenue from silver hake was $58,000-1.3 million, comprising <1% of total state fishing revenue. Revenue from red hake landings were $21,000-162,000 comprising <0.12% of total state fishing revenue. Revenue from silver hake landings in NY were $1.4 - $9.5 million for 1996-2016, representing ~0.14-7.68% of total state fishing revenue. Revenue from red hake landings were $33,000-501,000.

Point Judith (RI) led all other ports in New England and the Mid-Atlantic in silver hake landings (cumulative) during 1996-2016 (Table 47). It ranked number one port for silver hake landings in 1996 but drops to the second in 2016. New Bedford (MA) has risen to number one port for silver hake landings in 2016. It also ranked 2nd for cumulative silver hake landings during 1996-2016. Gloucester (MA) ranked 3rd for silver hake landing in 2016. New London (CT) was the 2nd highest silver hake landings port in 1996 but it dropped to 5th rank in 2016. Hampton Bays (NY) used to be 3rd highest silver hake landing port in 1996 but the landings significantly decreased over the past decade. Montauk (NY) had 6th in position in 1996 and risen to 4th in 2016. Portland (ME) was 5th in terms of silver hake landings in 1996 but now lands a very nominal amount of silver hake. Over the past two decades, many ports declined significantly or had variable landings of silver hake but only few ports have risen such as New Bedford (MA).

Table 46. Annual red and silver hake revenue by state as percentage of total state revenue from all species landed (in 2016$).

State	Year	Real Revenue$ (in 2016 $)			Percent of State Total	
		Red Hake	Silver Hake	State Total Fish	Red Hake %	Silver Hake %
ME, NH, NJ	1996	$83,579	$2,891,282	$553,053,627	0.02%	0.52%
	1997	114,346	2,001,919	578,689,931	0.02	0.35
	1998	118,869	1,059,039	568,180,403	0.02	0.19
	1999	116,141	666,413	625,570,725	0.02	0.11
	2000	162,950	634,001	657,039,015	0.02	0.10
	2001	123,379	723,669	579,729,866	0.02	0.12
	2002	72,796	664,077	582,620,901	0.01	0.11
	2003	21,062	232,211	588,608,956	0.00	0.04
	2004	30,242	208,576	712,881,191	0.00	0.03
	2005	40,731	249,314	733,522,509	0.01	0.03
	2006	30,620	209,161	616,346,979	0.00	0.03
	2007	68,611	720,453	631,959,574	0.01	0.11
	2008	48,714	539,200	960,811,301	0.01	0.06
	2009	77,813	801,619	559,233,930	0.01	0.14
	2010	76,936	463,688	718,530,582	0.01	0.06
	2011	61,285	682,858	729,203,935	0.01	0.09
	2012	118,760	753,037	787,305,310	0.02	0.10
	2013	49,492	466,987	645,395,862	0.01	0.07
	2014	48,269	686,408	784,781,525	0.01	0.09
	2015	60,977	409,205	839,025,432	0.01	0.05
	2016	33,687	367,246	953,902,085	0.00	0.04
MA	1996	292,604	1,423,336	354,813,675	0.08	0.40
	1997	220,609	1,707,444	335,870,277	0.07	0.51
	1998	137,076	1,945,140	303,207,370	0.05	0.64
	1999	193,229	3,765,538	375,168,871	0.05	1.00
	2000	152,541	3,116,006	406,058,498	0.04	0.77
	2001	162,557	3,672,638	380,555,635	0.04	0.97
	2002	198,408	2,681,924	396,767,537	0.05	0.68
	2003	205,703	3,556,839	382,826,051	0.05	0.93
	2004	181,376	3,226,553	412,397,917	0.04	0.78
	2005	110,865	2,619,618	525,180,701	0.02	0.50
	2006	141,573	2,370,783	521,560,874	0.03	0.45

State	Year	Real Revenue$ (in 2016 $)			Percent of State Total	
		Red Hake	Silver Hake	State Total Fish	Red Hake %	Silver Hake %
	2007	102,029	2,771,533	495,378,984	0.02	0.56
	2008	37,486	1,817,248	456,842,430	0.01	0.40
	2009	95,994	2,947,858	454,895,884	0.02	0.65
	2010	106,418	4,655,476	524,253,644	0.02	0.89
	2011	217,700	5,350,126	608,540,187	0.04	0.88
	2012	154,805	4,720,973	641,075,482	0.02	0.74
	2013	177,458	3,977,374	577,994,011	0.03	0.69
	2014	96,261	5,950,126	532,276,472	0.02	1.12
	2015	80,641	6,641,748	531,934,004	0.02	1.25
	2016	93,606	5,789,679	551,682,865	0.02	1.05
CT	1996	116,635	2,972,749	74,062,957	0.16	4.01
	1997	143,908	2,601,921	49,469,812	0.29	5.26
	1998	101,002	2,203,375	50,673,560	0.20	4.35
	1999	124,807	5,333,610	55,735,732	0.22	9.57
	2000	152,852	4,112,245	43,869,735	0.35	9.37
	2001	127,800	3,034,987	42,315,180	0.30	7.17
	2002	173,493	1,556,305	37,060,444	0.47	4.20
	2003	181,440	1,904,723	38,903,959	0.47	4.90
	2004	244,601	2,576,816	42,453,554	0.58	6.07
	2005	257,722	2,682,740	46,170,692	0.56	5.81
	2006	123,251	1,803,293	43,920,616	0.28	4.11
	2007	115,390	1,337,347	113,831,627	0.10	1.17
	2008	143,281	1,631,360	19,849,400	0.72	8.22
	2009	149,402	1,185,177	18,101,243	0.83	6.55
	2010	83,487	1,475,543	17,621,509	0.47	8.37
	2011	93,776	1,775,359	21,489,480	0.44	8.26
	2012	93,483	1,458,559	22,314,891	0.42	6.54
	2013	119,859	1,384,493	15,772,953	0.76	8.78
	2014	105,623	1,608,181	14,777,207	0.71	10.88
	2015	113,212	1,178,550	15,885,776	0.71	7.42
	2016	108,280	916,271	17,552,807	0.62	5.22
RI	1996	290,002	4,925,297	107,737,784	0.27	4.57
	1997	351,074	6,705,025	116,771,745	0.30	5.74
	1998	322,893	5,134,234	106,001,668	0.30	4.84
	1999	409,229	5,009,342	123,953,123	0.33	4.04
	2000	374,198	5,072,685	112,847,004	0.33	4.50
	2001	356,784	4,888,249	93,044,759	0.38	5.25
	2002	217,938	2,271,329	86,341,056	0.25	2.63
	2003	199,315	2,656,768	86,204,277	0.23	3.08
	2004	133,489	2,335,531	90,365,851	0.15	2.58
	2005	123,411	2,277,910	112,524,612	0.11	2.02
	2006	172,630	2,021,788	116,499,501	0.15	1.74
	2007	131,258	2,485,517	89,120,387	0.15	2.79

State	Year	Real Revenue$ (in 2016 $)			Percent of State Total	
		Red Hake	Silver Hake	State Total Fish	Red Hake %	Silver Hake %
	2008	170,525	2,057,383	94,725,109	0.18	2.17
	2009	105,341	1,734,468	73,005,442	0.14	2.38
	2010	155,479	2,149,914	66,480,286	0.23	3.23
	2011	153,475	1,539,593	87,788,026	0.17	1.75
	2012	145,889	1,502,363	92,577,343	0.16	1.62
	2013	125,140	1,172,182	89,087,625	0.14	1.32
	2014	201,379	1,401,353	87,571,112	0.23	1.60
	2015	167,116	1,035,256	83,079,048	0.20	1.25
	2016	138,747	2,066,775	93,869,978	0.15	2.20
NY	1996	290,356	8,533,867	132,577,474	0.22	6.44
	1997	347,708	9,476,900	134,007,315	0.26	7.07
	1998	447,511	9,261,065	120,519,848	0.37	7.68
	1999	490,463	6,714,212	107,883,701	0.45	6.22
	2000	449,489	3,610,342	85,190,382	0.53	4.24
	2001	455,536	5,716,788	74,634,612	0.61	7.66
	2002	251,495	2,838,853	68,392,698	0.37	4.15
	2003	155,935	3,985,483	67,310,567	0.23	5.92
	2004	142,469	4,374,076	58,898,394	0.24	7.43
	2005	92,543	3,048,590	69,332,543	0.13	4.40
	2006	33,214	2,209,247	68,798,442	0.05	3.21
	2007	90,815	2,631,610	178,768,749	0.05	1.47
	2008	91,741	2,902,670	163,776,138	0.06	1.77
	2009	88,098	2,813,426	92,720,876	0.10	3.03
	2010	141,561	3,377,231	54,741,356	0.26	6.17
	2011	134,017	2,380,544	73,728,506	0.18	3.23
	2012	501,343	2,350,640	981,627,657	0.05	0.24
	2013	122,804	1,981,182	273,397,523	0.04	0.72
	2014	118,963	1,953,728	111,758,203	0.11	1.75
	2015	84,951	1,386,133	1,021,745,226	0.01	0.14
	2016	142,356	1,522,726	171,153,810	0.08	0.89

Table 47. Silver hake landings (mt) for major ports in a state and their rankings, 1996-2016.

State	CT		MA				ME	NH	NJ			NY						RI	
Port	New London	Stonington	New Bedford	Gloucester	Provincetown	Boston	Portland	Seabrook	Point Pleasant	Belford	Cape May	Montauk	Hampton Bays	Greenport	Freeport	New York City	Point Lookout	Point Judith	Newport
1996	[redacted]	N/A	53	862	265	[redacted]	1436	[redacted]	[redacted]	[redacted]	62	943	2310	2274	223	N/A	N/A	4010	[redacted]
1997	[redacted]	[redacted]	10	805	424	[redacted]	561	[redacted]	617	[redacted]	144	1653	1721	1792	269	N/A	N/A	4913	[redacted]
1998	[redacted]	[redacted]	28	836	[redacted]	0.28	75	[redacted]	418	[redacted]	75	1703	2232	2263	231	N/A	N/A	4417	237
1999	[redacted]	[redacted]	78	1004	759	[redacted]	63	[redacted]	239	[redacted]	24	1266	1187	1602	280	[redacted]	N/A	4172	163
2000	[redacted]	[redacted]	486	1081	633	0.58	[redacted]	89	223	[redacted]	8.86	1060	696	167	128	N/A	N/A	4296	381
2001	[redacted]	[redacted]	1182	619	711	[redacted]	13	[redacted]	297	[redacted]	33	2343	908	14	80	N/A	[redacted]	3609	577
2002	[redacted]	[redacted]	1196	489	564	[redacted]	[redacted]	[redacted]	289	[redacted]	7.46	1165	455	12	144	N/A	[redacted]	2149	156
2003	[redacted]	[redacted]	2417	232	71	[redacted]	[redacted]	[redacted]	32	[redacted]	1.98	1424	495	25	82	N/A	N/A	2372	249
2004	[redacted]	[redacted]	2536	227	22	[redacted]	[redacted]	[redacted]	57	[redacted]	5.14	1522	464	[redacted]	13	332.33	4.82	1724	[redacted]
2005	[redacted]	[redacted]	2267	453	[redacted]	[redacted]	[redacted]	[redacted]	94	[redacted]	1.62	1216	200	[redacted]	N/A	26.68	49.39	1814	[redacted]
2006	[redacted]	[redacted]	1875	126	N/A	[redacted]	[redacted]	[redacted]	45	[redacted]	4.69	736	212	[redacted]	[redacted]	[redacted]	94.74	1486	51
2007	254	[redacted]	1475	320	20	[redacted]	0.16	[redacted]	224	[redacted]	1.59	934	268	4.86	[redacted]	[redacted]	113.97	1937	49
2008	401	110	1142	123	134	[redacted]	[redacted]	[redacted]	162	[redacted]	10	1487	180	10	[redacted]	[redacted]	105.51	1418	[redacted]
2009	321	[redacted]	1872	313	217	[redacted]	[redacted]	[redacted]	358	[redacted]	21	1590	189	[redacted]	[redacted]	[redacted]	52.96	1634	[redacted]
2010	300	361	2542	293	240	[redacted]	[redacted]	[redacted]	181	[redacted]	6.80	1549	179	1.34	[redacted]	[redacted]	174.41	1530	[redacted]
2011	315	276	2980	442	264	49	[redacted]	[redacted]	194	[redacted]	14	980	163	[redacted]	[redacted]	[redacted]	210.57	1163	[redacted]
2012	513	[redacted]	2656	602	29	[redacted]	[redacted]	[redacted]	191	[redacted]	3.37	1044	111	N/A	N/A	N/A	99.07	1109	[redacted]
2013	610	113	2456	444	41	[redacted]	[redacted]	[redacted]	104	[redacted]	[redacted]	1032	36	[redacted]	N/A	N/A	12.91	1093	2.84
2014	[redacted]	[redacted]	3120	687	[redacted]	[redacted]	[redacted]	[redacted]	153	152	[redacted]	919	86	[redacted]	N/A	[redacted]	14.60	1003	[redacted]
2015	536	[redacted]	3000	863	142	[redacted]	[redacted]	[redacted]	57	[redacted]	[redacted]	614	43	[redacted]	N/A	[redacted]	13.87	752	0.35
2016	333	36	1719	1352	[redacted]	[redacted]	[redacted]	[redacted]	17	13	1.12	538	16	N/A	N/A	[redacted]	[redacted]	1665	[redacted]
1996-2016	20286	6941	35093	12173	4943	492	2291	2020		2250	438	25717	12150	8201	1453	1271	956	48266	2687
Rank 1996	2			7	9		5		8			6	3	4	10			1	10
Rank 2016	5	10	1	3	8	9		7				4				6		2	
Rank 96-16	4	8	2	5	9				10			3	6	7				1	

Source: NMFS Dealer data

Note: Reporting by < 3 dealers are masked in black for data confidentiality requirement.

6.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The impacts of the alternatives under consideration are evaluated herein relative to the valued ecosystem components (VECs) described in the Affected Environment (Section 5.0) and to each other.

6.1 INTRODUCTION

This action evaluates the potential impacts using the criteria in Table 48.

Table 48. General definitions for impacts and qualifiers relative to resource condition (i.e., baseline).

VEC	Resource Condition	Impact of Action		
		Positive (+)	Negative (-)	No Impact (0)
Target and Non-target Species	Overfished status defined by the MSA	Alternatives that would maintain or are projected to result in a stock status above an overfished condition*	Alternatives that would 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 (e.g., no take)	Alternatives that result in interactions/take of listed resources, 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 will maintain takes below PBR and approaching the Zero Mortality Rate Goal	Alternatives that result in interactions with/take of marine mammal species 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 (see condition of the resources table for details)	Alternatives that improve the quality or quantity of habitat	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) or low (L), as in slight/low positive or slight negative	To a lesser degree / minor		
	Moderately (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.				

6.1.1 Approach to Impacts Analysis

Given 60 to 80% of southern red hake are currently discarded due to lack of marketability, the reduction in opportunity to land southern red hake through a lower possession limit is most likely not going to change fishing behavior and catch. Overall, because an analytical assessment, a forecasting tool, and a clear result from sea sampling data analysis are missing, the direction of impacts on the VECs are qualitative. The impacts may be characterized based on how the fishery could adapt to a reduction in possession limit as follows:

1. The fishery might not adapt.

   If the fishery doesn't adapt, southern red hake and other species catch is not likely to change, though may result in an increase in discarding and reduction in revenue from landings. <1% of observed trips had southern red hake >50% of the total revenue, which means these trips might not occur, may target a different species, or may relocate to a different fishing area, namely statistical areas 537, 539, and 611.

2. Vessels may adjust when and where they fish to avoid high amounts of southern red hake bycatch if they cannot land it (or can only land a small fraction of what they catch).

   The fishery may adapt spatially and temporarily where fishing takes place on a haul-by-haul basis, though there has been little indication of this.

3. Vessels may alter their gear (hanging ratios, floats, chains, etc.) to catch fewer southern red hake (and possibly other non-target species).

   This adaptation to a change in possession limits is the most likely response because fishermen believe discarding of a species they cannot land is not time or resource efficient as long as altering their gear does not negatively impact target species' catch by an appreciable amount.

4. Vessels may fish for a longer duration to make up for lost revenue from southern red hake landings.

   This adaptation is not very likely except in statistical areas where the percentage of revenue from southern red hake is >50% of the total revenue (537, 539, and 611 statistical areas).

6.2 Impacts on Target Species (Southern Red Hake)

For the purposes of this action and the following analysis, the target species is considered to be southern red hake. Few trips however target red hake, which is often discarded due to lack of demand and short 'shelf life' of red hake on trips that target other species, such as whiting, squid, mackerel, herring, scallops, and groundfish.

6.2.1 Rebuilding Southern Red Hake

The intention for this action is to reduce fishing mortality and increase survival of adult southern red hake, rebuilding both biomass due to growth and spawning potential. During 2006-2011, stock biomass increased from 0.30 kg/tow (three-year moving average) to 1.38 kg/tow, which is within the range observed in recent biomass and target levels (Figure 3). This biomass increase occurred without strong year classes. During this period, the estimated exploitation rate was 67% of the current maximum fishing mortality threshold (MFMT).

Based on the above observation, rebuilding is possible in as little as five years, a reasonable period if the mean generation time is 4 to 5 years (See Section 4.1). A reasonable upper bound for rebuilding is about two generation periods, or about 10 years.

6.2.1.1 Alternative 1 – No Action / Status Quo

Alternative 1 would not establish a rebuilding period and satisfactory progress toward rebuilding would be undefined. Therefore, there would not be a clear basis for taking corrective action that might be needed to achieve rebuilding targets. If rebuilding does not occur, the fishery would not achieve MSY and or achieve optimum yield. It would be more likely that the stock would remain in an overfished condition and the lack of corrective measures could perhaps worsen the overfished condition, thus this alternative would have a high negative impact on the target species.

6.2.1.2 Alternative 2 – Rebuilding Estimates and Maximum Mortality

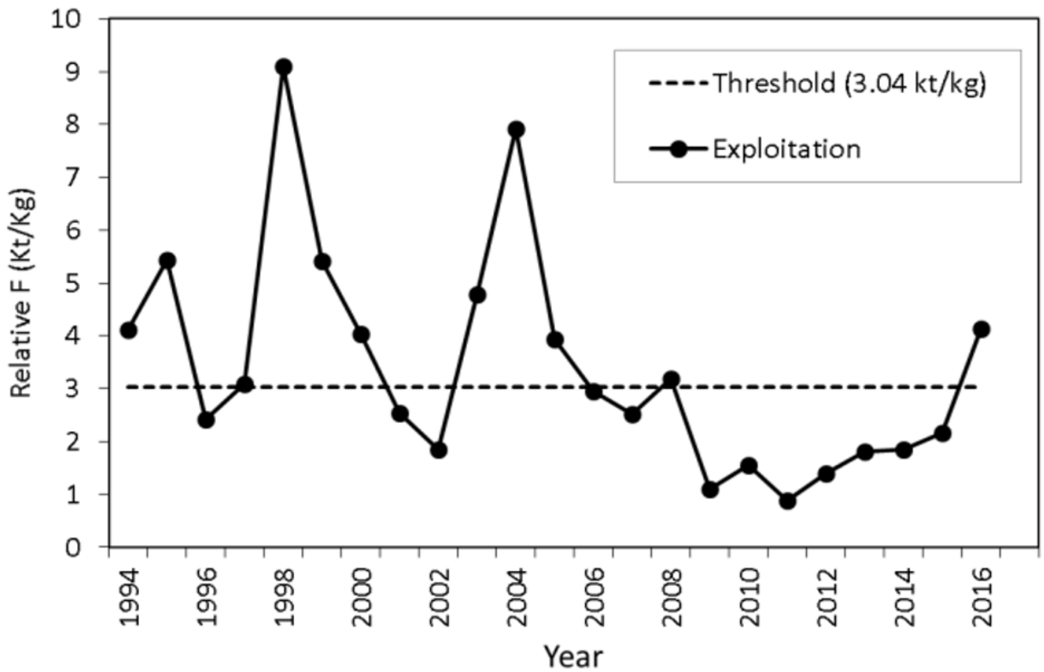
During 2006-2011, biomass increased from levels that approximated current conditions to above the B_{msy} proxy target, averaged 2.04 kt of fishery catch per 1 kg stratified mean biomass from the spring survey (i.e., kt/kg). This was 67% of the current MFMT, or 3.04 kg/kt. Both Option A (75% of OFL/F_{MSY} proxy) and Option B (50% of OFL/F_{MSY} proxy) are expected to have a moderate to high positive impact relative to Alternative 1. Impacts of Options A and B are compared in the analysis in each section below.

No analytical assessments or stock forecast models are available to estimate the potential for rebuilding biomass at various fishing mortality rates. It can, however, be assumed that a lower fishing mortality would be more certain to achieve the target biomass within the rebuilding period than can be expected with a higher fishing mortality. The two alternatives below bracket the average estimated fishing mortality during 2006-2011, when the biomass of southern red hake increased from current levels to the current target biomass.

Table 49. Summary of total catch (kt), NEFSC spring survey biomass in albatross units (kg/tow) and index of relative exploitation ratios of total catch to the spring survey biomass (kt/kg) for southern red hake. Note: This assessment update was based on the most recent three-year average of both the spring survey biomass (2015-2017) and the relative exploitation ratios from 2014-2016.

Year	Southern Spring Survey arithmetic kg/tow	Southern Spring Survey 3-year Average kg/tow	Total Southern Commercial Landings (000's mt)	Southern Commercial Discards (000's mt)	Southern Recreational Catch (000's mt)	Southern total Catch (000's mt)	Southern Exploitation Index (kg/000's mt)	Southern Exploitation Index 3-year Average (kg/000's mt)
2006	0.38	0.30	0.38	0.67	0.077	1.13	2.96	4.94
2007	0.86	0.54	0.47	1.55	0.151	2.17	2.53	3.14
2008	0.47	0.57	0.58	0.81	0.117	1.51	3.19	2.90
2009	1.44	0.92	0.58	0.87	0.133	1.58	1.10	2.27
2010	0.94	0.95	0.58	0.74	0.153	1.47	1.56	1.95
2011	1.79	1.39	0.50	1.01	0.094	1.60	0.89	1.18

Figure 12. Southern red hake exploitation index from the latest AIM model update assessment (NEFMC 2017).



6.2.1.2.1 Option A – 75% of the Overfishing Limit, or F_{msy} Proxy *(Preferred Alternative)*

This alternative is expected to rebuild biomass and keep it above an overfished condition and is therefore expected to have a moderately positive impact on southern red hake, the target species because biomass is expected to rebuild to the B_{msy} proxy in approximately seven to ten years. Because it has a lower probability than Option B of keeping the stock above an overfished condition, it is therefore expected to have a less positive impact on the target species than Option B because the rebuilding period would be longer. Measures needed to keep catch below this annual catch limit would be less restrictive and might cause fewer discards or other impacts compared to Option B.

This option would establish annual catch limits that are associated with lower fishing mortality than it would be with the status quo[14]. This option would reduce the ABC specification to 75% of the OFL, below what is usually required to account for scientific uncertainty. The other specifications would consequently be reduced (see Table 7). It is possible that rebuilding with this option could take longer than seven years because there are signs that the southern red hake is not as productive as it once was, whether due to a northward distribution shift (Nye et al. 2009), or due to a reduction in recruitment and growth or due to an increase in natural mortality (NEFSC 2020).

This option is consistent with T_{target} of seven years, slightly longer than the 5 years that biomass increased by an equivalent amount in 200-2011. Achieving this lower catch (and landings) is likely to require adjustments to measures, such as possession limits and possibly other technical measures, such as closed

[14] The status quo follows the procedure that the Scientific and Statistical Committee approved after the 2011 benchmark assessment. The ABC is reduced from the OFL to account for scientific uncertainty in the catch associated with the F_{msy} proxy (derived from spring survey data with error) and in the proxy reference point itself (derived from a range of fishing mortality rates during the base period, 1980-2010). The ABC has never been below 85% of the OFL (see Section 5.2).

areas or prohibited gears that exhibit a high bycatch rate. It would also cause the TAL trigger[15] to be met earlier in the season than otherwise required. If the fishery exceeds the reduced ACL during the rebuilding period, it would trigger a reduction in the TAL trigger and/or adjustments to technical measures intended to reduce red hake bycatch. Because southern red hake is not the primary target, it is not expected to have a meaningful effect on other target species in the fishery, i.e., northern silver hake, southern whiting, and northern red hake.

6.2.1.2.2 Option B – 50% of the Overfishing Limit, or F_{msy} Proxy

This alternative is expected to rebuild biomass and keep it above an overfished condition and is therefore expected to have a moderately positive impact on southern red hake, the target species, because biomass is expected to rebuild to the B_{msy} proxy in approximately five years or less. Because it has a higher probability than Option A of keeping the stock above an overfished condition, it is therefore expected to have a more positive impact on the target species than Option A because the rebuilding period would be shorter. Measures needed to keep catch below this lower annual catch limit would need to be more restrictive than those needed for Option A and might cause more discards compared to Option A.

This option would establish annual catch limits that are associated with lower fishing mortality than it would be with the status quo. This option would reduce the ABC specification to 50% of the OFL, well below what is usually required to account for scientific uncertainty. The other specifications would consequently be reduced (see Table 8).

This option is consistent with T_{min} of five years, approximately the period that biomass increased by an equivalent amount in 2006-2011. Achieving this lower catch (and landings) is more likely than Option 1 to require adjustments to measures, such as possession limits and possibly other technical measures, such as closed areas or prohibited gears that exhibit a high bycatch rate. It would also cause the TAL trigger to be met much earlier in the season than otherwise required. If the fishery exceeds the reduced ACL during the rebuilding period, it would trigger a reduction in the TAL trigger and/or adjustments to technical measures intended to reduce red hake bycatch. It is possible that the fishery could exceed the ACL by an amount that requires a reduction in the TAL trigger from 40.4% of the TAL to 0% of the TAL. In this case, the southern red hake possession limit would remain at 400 lb. throughout the year and other accountability measures might also be required. Because southern red hake is not the primary target, it is not expected to have a meaningful effect on other target species in the fishery, i.e. northern silver hake, southern whiting, and northern red hake.

6.2.2 Management Alternatives – Possession Limits

Impacts of possession limit alternatives are analyzed in the following sections. Because the intended effect of changing fishing behavior to avoid catching southern red hake are unknown, there are limitations on how the impacts can be analyzed based on available information. Fishing behavior and levels of fishing effort are generally expected to remain similar to current levels even with a change in possession limit, however. We do know that landings would be reduced potentially through converting landings into discards and that it may cause vessels to fish in ways that avoid catching red hake, though this is unlikely in any meaningful amount relative to current fishing activity. At face value, the number of landings lost can be quantified, compared to 2018 fishing activity (Table 50). Under No Action, landings would be reduced by 13.4% compared to 2018 due to the effect of the lower TAL trigger (declining from 90% to

[15] The TAL trigger causes the red hake possession limit to be lowered in-season from the initial possession limit to 400 lb., which was set at a level that the Council associates with unavoidable bycatch in the small-mesh multispecies fishery.

40.4% of the TAL). If those landings are not caught, it would total 4.2% of the total catch. We do however expect that the effect on catch will be less if vessels do not attempt to avoid catching red hake.

For the action alternatives (ranging from a 1,000 lb. possession limit to a prohibition on landings), the expected landings reduction ranges from 19% to 100%, and a nominal catch reduction ranging from 5.9% to 31%.

If these measures do not prevent the catch from exceeding the ACL, either the TAL trigger would be automatically lowered (to the point where the possession limit becomes 400 lb. throughout the fishing year), or the Council must take additional action, or both.

Table 50. Summary of estimated southern red hake landings (lb.) and catch reductions from 2018 levels at various possession limit alternatives.

Alternative	Lost landings (lb.)	Landings reduction	Catch reduction
No Action (AM @ 40.4%)	112,649	14.8%	4.6%
Status quo (AM @ 90%)	7,568	1.0%	0.3%
1,000 lb. (AM @ 40.4%)	154,591	20.4%	6.3%
600 lb. (AM @ 40.4%)	227,447	30.0%	9.3%
400 lb. (No AM)	273,701	36.1%	11.2%
0 lb. (No AM)	759,299	100.0%	31.0%
Total catch (31% landed)	2,449,352		

6.2.2.1 Alternative 1 – No Action

Under Alternative 1 No Action, the 5,000 lb. possession limit would be maintained but there would also be a 40.4% post-season AM that is expected to take effect in the 2021 fishing year. This post-season AM would reduce the TAL trigger for southern red hake from 90% of the TAL to 40.4% to account for an overage of 49.6% of the TAL in the previous fishing year. No Action would reduce landings and possibly catch, compared to the status quo.

Alternative 1 would have a low positive impact on southern red hake, acting to prevent catch from exceeding the overfishing level and allow the stock to no longer be overfished. Currently, this measure is not in effect and by keeping mortality below the overfishing level, it could allow the stock to rebuild and allow for a positive stock status, particularly if recruitment is average or above. Alternative 1 would reduce southern red hake catch and have a low positive impact relative to Alternative 2. It would allow for higher catches of southern red hake and have a low negative impact relative to any of the options in Alternative 3. Alternative 1 would have a low negative impact to the stock relative to Alternative 4 because of Alternative 1's higher possession limit, which would allow for higher catch.

6.2.2.2 Alternative 2 – Status Quo

Under Alternative 2 Status Quo, the 2018 fishing year regulations would be in place: 5,000 lb. possession limit and AMs in place reducing the southern red hake possession limit to 400 lb. when landings reach an in-season trigger of 90% of the TAL. Status quo would not reduce landings or catch compared to fishing year 2018, when the stock was declared overfished. It would be more likely that catch would continue to exceed the overfishing limit and the stock would remain in an overfished condition.

The expected impact of Alternative 2 on southern red hake, the target species, is low negative. Alternative 2 would allow for higher landings and catch than Alternative 1 and any Option in Alternative 2, thus, Alternative 2 is the most likely alternative to result in an overfished and overfishing stock status and the most negative potential impacts compared to the other alternatives.

6.2.2.3 Alternative 3 – Year-Round Possession Limits for All Gear and Fisheries

Alternative 3 would reduce year-round southern red hake possession limits. Because 60-80% of southern red hake are currently discarded due to lack of marketability, the reduced opportunity to land southern red hake would most likely not change fishing behavior and catch. All options in Alternative 3 would result in negligible to low positive impacts relative to Alternative 1 No Action and Alternative 2 Status Quo. Relative to Alternative 4, all options in Alternative 3 would result in negligible impacts because both alternatives have similar year-round possession limits with a 40.4% AM in place. Although the proposed measures in this alternative would decrease landings, the majority of trips that land red hake are targeting other species. The measures will reduce landings and have the potential to reduce southern red hake catches and convert landings into discards, depending on how fishermen react to a reduced possession limit. Estimated landing and potential reductions are given for each option below, based on analysis of 2017-2019 observed trips and based on analysis of 2018 VTR and dealer economic data.

Overall, all options in this alternative are expected to have low positive impacts on southern red hake, the ‘target’ species, and are further described below. Catches that are reduced by this alternative will decrease fishing mortality and increase rebuilding potential.

This action would reduce the year-round possession limit from 5,000 lb. and would be applicable to all vessels fishing in the southern management area using any gear. The intention of this measure is to disincentivize targeting southern red hake (most trips do not target southern red hake, but an additional number may derive a meaningful amount of revenue from red hake landings). The measure is also intended to incentivize vessels to fish in ways that fewer red hake are caught while fishing for other species, though fishing behavior is generally not expected to substantially change relative to current levels.

6.2.2.4 Analysis

The relationship between southern red hake catch rates (here expressed as the ratio of red hake catch to total kept for all species, or ‘C/K_all’) for various possession limits and other factors such as trip length, area fished, type of gear, target species, and type of trawl gear was analyzed using observer (NEFOP) and at-sea monitoring (ASM) data for all trips from 2017-2019. Notably, this happened to be a period when an expansion of fishing effort for loligo occurred due to increases in the abundance and availability of that species. This analysis included only observed trips and hauls that fished in sub-divisions 5ZU, 5ZW, and 6 (see Map 2). Trips were binned into broad fishery categories following the binning rules provided by GARFO (Caless, pers. comm.). Prices for kept catch were derived from matching dealer data using a procedure developed and tested for Amendment 19 (NEFMC 2012). These value data were required for determination of target species and assignment to broad fishery categories but were not further analyzed here. For the analysis given here, only trips using small-mesh (i.e. < 5.5 inches) are included. These small-mesh trips contribute to the majority of red hake catches (see 2018 Annual Monitoring Report, NEFMC 2019).

The C/K_all ratios were binned into seven categories. In the following charts, observed hauls with zero catch of red hake are coded with a dark blue color. Other categories were binned and coded according to the scheme in the table below. It is expected that trips with higher ratios are more likely to make an effort to avoid catching southern red hake and the associated measure will be more effective when these ratios are high. It should be noted that hauls with catches greater than 50% of total kept might be considered as targeting red hake, but this is not necessarily so. Hauls with a high red hake catch ratio (C/K_all) might have retained red hake for landings (i.e. targeting) or discarded them. Hauls with high C/K_all ratios occur for two reasons: the catches of red hake were high or the catches of target species to be landed were very low.

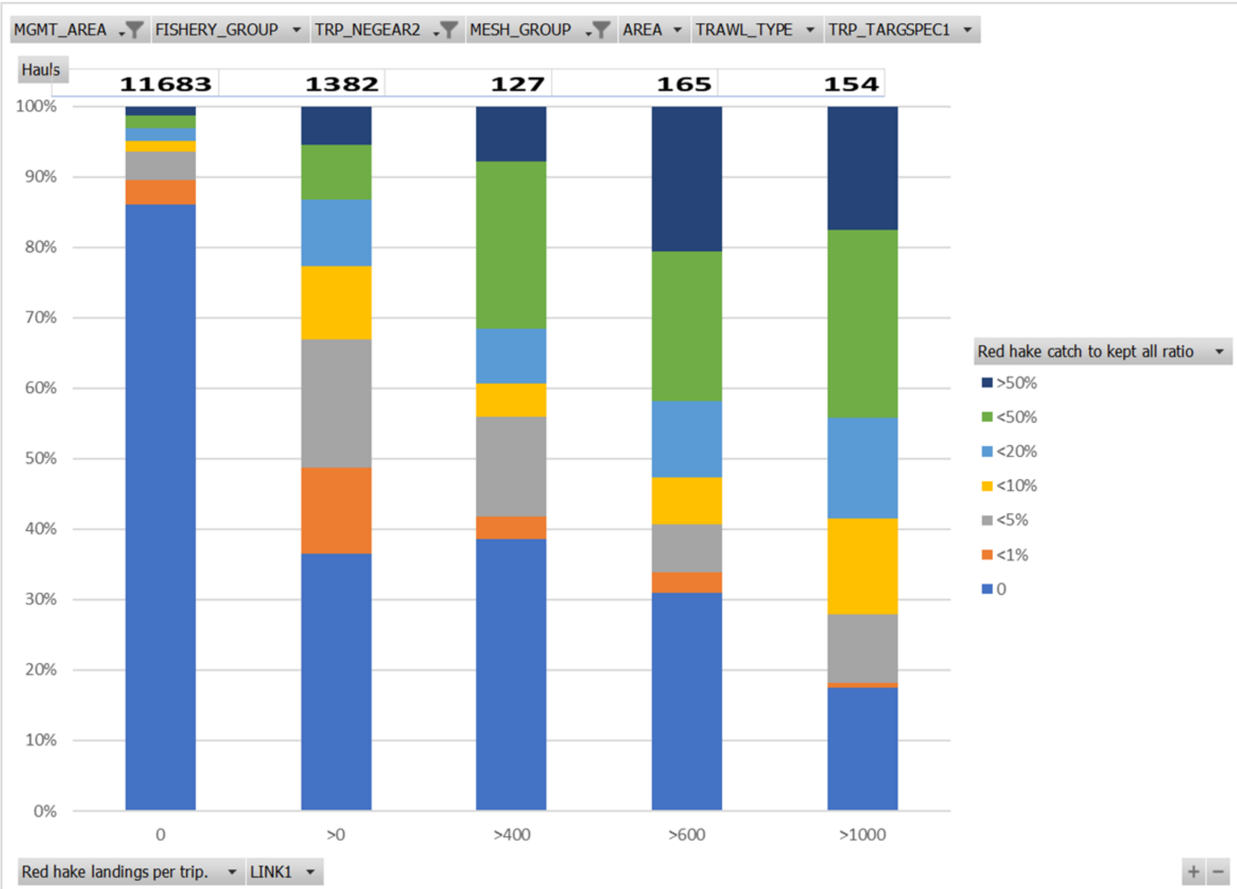
Table 51. Color coding of red hake catch ratios used in this analysis.

Red hake catch to kept fish (weight-based)	Color
No red hake catch	Dark blue
<1%	Orange
1 – 5%	Grey
5 – 10%	Yellow
10 – 20%	Light blue
20 – 50%	Green
>50%	Navy

Across all areas and gears, there is a higher proportion of red hake compared to landed fish (C/K_all) as landings of red hake increase (Figure 13). When red hake landings were above 1,000 lb. red hake catch was above 20% of the amount kept to be landed on about 45% of hauls. Eighteen percent of hauls had red hake catches that exceeded 50% of the amount kept to be landed. Trips with lower amounts of southern red hake landings (binned into categories that correspond to the proposed alternatives and options) generally had fewer red hake catch.

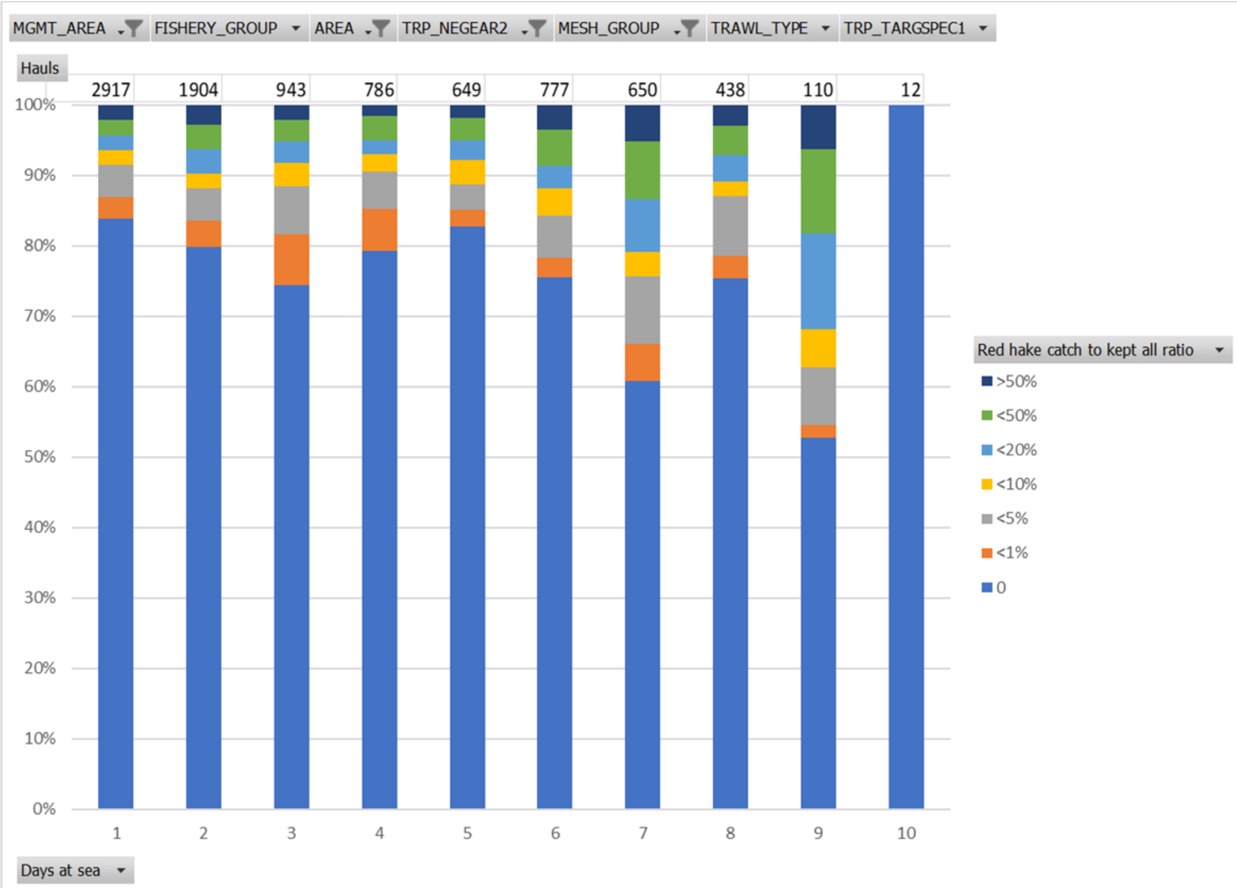
While this outcome might seem obvious, it suggests that lowering the southern red hake possession limit could induce vessels to fish in ways that would reduce the total catch of red hake. For trips with no red hake landings, only 23% of hauls had red hake catch ratios exceeding 20% and only 5% of hauls had red hake catch ratios exceeding 50%. Some of this effect may arise from different ways of fishing or from differences in season or area fished, but these other causes are examined further below. Nonetheless, some vessels may be unable to fish in other areas or seasons due to physical or economic limitations.

Figure 13. Observed trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by the amount of red hake landings per trip. The number above each column is the total number of observed hauls within that column.



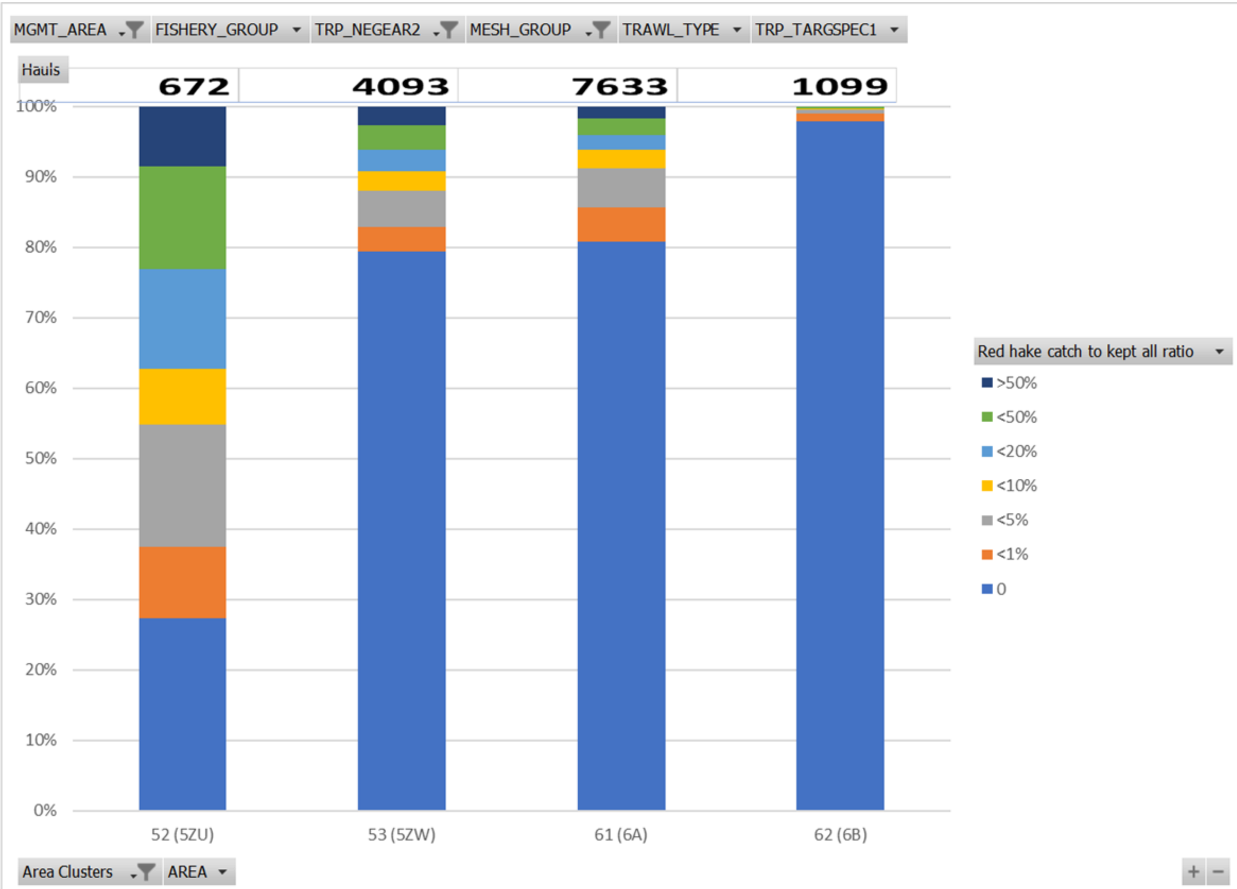
Longer trips tended to have more hauls with higher red hake catch rates than shorter trips (Figure 14). Trips of seven to nine days had more hauls with proportionally higher red hake catches than did trips lasting three to six days. Trips of one to two days tended to have the lowest red hake catch rates.

Figure 14. Observed trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by trip duration. The number above each column is the total number of observed hauls within that column.



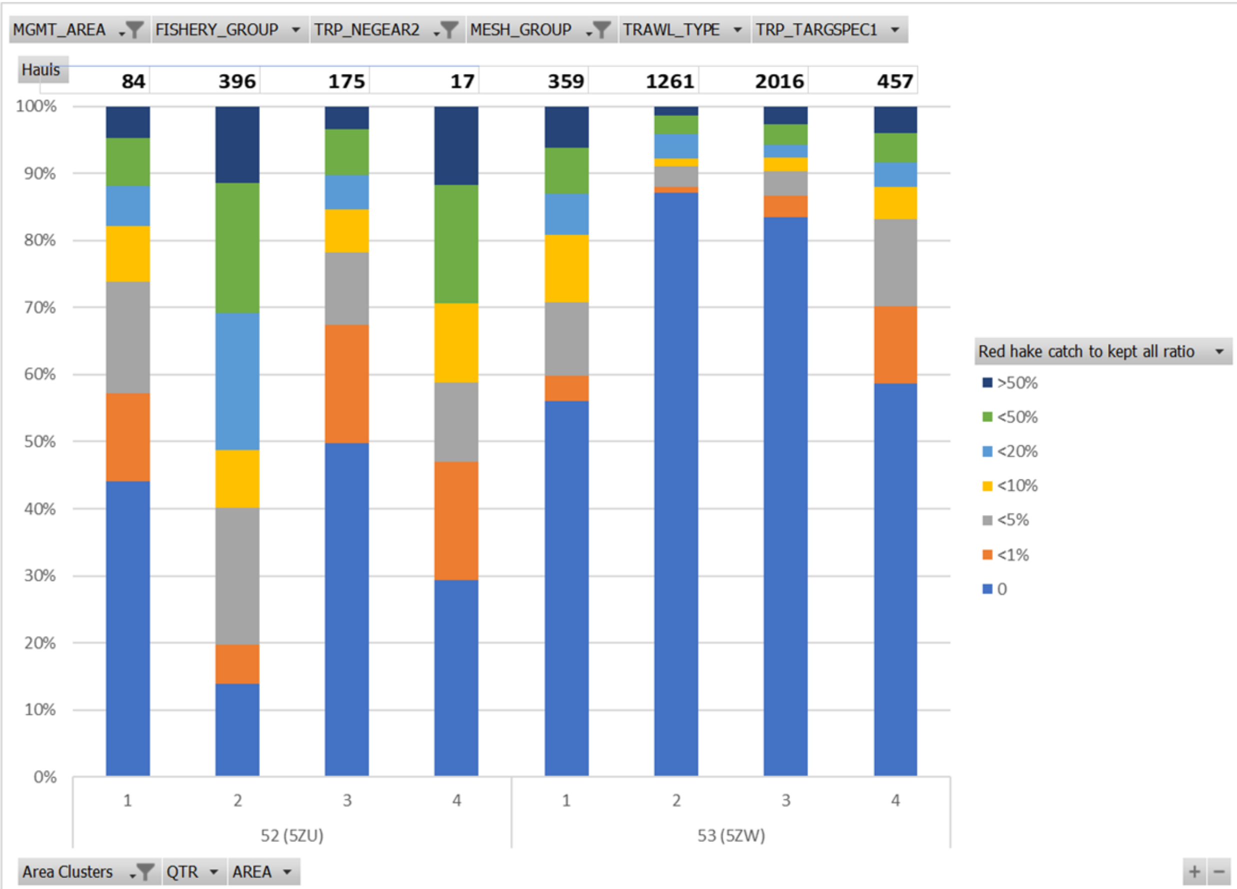
The two results above are consistent with differences in catch rates by area. Trips taken in sub-division 5ZU are typically longer and taken by larger vessels that land larger quantities of fish. If they do land an incidental amount of red hake, the volumes landed tend to be greater. By a significant margin, the trips with hauls having the highest red hake C/K_all ratios were those fishing in sub-division 5ZU (Figure 15).

Figure 15. Observed small-mesh trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by statistical sub-division (see Map 2). The number above each column is the total number of observed hauls within that column.



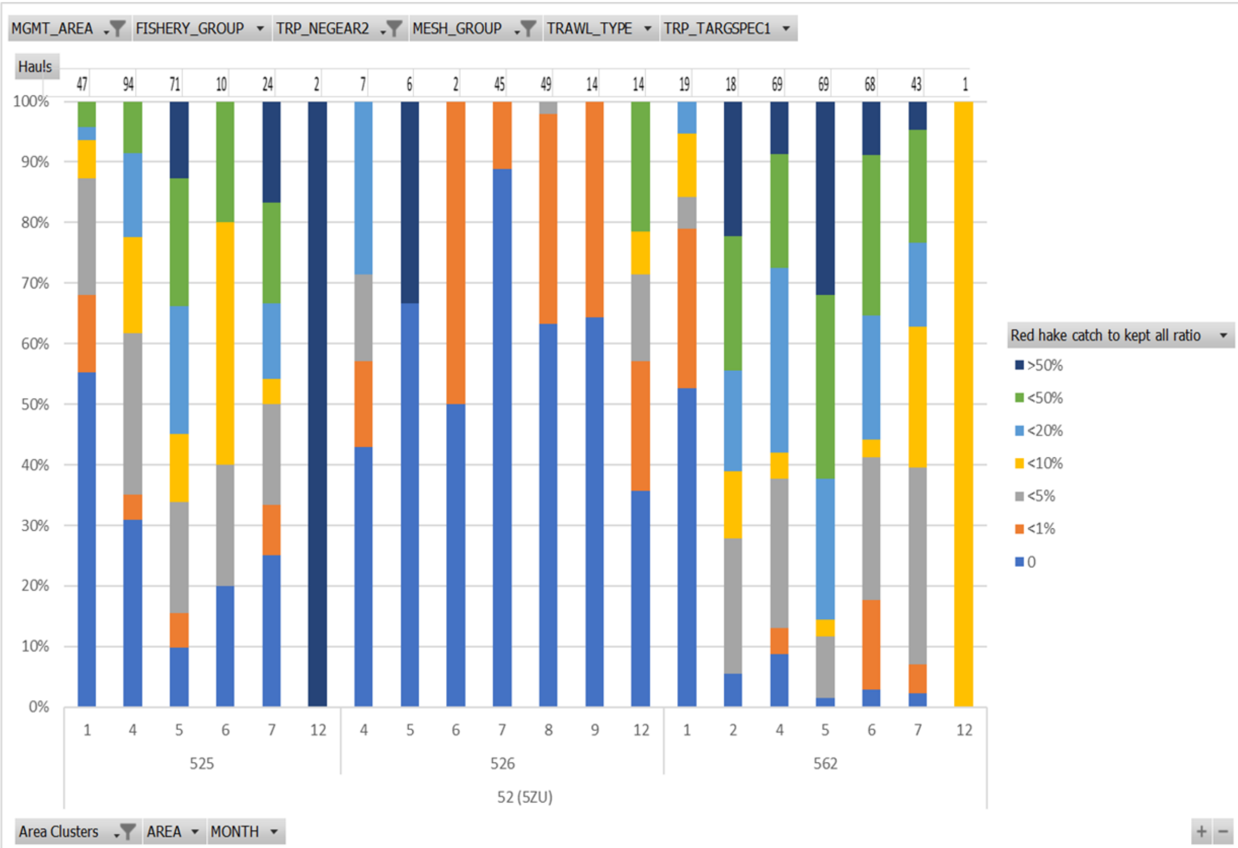
Breaking this down further into calendar quarters and focusing on sub-divisions 5ZU and 5ZW (Figure 16), the analysis shows that the highest red hake catch rates occur in quarters 2 and 4 in sub-division 5ZU and in quarters 1 and 4 in sub-division 5ZW.

Figure 16. Observed trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by statistical sub-division (see Map 2) and calendar quarter. The number above each column is the total number of observed hauls within that column.



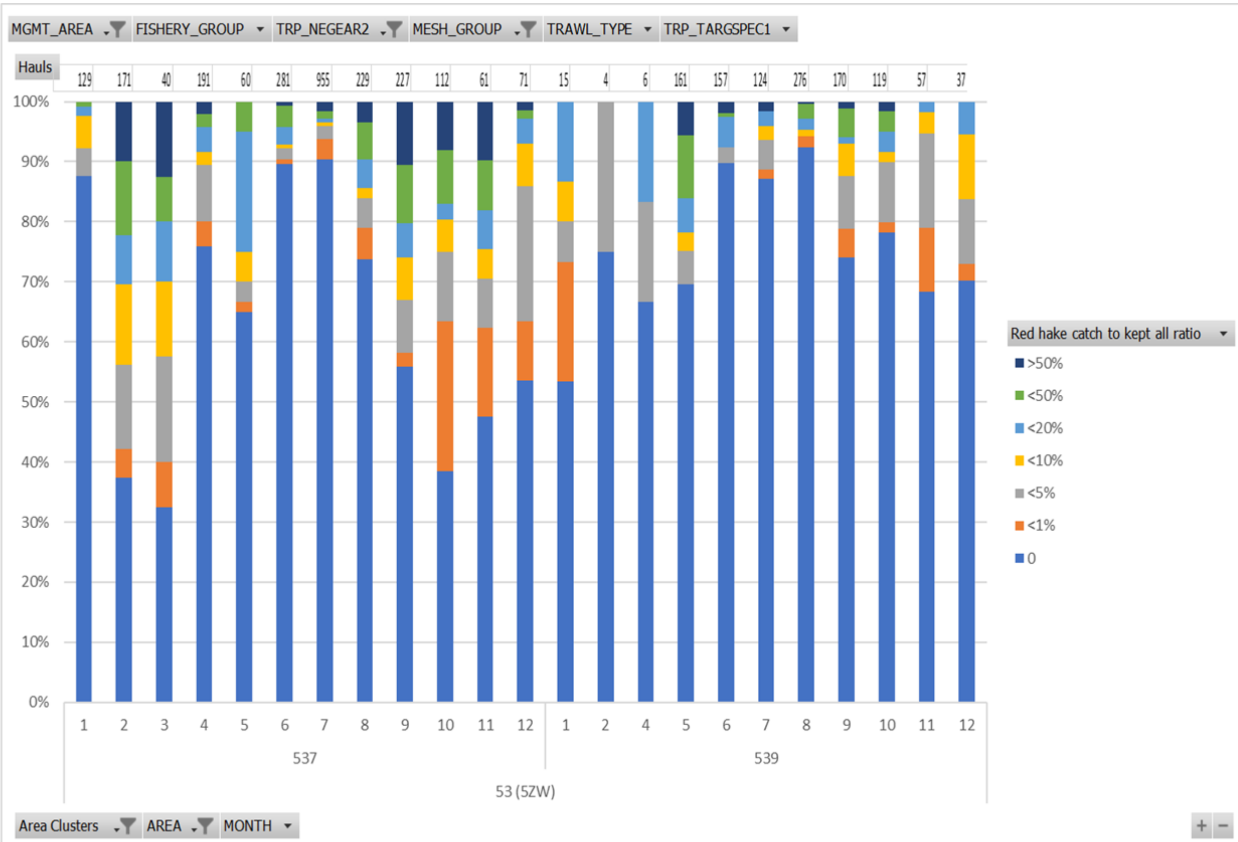
Breaking the catch rates down even further into calendar month and statistical area, we see that the highest catch ratios occur throughout most of the year in statistical areas 525 and 526. Notable catches in area 525 occurred from May to July and in area 526 from February to June (March is missing because there were no observed small-mesh multispecies trips in the area).

Figure 17. Observed trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by statistical area and month sub-division 52 (5ZU) (see Map 2). The number above each column is the total number of observed hauls within that column.



Red hake catch rates in sub-division 5ZW tend to be less than in 5ZU (compare Figure 17 to Figure 18). Within this subdivision, red hake catch ratios appear to be significantly higher than other months in statistical area 537 during Feb, Mar, and Oct to Dec (Figure 18).

Figure 18. Observed trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by statistical area and month sub-division 53 (5ZW) (see Map 2). The number above each column is the total number of observed hauls within that column.



On the other hand, broken down by sub-division and target species, the highest red hake catch ratios appear in the whiting fishery in sub-divisions (5ZW and 6A) (Figure 19). A higher amount of red hake landings (which would be affected by a reduced possession limit) occur in statistical areas 539 during quarter 1, 611 during quarters 3 and 4, and 612 in quarter 3 (Figure 20).

Although some have suggested that the raised footrope trawl or other more selective nets catch fewer red hake, it does not appear to have a lower red hake catch ratio than does the standard groundfish or 2/4 seam trawl (Figure 21). In fact, some other nets, may have lower red hake catch ratios (C/K_all) than the raised footrope trawl or other standard nets. For example, less than 4% of observed hauls had red hake catch ratios exceeding 10%. Notably the balloon net had zero observed hauls with red hake. More investigation is needed here, however, because these differences may be caused by differences in areas fished, season fished, or target species. Other factors, such as depth, net deployment, and time of day relative to sunrise/sunset should be investigated.

Figure 19. Observed trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by the trip's target species and statistical sub-division (see Map 2). The number above each column is the total number of observed hauls within that column.

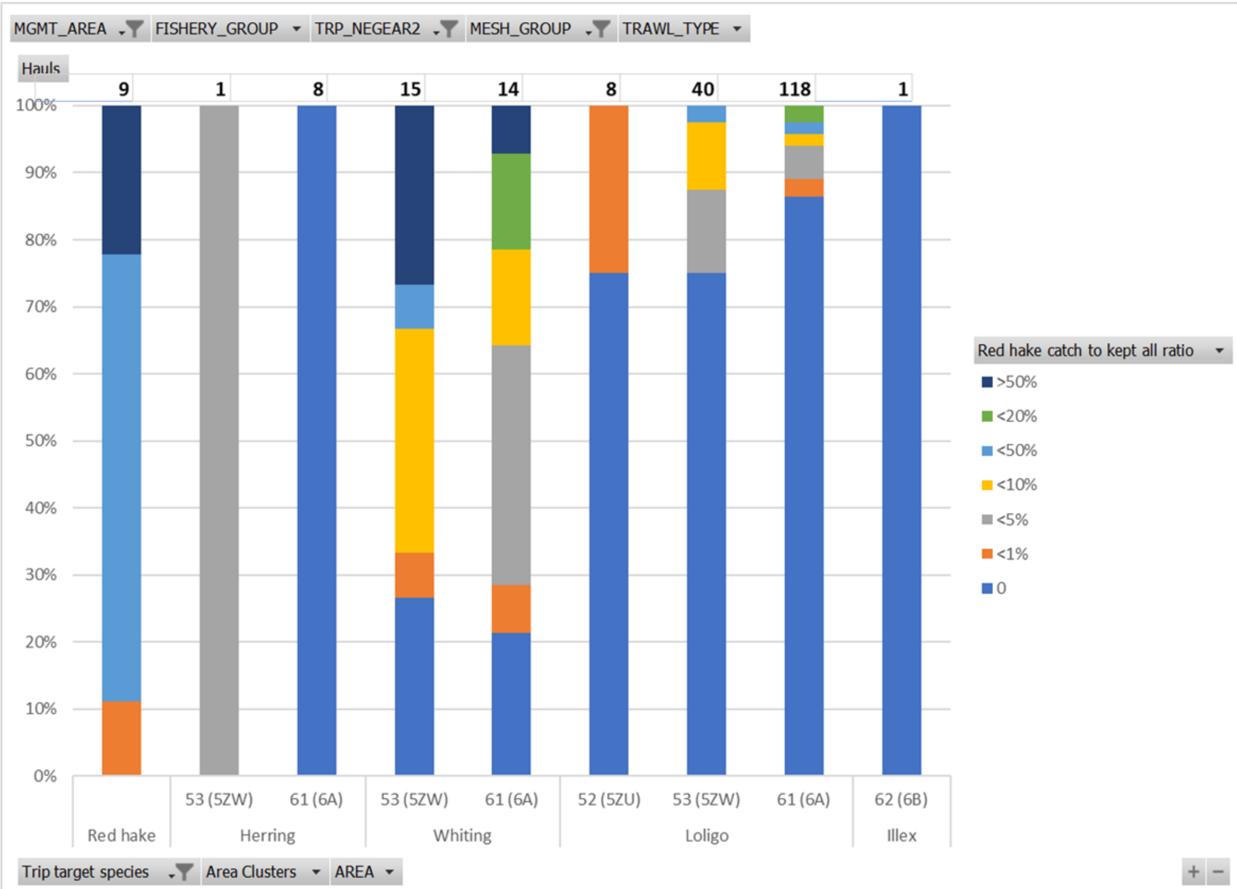


Figure 20. Percent of southern red hake landed on observed small-mesh trawl trips by statistical area (see Map 2) and quarter, 2017-2019 NEFOP and ASM observer data.

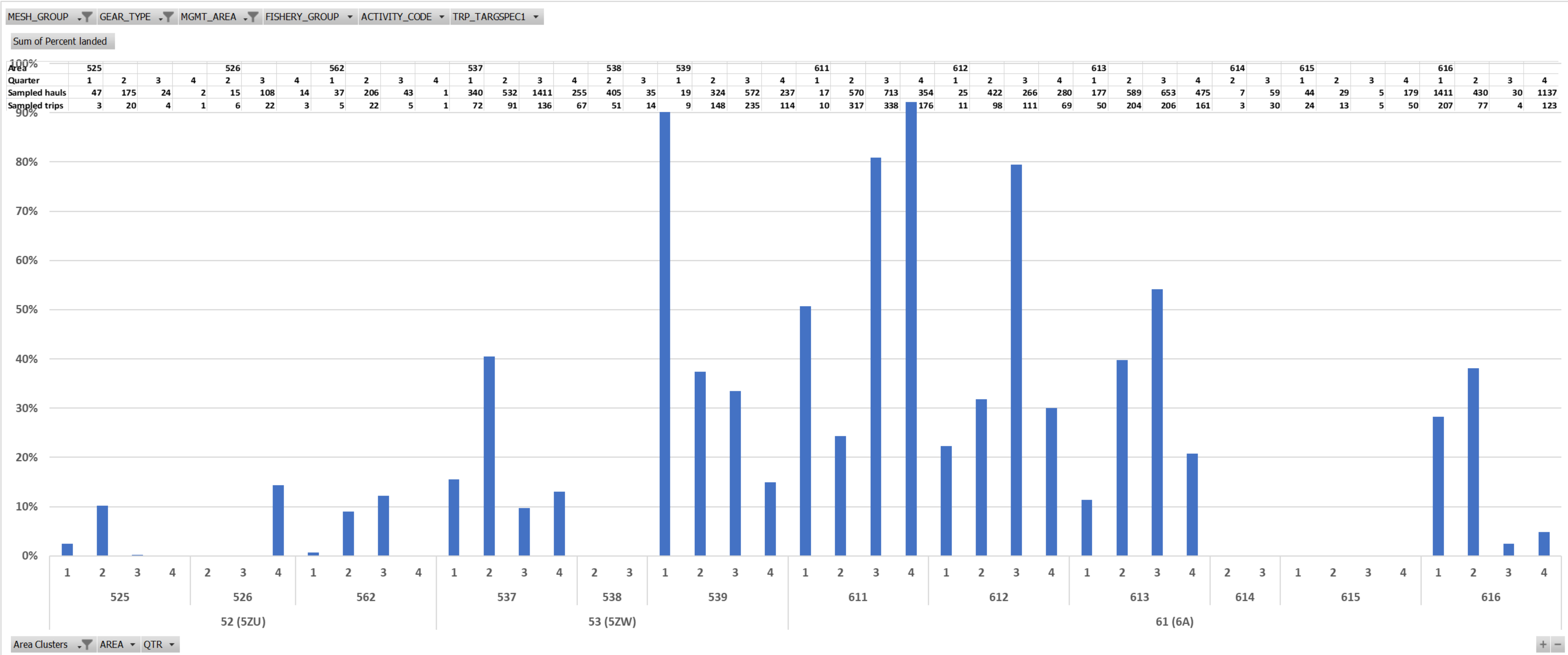
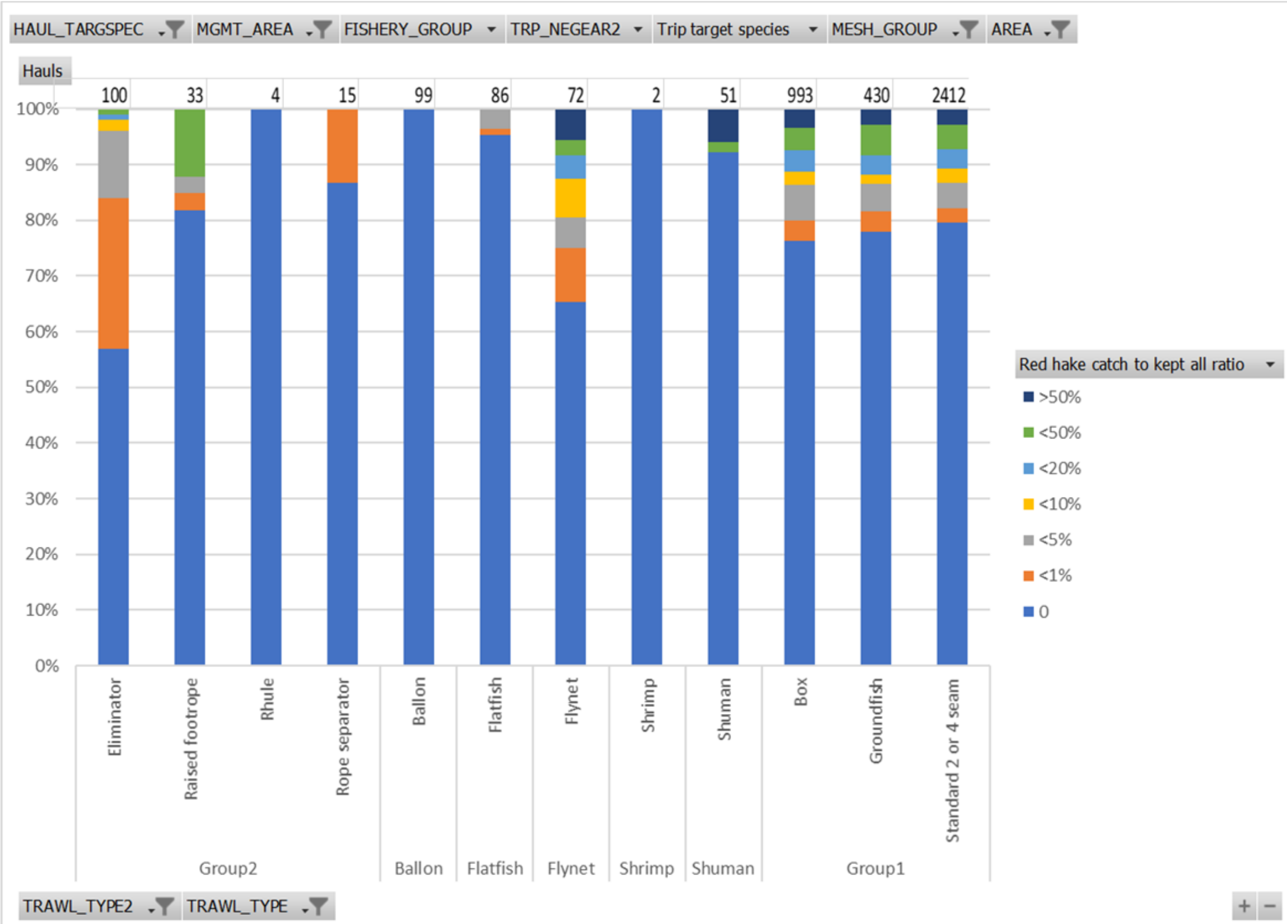


Figure 21. Observed trips during 2017-2019 categorized by the southern red hake catch to all species landings ratio (higher values imply more discards compared to landings) by small-mesh trawl type. The number above each column is the total number of observed hauls within that column.



6.2.2.4.1 Option A – 0 lb. Possession Limit

Option A would prohibit red hake landings from trips in or passing through the southern management area (Figure 2). Any unavoidable catch would need to be discarded. Theoretically, prohibiting landings would be the most effective at changing fishing behavior, but because southern red hake is seldom the target species on trips, there are diminishing returns compared to a higher level such as 400 lb. that has been associated with an incidental catch level in the small-mesh multispecies fishery.

Thus, a prohibition on landings is expected to have low positive impact on the target species, more positive than Option C or D, slightly more positive than Option B, and much more positive than Alternative 1 (No Action) or 2 (Status Quo). Compared to Alternative 4, Alternative 3 Option A would have a more positive impact because no landings would be allowed in this alternative compared to the 600-1,000 lb. possession limit in Alternative 4.

Southern red hake landings would be prohibited but using the 2017-2019 observer data as the basis for analysis, the foregone landings represent only 20% of total catch (Table 52). Based on the economic analysis of 2018 trips, the measure is expected to reduce landings and catch by a similar fraction, 100% and 31% respectively.

The measure would have a smaller impact on catch reduction if fishing vessels do not adapt to the lower possession limit and continue fishing as before. It could have a greater reduction in catch if the vessels fish in ways to avoid catching southern red hake, though this is unlikely in any substantial way.

The expected reductions in landings and catch are mostly focused in the squid and whiting fishery, in sub-divisions 5ZW and 6A. Reductions in landings and catch are expected to be less in the large-mesh trawl fishery, e.g. fisheries targeting groundfish, skates, and monkfish, with no expected reduction in landings or catch in the herring and scallop fisheries.

Table 52. Estimated proportion of trips, landings, and potential catch reduction associated with a 0 lb. southern red hake possession limit. *Source*: Observer data, 2017-2019.

Fishery	Gear	Cumulative trips	Percent of trips affected	Landings reduction (%)	Catch reduction (%)
Whiting	Small-mesh trawl	281	100%	100%	22%
Squid	Small-mesh trawl	144	100%	100%	16%
Herring	Small-mesh trawl	0	0%	0%	0%
All	Large-mesh trawls	132	100%	100%	22%
Scallop	Dredge & Trawl	0	0%	100%	0%
52 (5ZU)	All	9	100%	100%	8%
53 (5ZW)	All	224	100%	100%	26%
6X (6A, 6B, 6C)	All	247	100%	100%	30%
All	All	557	100%	100%	20%
FY 2018 Economic analysis	All	4,572	100%	100%	31%

6.2.2.4.2 Option B – 400 lb. Possession Limit

Option B would establish a year-round possession limit at 400 lb. This level has been associated with an appropriate amount that is consistent with unavoidable bycatch in the small-mesh multispecies fishery, used as an in-season AM to slow landings and catch to prevent catch from exceeding the Annual Catch Limit.

Thus, a 400 lb. possession limit is expected to have a low positive impact on the target species, more positive than Option C or D, and much more positive than Alternative 1 No Action or 2 Status Quo. Option B would have a less positive impact than Option A but is expected to create much fewer discards. Alternative 3 Option B would have a more positive impact on the stock compared to Alternative 4 because of the lower possession limit under this alternative.

Using the 2017-2019 observer data as the basis for analysis, Option B is expected to reduce southern red hake landings by 36% but because most red hake are discarded, the foregone landings represent only 7% of total catch (Table 53). Based on the economic analysis of 2018 trips, the measure is expected to reduce landings and catch by a similar fraction, 36% and 11% respectively.

The measure would have a smaller impact on catch reduction if fishing vessels do not adapt to the lower possession limit and continue fishing as before. It could have a greater reduction in catch if the vessels fish in ways to avoid catching southern red hake.

The expected reductions in landings and catch are mostly focused on the squid and whiting fishery, in sub-divisions 5ZW and 6A (Map 2). Reductions in landings and catch are expected to be less in the large-mesh trawl fishery, e.g. fisheries targeting groundfish, skates, and monkfish.

Table 53. Estimated proportion of trips, landings, and potential catch reduction associated with a 600 lb. southern red hake possession limit. *Source*: Observer data, 2017-2019.

Fishery	Gear	Cumulative trips	Percent of trips affected	Landings reduction (%)	Catch reduction (%)
Whiting	Small-mesh trawl	63	2%	35%	8%
Squid	Small-mesh trawl	22	2%	32%	5%
All	Large-mesh trawl	11	1%	28%	6%
52 (5ZU)	All	*Omitted due to confidentiality*			
53 (5ZW)	All	35	1%	36%	9%
6X (6A, 6B, 6C)	All	30	1%	34%	10%
All	All	96	1%	36%	7%
FY 2018 Economic analysis	All	439	10%	36%	11%

6.2.2.4.3 Option C – 600 lb. Possession Limit

Option C would establish a year-round possession limit at 600 lb. This level is slightly more than a level that has been associated with an appropriate amount that is consistent with unavoidable bycatch in the small-mesh multispecies fishery, used as an in-season AM to slow landings and catch to prevent catch from exceeding the Annual Catch Limit. Option C could allow vessels to land a bit more southern red hake when it is encountered in the catch and might be a bit less effective in changing fishing behavior than Option B (400 lb.). If and when landings exceed the in-season TAL trigger, the southern red hake possession limit would be automatically reduced to 400 lb. for the remaining fishing year.

Thus, a 600 lb. possession limit is expected to have a low positive impact on the target species, more positive than Option D, and much more positive than Alternative 1 No Action or 2 Status Quo. Option C would have a less positive impact than Option A and B but may not require vessels to discard as many red hake if they cannot be avoided, though fishing behavior and effort is not expected to substantially change from current activity. Alternative 3 Option C would have negligible impacts relative to Alternative 4 because of the similar possession limits of southern red hake, depending on gear selectivity.

Using the 2017-2019 observer data as the basis for analysis, Option C is expected to reduce southern red hake landings by 23% but because most red hake are discarded, the foregone landings represent only 5% of total catch (Table 54). Based on the economic analysis of 2018 trips, the measure is expected to reduce landings and catch by a similar fraction, 29% and 9% respectively.

The measure would have a smaller impact on catch reduction if fishing vessels do not adapt to the lower possession limit and continue fishing as before. It could have a greater reduction in catch if the vessels fish in ways to avoid catching southern red hake.

The expected reductions in landings and catch are mostly focused in the squid and whiting fishery, in sub-divisions 5ZW and 6A (Map 2). Reductions in landings and catch are expected to be less in the large-mesh trawl fishery, e.g., fisheries targeting groundfish, skates, and monkfish.

Table 54. Estimated proportion of trips, landings, and potential catch reduction associated with a 600 lb. southern red hake possession limit. ***Source*****: Observer data, 2017-2019.**

Fishery	Gear	Cumulative trips	Percent of trips affected	Landings reduction (%)	Catch reduction (%)
Whiting	Small-mesh trawl	37	1%	28%	6%
Squid	Small-mesh trawl	13	1%	22%	3%
All	Large-mesh trawl	4	0%	23%	5%
52 (5ZU)	All	*Omitted due to confidentiality*			
53 (5ZW)	All	22	1%	28%	7%
6X (6A, 6B, 6C)	All	15	0%	28%	9%
All	All	54	0%	30%	6%
FY 2018 Economic analysis	All	272	6%	30%	9%

6.2.2.4.4 Option D – 1,000 lb. Possession Limit

Option D would establish a year-round possession limit at 1,000 lb. This level is more than a level that has been associated with an appropriate amount that is consistent with unavoidable bycatch in the small-mesh multispecies fishery, used as an in-season AM to slow landings and catch to prevent catch from exceeding the Annual Catch Limit. Option D could allow vessels to land more southern red hake when it is encountered in the catch and might be a bit less effective in changing fishing behavior than Option B (400 lb.) or Option C (600 lb.). If and when landings exceed the in-season TAL trigger, the southern red hake possession limit would be automatically reduced to 400 lb. for the remaining fishing year.

Thus, a 1,000 lb. possession limit is expected to have a low positive impact on the target species, and a positive impact compared to Alternative 1 No Action or 2 Status Quo. Option D would have a less positive impact than Option A B and C but may not require vessels to discard as many red hake if they cannot be avoided, though fishing behavior and effort is not expected to substantially change from current activity. Alternative 3 Option D would have negligible impacts relative to Alternative 4 because of the similar possession limits of southern red hake, depending on gear selectivity.

Using the 2017-2019 observer data as the basis for analysis, Option C is expected to reduce southern red hake landings by 18% but because most red hake are discarded, the foregone landings represent only 4% of total catch (Table 55). Based on the economic analysis of 2018 trips, the measure is expected to reduce landings and catch by a similar fraction, 19% and 6% respectively.

The measure would have a smaller impact on catch reduction if fishing vessels do not adapt to the lower possession limit and continue fishing as before. It could have a greater reduction in catch if the vessels fish in ways to avoid catching southern red hake. Option D is expected to have less effect on fishing behavior than Options A, B, and C, but would have fewer discards if southern red hake catches are unavoidable.

The expected reductions in landings and catch are mostly focused in the squid and whiting fishery, in sub-divisions 5ZW and 6A (Map 2). Because longer trips are taken in sub-division 52, larger amounts of red hake are landed when they are retained than for vessels fishing elsewhere. In this case, a 1,000 lb. possession limit would reduce landings from catches in sub-division 52 by 47%, which amounts to 4% of the total observed catch in sub-division 52. Reductions in landings and catch are expected to be less in the large-mesh trawl fishery, e.g. fisheries targeting groundfish, skates, and monkfish.

Table 55. Estimated proportion of trips, landings, and potential catch reduction associated with a 1,000 lb. southern red hake possession limit. *Source*: Observer data, 2017-2019.

Fishery	Gear	Cumulative trips	Percent of trips affected	Landings reduction (%)	Catch reduction (%)
Whiting	Small-mesh trawl	11	0%	19%	4%
Squid	Small-mesh trawl	5	0%	10%	2%
All	Large-mesh trawl	*Omitted due to confidentiality*			
52 (5ZU)	All	*Omitted due to confidentiality*			
53 (5ZW)	All	5	0%	19%	5%
6X (6A, 6B, 6C)	All	4	0%	19%	6%
All	All	17	0%	21%	4%
FY 2018 Economic analysis	All	152	3%	20%	6%

6.2.2.5 Alternative 4 - Dual 1,000 lb./600 lb. Year-Round Possession Limit *(Preferred Alternative)*

Like Alternative 3, Alternative 4 is intended to disincentivize targeting southern red hake and incentivize avoiding catching southern red hake when possible. In addition, it is intended to incentivize fishermen to use more selective gear to reduce catches of southern red hake (and potentially other species) in the small-mesh trawl fisheries (whiting, squid, herring, etc.).

Alternative 4 is expected to have low positive impacts on the target species, southern red hake. It is expected to have a more positive impact than Alternatives 1 and 2, and any option in Alternative 3 because it is expected to result in a stock that would no longer be overfished through a reduction in both landings and catch more than simple avoidance and probably discarding caused by the possession limit alone. Generally, fishing behavior and levels of effort are expected to remain similar to current activity.

Most trips catching red hake would have a lower 600 lb. southern red hake possession limit but could reduce discards and increase red hake landings by using more selective trawls. At the same time, trips already using large-mesh or selective small-mesh trawls would have a higher 1,000 lb. possession limit and discard fewer red hake than they would if a straight 600 lb. possession limit applied.

Some trips using standard small-mesh trawls may modify or replace their trawls to reduce catches of southern red hake that they would not be able to otherwise retain. We cannot quantitatively estimate how many trips would convert to use more selective small-mesh trawls or how effective those more selective trawls would be for reducing red hake catch. We do not however expect the fishermen to switch unless the cost is low, it improves the catch of target species (such as whiting, squid, and herring), or it reduces the bycatch of other species to make the catch cleaner and easier/quicker to process onboard the vessel.

It is more difficult to quantitatively analyze the impacts of Alternative 4 on southern red hake because we cannot predict how many vessels will use selective small-mesh trawls to target whiting, squid, and other species. Reductions on catch however could be more than either Option C or D (and possibly Options A and B) depending on how well this alternative incentivizes the use of more selective trawls and how well they exclude red hake from the catch. Although the analysis of observed trip data did not reveal a significant reduction of red hake catch in the raised footrope trawl (Figure 21), there are some indications that other trawl gears might have a meaningful effect but the number of sampled trips using those alternative trawls are low and the effects of those gears on red hake catches are otherwise largely unknown.

The quantitative effect of Alternative 4 on landings is similar to that for 600 lb. (Table 60, Figure 23), but it does not take into account how many small-mesh multispecies trips use or would begin using more selective gears. Trips that use large-mesh trawls or selective small-mesh trawls would be expected to continue less under this alternative.

During 2017-2019, 40% (12+27+1%) of trawl trips catching one or more pounds of southern red hake used standard small-mesh trawls (Table 56). Although the proportion of observed hauls is similar (38%), standard small-mesh trips account for 61% of the observed red hake catch. Specifically, these are the trips that would have a 600 lb. red hake possession limit unless they modified or replaced the trawls with selective gear for these trips. Of the observed small- and large-mesh trawl trips, 60% would have a 1,000 lb. southern red hake possession limit.

Table 56. Percent of trips, hauls, and red hake catch by mesh category and net type on 2017-2019 observed trips catching southern red hake. Shaded cells represent trips that would have a 1,000 lb. possession limit because the trip used a large-mesh or selective small-mesh trawl. Small-mesh (SM) represent trips using trawl mesh between 3 and 5.5. inches square or diamond.

	Net types Standard	Selective	Raised footrope	Grand Total
Observed trips				
Standard	**87%**	**4%**	**8%**	**99%**
LG	48%	0%	0%	48%
SM	12%	1%	2%	15%
XS	27%	2%	5%	34%
Unknown	1%	0%	0%	1%
Separator or Rhule	**0%**	**1%**	**0%**	**1%**
LG	0%	1%	0%	1%
XS	0%	0%	0%	0%
Observed hauls				
Standard	**88%**	**4%**	**5%**	**97%**
LG	51%	0%	0%	51%
SM	12%	1%	2%	15%
XS	25%	3%	2%	30%
Unknown	1%	0%	0%	1%
Separator or Rhule	**0%**	**3%**	**0%**	**3%**
LG	0%	3%	0%	3%
XS	0%	0%	0%	0%
Red hake catch (lbs)				
Standard	**75%**	**3%**	**22%**	**100%**
LG	5%	0%	0%	5%
SM	17%	1%	11%	28%
XS	47%	2%	10%	59%
Unknown	7%	0%	0%	7%
Separator or Rhule	**0%**	**0%**	**0%**	**0%**
LG	0%	0%	0%	0%
XS	0%	0%	0%	0%
Total Observed trips	**87%**	**5%**	**8%**	**100%**
Total Observed hauls	**88%**	**7%**	**5%**	**100%**
Total Red hake catch (lbs)	**75%**	**3%**	**22%**	**100%**

This observed trip analysis was also broken down by the amount of southern red hake landed (Table 57). For observed trips landing over 1,000 lb. of southern red hake, 45% used standard small-mesh trawls and would have a 600 lb. possession limit or would be able to land 1,000 lb. of red hake by switching to a selective trawl. These trips represent 50% of the observed red hake catch.

Table 57. Percent of trips, hauls, and red hake catch by mesh category and net type on 2017-2019 observed trips landing 1,000 lb. or more of southern red hake. Shaded cells represent trips that would have a 1,000 lb. possession limit because the trip used a large-mesh or selective small-mesh trawl. Small-mesh (SM) represent trips using trawl mesh between 3 and 5.5. inches square or diamond.

	Net types			
	Standard	Selective	Raised footrope	Grand Total
Observed trips				
Standard	**44%**	**3%**	**52%**	**100%**
LG	0%	0%	2%	2%
SM	15%	3%	25%	43%
XS	30%	0%	26%	56%
Observed hauls				
Standard	**54%**	**3%**	**43%**	**100%**
LG	0%	0%	1%	1%
SM	17%	3%	25%	45%
XS	37%	0%	17%	54%
Red hake catch (lbs)				
Standard	**51%**	**1%**	**48%**	**100%**
LG	0%	0%	1%	1%
SM	19%	1%	30%	50%
XS	31%	0%	18%	49%
Total Observed trips	**44%**	**3%**	**52%**	**100%**
Total Observed hauls	**54%**	**3%**	**43%**	**100%**
Total Red hake catch (lbs)	**51%**	**1%**	**48%**	**100%**

For trips landing 600 or more pounds of southern red hake, 55% of the observed trips used standard small-mesh trawls catching one or more pounds of southern red hake (Table 58). These trips comprised 63% of total red hake catch. The difference in the 600 lb. and 1,000 lb. possession limit is the incentive for fishermen using small-mesh trawls to switch to using more selective trawls, but given the relative low value and proportion of total revenue from red hake landings, we do not expect the fishermen to switch unless the cost is low, it improves the catch of target species (such as whiting, squid, and herring), or it reduces the bycatch of other species to make the catch cleaner and easier/quicker to process onboard the vessel.

Table 58. Percent of trips, hauls, and red hake catch by mesh category and net type on 2017-2019 observed trips landing 600 or more lb. of southern red hake. Shaded cells represent trips that would have a 1,000 lb. possession limit because the trip used a large-mesh or selective small-mesh trawl. Small-mesh (SM) represent trips using trawl mesh between 3 and 5.5. inches square or diamond.

	Net types			
	Standard	Selective	Raised footrope	Grand Total
Observed trips				
Standard	**55%**	**2%**	**43%**	**100%**
LG	0%	0%	1%	1%
SM	11%	2%	15%	29%
XS	44%	0%	27%	70%
Observed hauls				
Standard	**65%**	**2%**	**33%**	**100%**
LG	0%	0%	1%	1%
SM	14%	2%	16%	32%
XS	51%	0%	16%	67%
Red hake catch (lbs)				
Standard	**63%**	**1%**	**36%**	**100%**
LG	0%	0%	0%	0%
SM	19%	1%	20%	40%
XS	44%	0%	15%	59%
Total Observed trips	**55%**	**2%**	**43%**	**100%**
Total Observed hauls	**65%**	**2%**	**33%**	**100%**
Total Red hake catch (lbs)	**63%**	**1%**	**36%**	**100%**

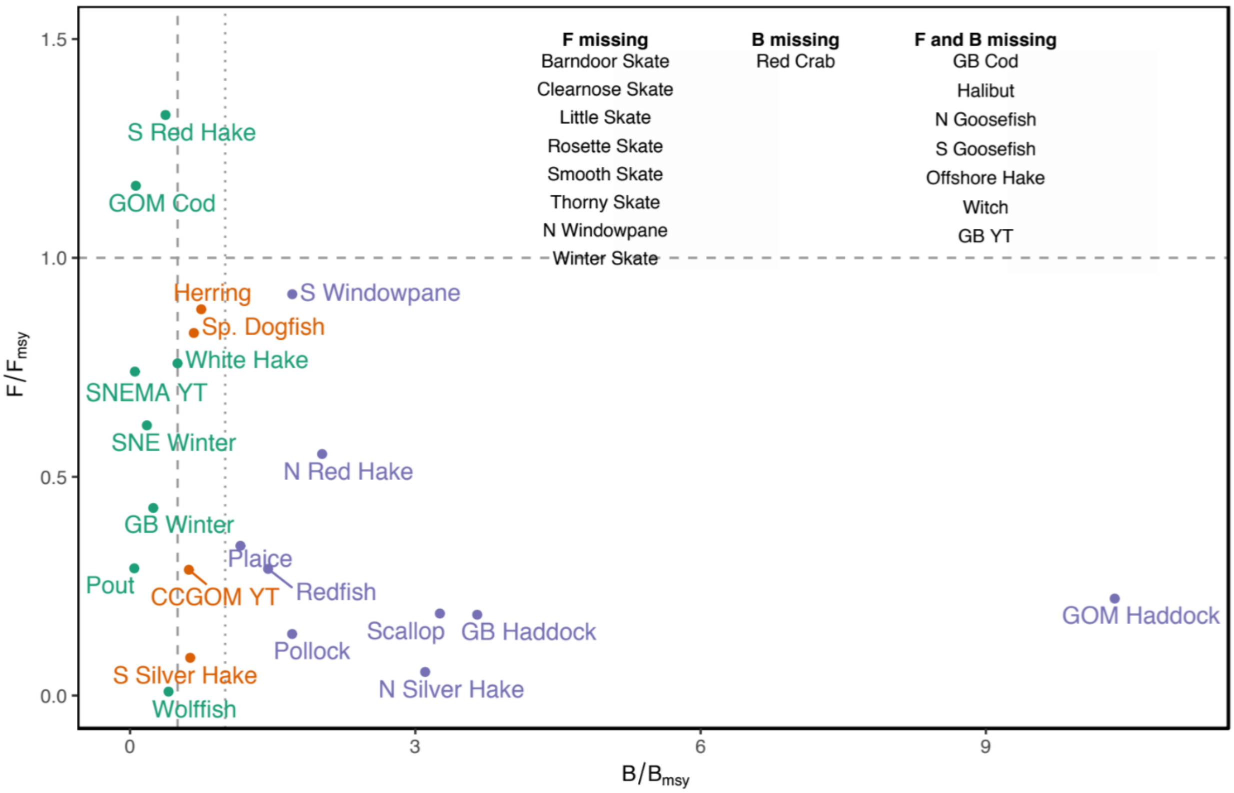
6.3 Impacts on Non-target Species

For the purposes of the following analysis of impacts on non-target species, this includes all commercial and recreational catches of finfish and shellfish other than southern red hake. It includes species that are targeted on small-mesh multispecies fishery trips, e.g. silver hake and whiting, squids, and herring as well as large-mesh species and species caught by fishermen using other gears. It also includes species such as haddock and yellowtail flounder that are caught and discarded in the small-mesh multispecies whiting fishery.

Georges Bank haddock, for example, are not considered to be overfished and overfishing is not occurring (Figure 22). The stock status is unknown for Georges Bank yellowtail flounder, another stock that is common bycatch in the southern management area small-mesh multispecies fishery. Georges Bank and SNE winter flounder and SNE yellowtail flounder are overfished and are subject to a rebuilding plan, but overfishing is not occurring. Changes in effort or increases in selectivity to avoid catching southern red hake could have a low negative (because the bycatch of these species in the small-mesh fishery is generally low) impact on these overfished stocks, though substantial changes in behavior and effort are not expected relative to current fishing activity. We don’t know how fishermen would respond to the lower southern red hake possession limits, but it should be noted that these overfished stocks are flatfish and therefore have different swimming behavior than do red hake. On the other hand, there are a few selective nets (such as the raised footrope trawl and the large-mesh belly panel trawl) that can be used in the fishery to reduce catches of flatfish. Some fishermen use these nets in the southern management area, particularly to target squid.

The southern whiting stock and loligo squid, the main target species in the small-mesh multispecies fishery, are not experiencing overfishing and are not overfished.

Figure 22. Summary of single species status for NEFMC and jointly managed stocks (goosefish and spiny dogfish). NEFSC 2020b.



Alternatives and options are considered to have a low positive impact if they are expected to not cause increases in catch of non-target species that would cause overfishing to occur or that would not cause the species to become overfished. This effect would occur if the expected responses to the measures do not shift effort to different areas or change gear selectivity such that catches of the non-target species do not substantially increase.

A high negative impact would be expected if the proposed alternatives would increase catches or damage habitat of a non-target species and cause or exacerbate overfishing or cause that species to become overfished or impede an existing rebuilding plan. This effect would occur if the expected responses to the measures shift effort to different areas where non-target species are more abundant or change gear selectivity such that catches of the non-target species do substantially increase, causing overfishing or causing the non-target species to be overfished.

Alternatives are considered to have negligible or likely no impact if there is no expected effect on catches or the habitat of non-target species.

6.3.1 Rebuilding Southern Red Hake

6.3.1.1 Alternative 1 – No Action / Status Quo

No Action/Status Quo could have a slight positive impact on non-target species that co-occur or act similar to red hake on the bottom because fishing would continue at present levels and the non-target species would remain in positive status and continue to be sustainably managed. The stock status of overfished species would likely remain similar because fishing behavior is not expected to change as southern red hake is often not a target species and other factors such as marketability control behavior more. Thus, the impacts to non-target species would range from low positive to low negative depending on the stock status of the species.

6.3.1.2 Alternative 2 – Rebuilding Estimates and Maximum Mortality

Alternative 2 would establish a rebuilding plan and would reduce the southern red hake ABC. The impacts of both options of Alternative 2 relative to Alternative 1 are low positive because Alternative 2 would reduce the overfishing limit and would allow for rebuilding an overfished stock.

6.3.1.2.1 Option A – 75% of the Overfishing Limit, or F_{msy} *(Preferred Alternative)*

Option A would reduce the annual catch limit by 25%, potentially causing a reduction in the southern red hake possession limit to 400 lb. when it triggers the in-season AM. If catch overages occur, a payback provision would reduce the TAL trigger and/or cause the Council to take other actions to further reduce catches of southern red hake or curtail fishing effort. Overall, the impacts on non-target species by Option A may be slightly less positive or slightly less negative than Option B. Compared to Alternative 1, Alternative 2 Option A would be more positive because of the reduction in the overfishing limit that could help rebuild the overfished stock.

Depending on the non-target species, this option is expected to have a low positive effect for non-target species that tend to co-occur with red hake, such as white hake and other benthic roundfish, because these stocks are not overfished and overfishing is not occurring and this action would be expected to generally maintain current levels of fishing, and thus, status. Option A could also have a low negative effect on other species if they are overfished or are experiencing overfishing and this alternative would cause changes in fishing that shift effort into areas where the non-target species is more prevalent or increase selectivity of that species. This low negative effect on species that are overfished or that overfishing is occurring would occur by slightly increasing catch or slightly delaying rebuilding of an overfished species, such as Georges Bank winter flounder, Southern New England winter flounder, and Southern New England yellowtail flounder.

6.3.1.2.2 Option B – 50% of the Overfishing Limit, or F_{msy} Proxy

Option B would reduce the southern red hake ABC to 50% of the MSY proxy for the duration of the rebuilding period or until the southern red hake biomass reached the target. The maximum catch level would be substantially less than the ACL currently in place, however, catch and fishing activity are not expected to change because red hake is not often a target species and other factors control catch and fishing behavior more, like marketability of species. Overall, the impacts on non-target species by Option B may be slight positive or negative (depending if the species is overfished or not, respectively) and slightly more positive or negative than Option A (depending if the species is overfished or not, respectively). Compared to Alternative 1, Alternative 2 Option B would be more positive because of the reduction in the overfishing limit that could help rebuild the overfished stock. The impacts may be slightly more negative if the lower catch limit associated with Option B causes the Council to take more drastic measures that could shift effort into alternative fisheries. The same set of overfished stocks as described above would be more negatively affected by Option B than they would be by Option A.

6.3.2 Management Alternatives – Possession Limits

The following set of management alternatives were developed based on the assumption that reduced, or more restrictive possession limits, could lead to a lower exploitation rate and result in an increase in biomass.

6.3.2.1 Alternative 1 – No Action

No Action would retain the 5,000 lb. southern red hake possession limit, which would automatically reduce to 400 lb. when landings reach 40.4% of the TAL. This alternative would have a slight low positive impact on non-target species that have similar distributions and behavior of other bottom-tending roundfish species. If vessels change fishing behavior because of the 400 lb. possession limit, the alternative could have a low negative impact on other non-target species that are overfished and that have similar distributions and behavior of other bottom-tending roundfish species. Note that there are no roundfish species in the southern management area that are considered to be overfished or that overfishing is occurring. Otherwise, Alternative 1 is expected to have a low positive impact on other non-target species because they are not overfished, and overfishing is not occurring and because this action is expected to generally maintain current levels of fishing effort, and therefore, current stock status.

6.3.2.2 Alternative 2 – Status Quo

Under Alternative 2 Status Quo, the 2018 fishing year regulations would be in place: 5,000 lb. possession limit and AMs in place reducing the southern red hake possession limit to 400 lb. when landings reach an in-season trigger of 90% of the TAL. This alternative would have a low negative impact on non-target species that are overfished and that have similar distributions and behavior of other bottom-tending roundfish species. Note that there are no roundfish species in the southern management area that are considered to be overfished or that overfishing is occurring. Otherwise, Alternative 2 is expected to have a low positive impact on other non-target species because they are not overfished, and overfishing is not occurring and because this action is expected to generally maintain current levels of fishing effort, and therefore, current stock status.

Relative to Alternative 1, Alternative 2 is expected to have less positive impacts on species that are not overfished or that overfishing is not occurring, and less negative impacts on species that are overfished or that overfishing is occurring. This is because Alternative 2 has a higher TAL trigger, potentially resulting in more fish being caught and worsening current status of overfished species. In contrast, relative to Alternative 3, Alternative 2 is expected to have more positive impacts on species that are not overfished or that overfishing is not occurring, and more negative impacts on species that are overfished or that overfishing is occurring. This is because more fishing would be allowed under Alternative 2’s higher TAL trigger and higher possession limit.

6.3.2.3 Alternative 3 – Year-Round Possession Limits for All Gear and Fisheries

As explained above, these alternatives could change fishing behavior to avoid catching southern red hake but are unlikely to affect many trips. Shifts in effort (by area, season, or time of day) or changes in gear to reduce red hake catch could have low positive or low negative effect on non-target species, depending on their co-occurrence with southern red hake and/or similarities in behavior. Nonetheless the fishery’s response to a lower southern red hake possession limit is expected to be low because few trips target or derive a substantial amount of revenue from southern red hake landings. A small number of trips may shift to a different time or area if it derived a meaningful proportion of revenue from southern red hake landings. These effects cannot currently be quantified or estimated. See Section 5.6.1.3 for more details about the proportion of a permitted vessel’s or trip’s revenue derived from southern red hake landings.

Relative to Alternatives 1 and 2, all options under Alternative 3 is expected to have more positive impacts on species that are not overfished or that overfishing is not occurring, and more negative impacts on species that are overfished or that overfishing is occurring. This low negative effect on species that are overfished or that overfishing is occurring would occur by slightly increasing catch or slightly delaying rebuilding of an overfished species, such as Georges Bank winter flounder, Southern New England winter flounder, and Southern New England yellowtail flounder. In other words, this alternative may slightly increase catch of these overfished species because a low amount of effort could shift to avoid southern red hake and thus could have more negative impacts. The stocks that are not overfished could have more positive impacts because the positive stock status would be maintained and there could be less effort on these stocks that co-occur with southern red hake.

6.3.2.3.1 Option A – 0 lb. Possession Limit

Option A would have low positive or negative impacts on non-target species, depending on their status, relative to the other options. Option A would have a low positive impact on non-target species that co-occur with red hake and exhibit similar behavior on the bottom. Option A would have a low negative impact on other non-target species if induced changes in fishing shift effort or increase selectivity to that non-target species. This option is expected to maintain similar levels of fishing effort and behavior and thus, maintain the current stock status of all non-target species, overfished or not, leading to low negative or low positive impacts, respectively.

6.3.2.3.2 Option B – 400 lb. Possession Limit

Option B would have few low positive or low negative impacts on non-target species than Option A, but more than Options C and D. Option B would have a low positive impact on non-target species that co-occur with red hake and exhibit similar behavior on the bottom. Option B would have a low negative impact on other non-target species if induced changes in fishing shift effort or increase selectivity to that non-target species. This option is expected to maintain similar levels of fishing effort and behavior and thus, maintain the current stock status of all non-target species, overfished or not, leading to low negative or low positive impacts, respectively.

6.3.2.3.3 Option C – 600 lb. Possession Limit

Option C would have fewer low positive or low negative impacts on non-target species than Options A or B, but more than Option D. Option C would have a low positive impact on non-target species that co-occur with red hake and exhibit similar behavior on the bottom. Option C would have a low negative impact on other non-target species if induced changes in fishing shift effort or increase selectivity to that non-target species. This option is expected to maintain similar levels of fishing effort and behavior and thus, maintain the current stock status of all non-target species, overfished or not, leading to low negative or low positive impacts, respectively.

6.3.2.3.4 Option D – 1,000 lb. Possession Limit

Option D would have less low positive or low negative impacts on non-target species than the other options. Compared to the No Action and Status Quo alternatives, Option D would have a low positive impact on non-target species that co-occur with red hake and exhibit similar behavior on the bottom. Option D would have a low negative impact on other non-target species if induced changes in fishing shift effort or increase selectivity to that non-target species. This option is expected to maintain similar levels of fishing effort and behavior and thus, maintain the current stock status of all non-target species, overfished or not, leading to low negative or low positive impacts, respectively.

6.3.2.4 Alternative 4 - Dual 1,000 lb./600 lb. Year-Round Possession Limit *(Preferred Alternative)*

Alternative 4 is expected to have a low positive to low negative impact on non-target species. Alternative 4 could incentivize the use of more selective small-mesh trawl gears including raised footrope trawls, large-mesh belly panel trawls, and rope trawls which would reduce impacts to non-target species. However, the higher possession limit could mean additional effort (more tows, longer trips, etc.) in order to land the higher possession limit compared to the lower 600 lb. possession limit. Southern red hake is not typically targeted, however, and the reduced opportunity to land this stock would most likely not substantially change fishing behavior and catch. Due to the incentive to use more selective trawls to reduce southern red hake catch and possibly the bycatch of non-target species, Alternative 4 is more positive than Alternative 1 and 2, and more positive than any Alternative 3 option. Although there are Alternative 3 options with lower possession limits, the lower possession limits are unlikely to substantially reduce catch and more likely to convert landings into discards. This option is expected to maintain similar levels of fishing effort and behavior and thus, maintain the current stock status of all non-target species, overfished or not, leading to low negative or low positive impacts, respectively.

Alternative 4 is expected to have impacts similar to Alternative 3 Option C, but some fishermen that use small-mesh trawls could be expected to switch to more selective trawls and would then have a 1,000 lb. possession limit. For observed trips landing over 1,000 lb. of southern red hake, 45% used standard small-mesh trawls and would have a 600 lb. possession limit or would be able to land 1,000 lb. of red hake by switching to a selective trawl (Table 57). These trips represent 50% of the observed red hake catch. Trips using more selective trawls would reduce bycatch of other species that have similar characteristics and behavior as red hake, such as haddock and white hake. On the other hand, the more selective gear could be less effective for the species being targeted (i.e. whiting, squid, and herring), increasing the duration or number of tows to maintain landings. The raised footrope trawl however has been tested and in the northern management area, the gear reduces catches of many groundfish species, in particular flatfish such as yellowtail flounder, plaice, monkfish, and skates (NEFMC 2019). But because the relative value of the extra 400 lb. of southern red hake (the difference between 600 and 1,000 lb.), costly changes in gear would not be very likely in response to the tiered possession limit. Unless there are other reasons for using the selective trawls, it would be more likely that fishermen will simply avoid areas and times when excessive southern red hake are caught, similar to the impacts of Alternative 3, which is not expected do differ by any substantial amount relative to current fishing activity.

6.4 Impacts on Protected Species

6.4.1 Rebuilding Southern Red Hake

According to the 2017 Northern and Southern Silver Hake and Red Hake Stock Assessment Update Report (https://repository.library.noaa.gov/view/noaa/17249 [repository.library.noaa.gov]), the southern red hake spring biomass index was 0.25 kg/tow in 2017, a value below the management threshold of 0.51 kg/tow. As a result, NOAA Fisheries determined that the southern red hake stock was overfished and notified (https://www.fisheries.noaa.gov/species/red-hake) the Council in January of 2018 that southern red hake was overfished. The FW 62 actions and alternatives are meant to satisfy the requirement of the Council to develop a rebuilding plan in two years.

Section 5.4 of the Affected Environment Section identifies numerous species under NMFS jurisdiction that are afforded protection under the Endangered Species Act (ESA) of 1973 and/or the Marine Mammal Protection Act (MMPA) of 1972, that occur in the affected environment of the small-mesh multispecies fishery (Table 14) and have the potential to be impacted by the proposed action. This analysis evaluates how the southern red hake fishery may impact these protected species under each of the FW 62 actions and alternatives.

6.4.1.1 Alternative 1 – No Action / Status Quo

Under Alternative 1 No Action/Status Quo, a rebuilding schedule would not be specified and the maximum fishing mortality level at MSY would be retained, subject to scientific and management uncertainty buffers. Scientific uncertainty varies and is estimated based on the joint uncertainty in the biological reference point and in the status determination derived from the three-year average spring survey stratified mean weight per tow. This scientific uncertainty estimate applies to the Allowable Biological Catch (ABC), which is derived from MSY. A five percent uncertainty buffer is applied to the Annual Catch Limit (ACL) which is a function of the ABC.

Alternative 1 No Action/Status Quo would maintain the previously established year-round possession limit and AM. As a result, fishing patterns would likely remain similar to present patterns (e.g., no spatial or temporal shifts in effort; no changes in gear type, quantity, or relative soak/tow time). Based on this information, fishing behavior and effort is anticipated to remain similar to current conditions under Alternative 1 No Action/Status Quo.

Potential interaction risks between a fishery and protected species (ESA listed and MMPA protected species) are largely determined by expected fishing behavior and effort. Specifically, the type of fishing gear, amount of gear in the water, soak time, tow time, and the area of overlap between fishing and protected species are strongly related with the potential interaction risks expected to occur to protected resources. Taking this into account, as well as the expected fishing behavior/effort for Alternative 1 No Action/Status Quo, impacts on protected resources listed in Table 14 for Alternative 1 No Action/Status Quo are listed below.

MMPA (Non-ESA listed) Protected Species Impacts

The potential impacts of Alternative 1 No Action/Status Quo on non-ESA listed MMPA protected species have not been analyzed quantitatively. This is largely due to the fact that these potential impacts are dependent upon fishing behavior and effort, which although expected to remain similar to current conditions, are not possible to predict for quantitative analysis. In order to best classify the potential impacts of Alternative 1 No Action/Status Quo on MMPA protected species, we have reviewed marine mammal serious injury and mortality reports, as well as the US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments that cover that most recent 10 years of data (Waring et al. 2015a; Waring et al. 2016; Hayes et al. 2017; Hayes et al. 2018; Hayes et al. 2019; Hayes et al. 2020).

As provided in section 5.4, of the non-ESA listed marine mammal species provided in Table 13 that have the potential to be affected by the proposed action, only several stocks of bottlenose dolphin stocks are considered strategic stocks (i.e., stocks in which the level of take has resulted in the exceedance of the stocks PBR level). Aside from these stocks of bottlenose dolphins, there has been no indication that takes of non-ESA listed marine mammals in commercial fisheries have gone beyond levels which would result in the inability of the populations to sustain themselves; that is, PBR levels have not been exceeded for any of these non-ESA listed marine mammal species (see section 5.4; Table 13). Although several stocks of bottlenose dolphin have experienced levels of take that resulted in the exceedance of their PBR level, a take reduction strategy has been implemented to reduce bycatch in the fisheries affecting this species (i.e., Atlantic Trawl Take Reduction Strategy; see section 5.4.4.1.2).

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, the impacts of Alternative 1 on non-ESA listed species of marine mammals are likely to range from low negative to low positive, depending on the species/stock. As provided above, some bottlenose dolphin stocks 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 previously noted, the risk of an interaction is strongly associated with the amount of gear in the water, the time the gear is in the water (e.g., tow time), and the presence of protected species in the same area and time as the gear, with risk of an interaction increasing with increases in of any of these factors. As commercial fishing effort under Alternative 1 is expected to remain unchanged from current operating conditions, Alternative 1 is not expected to introduce new or elevated interaction risks to these non-ESA listed marine mammal stocks in poor condition. Specifically, the amount of gear in the water, tow times, and overlap between protected species and fishing gear is expected to remain unchanged relative to current conditions. Given this information, and the information provided in section 5.4, Alternative 1 is likely to result in low negative impacts to non-ESA listed marine mammal stocks/species in poor condition (i.e., bottlenose dolphin stocks).

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 result in 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 low 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 low positive impacts would remain. As provided above, Alternative 1 is expected to result in *status quo* commercial fishing effort relative to recent levels. Given this, the impacts of Alternative 1 on these non-ESA listed species of marine mammals are expected to be low positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level).

Based on this information, Alternative 1 is expected to have low negative to low positive impacts on non-ESA listed species of marine mammals, depending on the species.

ESA Listed Species Impacts

As identified in the Affected Environment – Protected Species section (section 5.4), several ESA listed species are expected to occur within the range that small mesh multispecies fisheries operate in. The small-mesh fishery gear types are predominantly trawl. The ESA listed species in Table 14 are at risk for interacting with these gear types and therefore may be susceptible to serious injury and/or mortality. Interaction risks with protected species are strongly associated with fishing behavior and effort, specifically the type of fishing gear, amount of gear in the water, soak time, tow time, and the area of overlap between fishing and protected species, with risk of an interaction increasing with increases of any or all of these factors. Considering that it is expected that fishing behavior and effort under Alternative 1 No Action/Status Quo will likely remain the same as current conditions, we have determined the impacts to ESA listed species to be low negative.

As stated above, Alternative 1 No Action/Status Quo would maintain the previously established year-round possession limit and AM. As this would be unlikely to result in a significant change in fishing behavior or effort, factors such as the amount of gear in the water (small-mesh otter trawl), tow time, and area fished are expected to be similar to those previously observed in the small-mesh fishery. Considering the information presented above, Alternative 1 No Action/Status Quo is expected to have low negative impacts on ESA listed species.

Overall Impacts to Protected Species

Based on the analysis presented above for MMPA and ESA listed species of protected resources, Alternative 1 No Action/Status Quo is expected to have low positive to low negative impacts on protected species, with low negative to low positive impacts expected for non-ESA listed marine mammals and low negative impacts expected for ESA-listed species. Relative to both Option A and Option B presented under Alternative 2, impacts to protected resources under Alternative 1 are likely to be negligible. This is due to the fact that fishing behavior and effort under Alternative 2 are likely to be the same as that under Alternative 1.

6.4.1.2 Alternative 2 – Rebuilding Estimates and Maximum Mortality

This alternative proposes that rebuilding of the southern red hake stock could be achieved within 5 to 14 years with a target rebuilding schedule of about 10 years. The minimum of 5 years is based upon an increasing biomass trend that was observed from 2006 – 2011 while the longer duration of 14 years was formulated after considering the life history characteristics of red hake.

Stock rebuilding under this alternative considers two options, both of which would reduce the ABC for the duration of the rebuilding period, or until the southern red hake biomass reaches the B_{MSY} target, whichever happens first. A reduction to the ABC is expected to decrease red hake landings, however, this will likely not significantly decrease total catch as southern red hake are frequently encountered as bycatch in other fisheries. According to the 2017 Small-mesh Multispecies Annual Monitoring Report (https://s3.amazonaws.com/nefmc.org/5_Annual-Monitoring-Report-for-Fishing-Year-2017_180919_150658.pdf), southern red hake is mostly caught on squid, lobster/crab, and squid/whiting trips. The predominant commercial gear types in the small-mesh fishery are trawl. Fishing behavior and levels of fishing effort are generally expected to remain similar to current levels. As commercial fishing effort under Alternative 2 is expected to remain unchanged from current operating conditions, Alternative 2 is not expected to introduce new or elevated interaction risks to non-ESA listed marine mammal stocks (in poor or good condition) or to ESA listed species. Specifically, the amount of gear in the water, tow times, and overlap between protected species and fishing gear is expected to remain unchanged relative to current conditions. Given this information, and the information provided in section 5.4, the impacts of Alternative 2 are likely to be similar to those provided under Alternative 1 (i.e., low negative to low positive impacts on protected species; see Alternative 1 for rationale). For similar reasons, Alternative 2 impacts to protected resources relative to Alternative 1 would likely be negligible.

6.4.1.2.1 Option A – 75% of the Overfishing Limit, or F_{msy} Proxy *(Preferred Alternative)*

Option A under this alternative would reduce the ABC to 75% of the OFL or MSY proxy for the duration of the rebuilding period, or until the southern red hake biomass reaches the B_{MSY} target, whichever happens first. This would result in an ACL of 819 mt, a level substantially less than the existing ACL. Under this Option, fishing behavior and levels of fishing effort are generally expected to remain similar to current levels. as southern red hake are primarily encountered as bycatch. Total removal could be reduced if changes in fishing effort and behavior are implemented in order to avoid red hake, though this is unlikely. The amount of gear in the water, soak time, tow time, and area fished are all factors that impact the potential for interactions with protected resources and these factors are all expected to remain similar to current levels. Given the analysis provided in sections 6.4.1.1 and 5.4, Alternative 2 Option A is likely to have low negative to low positive impacts on protected species (MMPA non-ESA listed species range from low negative to low positive impacts; ESA listed species with low negative impacts). For similar reasons, Alternative 2 Option A impacts to protected resources relative to Alternative 2 Option B and Alternative 1 would likely be negligible.

6.4.1.2.2 Option B – 50% of the Overfishing Limit, or F_{msy} Proxy

Option B under this alternative would reduce the ABC to 50% of the OFL or MSY proxy for the duration of the rebuilding period, or until the southern red hake biomass reaches the target, whichever happens first. This would result in an ACL of 546 mt, a level substantially less than the existing ACL and that presented under Option A. Similar to Option A, under Option B fishing behavior and levels of fishing effort are generally expected to remain similar to current levels. as southern red hake are frequently encountered as bycatch. Option B is expected to decrease southern red hake landings while increasing discards in the absence of any changes to fishing effort or behavior. Total removal could be reduced if changes in fishing effort and behavior are implemented in order to avoid red hake, though this is unlikely. The amount of gear in the water, soak time, tow time, and area fished are all factors that impact the potential for interactions with protected resources and these factors are all expected to remain similar to current levels. Given the analysis provided in sections 6.4.1.1 and 5.4, Alternative 2 Option B is likely to have low negative to low positive impacts on protected species (MMPA non-ESA listed species range from low negative to low positive impacts; ESA listed species with low negative impacts). For similar reasons, Alternative 2 Option B impacts to protected resources relative to Alternative 2 Option A and Alternative 1 would likely be negligible.

6.4.2 Management Alternatives – Possession Limits

The management alternatives provided in section 4.0 were developed based on the assumption that reduced, or more restrictive possession limits could lead to a decreased exploitation rate and result in an increase in survey biomass. A substantial increase in the spring survey biomass was observed from 2006 – 2011 (Figure 3). This increase in survey biomass was associated with a substantial decrease in the 3-year average relative F during the same time period.

In each of the management alternatives provided in section 4.0, the small-mesh multispecies fishery would continue to operate within the affected environment described in section 5.0. Each of these alternatives presents a different proposed possession limit with an AM in an effort to reduce southern red hake catch. Although unlike the other management alternatives with a change in possession limits, Alternative 4 would apply different limits for different gear types but this type of incentive still isn't expected to change fishing behavior or interaction risks. These trips represent 50% of the observed red hake catch (Table 57). Given the higher possession limit, Alternative 4 could incentivize the use of more selective small-mesh trawl gears including raised footrope trawls, large-mesh belly panel trawls, and rope trawls which would reduce protected species interactions. However, the higher possession limit could mean additional effort (more tows, longer trips, etc.) in order to land the higher possession limit compared to the lower 600 lb. possession limit. Even in the case where there could theoretically be some minor changes in gear choice and behavior associated with the gear-specific limits, it is unlikely and would not be enough to substantially change behavior or interaction risk. Furthermore, southern red hake is not typically targeted, and the reduced opportunity to land this stock would most likely not substantially change fishing behavior and catch relative to current levels. Overall, under any of the management alternatives provided in section 4.0, fishing behavior and levels of fishing effort are expected to remain similar to current levels, even with a change in possession limit.

As previously outlined, interactions between gear and protected resources are associated with the amount of gear in the water, gear soak/tow duration, and area overlap between the fishery and protected species. As none of the management alternatives are expected to provide incentive for longer tow durations, changes in area fished, or an increase in the amount of gear fished, relative to current operating conditions, fishing behavior and effort under any of the proposed alternatives is not expected to differ greatly from current operating conditions. As a result, none of the management alternatives are expected to introduce new or elevated interaction risks to MMPA and/or ESA listed species. Given this and the information above, the impacts to protected resources from any of the management alternatives are likely low negative to low positive (MMPA non-ESA listed species range from low negative to low positive impacts; ESA listed species with low negative impacts). Based on this, when any of the management alternatives are compared to one another, impacts to MMPA (non-ESA listed) protected species of marine mammals are likely to be negligible.

6.5 Impacts on Physical Environment and Essential Fish Habitat

6.5.1 Rebuilding Southern Red Hake

6.5.1.1 Alternative 1 – No Action / Status Quo

The No Action alternative would not specify a rebuilding schedule for southern red hake and therefore would not adjust the ABC, which is related to the ACL, the TAL, and thereby to effort in the fishery. Adopting Alternative 1 would likely not change fishing effort or behavior because the catch limits are not the primary factor in limiting effort in this fishery. This means gear is expected to continue to impact habitat, similar to how it has in the past as described in Section 5.5. Similar levels of fishing activity will continue to degrade the quality and quantity of the habitat areas in which the fishery already interacts in the future. Therefore, the No Action alternative would have a low negative impact on habitat.

6.5.1.2 Alternative 2 – Rebuilding Estimates and Maximum Mortality

Alternative 2 would establish a rebuilding plan and would reduce the southern red hake ABC but is unlikely to change fishing effort, thus this alternative for both Option A and Option B would result in a low negative physical environment/EFH impact which means gear is expected to continue to impact habitat, similar to how it has in the past as described in Section 5.5. Thus, similar levels of fishing activity will continue to degrade the quality of the habitats with which the fishery already interacts. Relative to Alternative 1 No Action, Alternative 2 Option A and Option B would likely be negligible as fishing effort is not expected to change.

6.5.1.2.1 Option A – 75% of the Overfishing Limit, or F_{msy} Proxy *(Preferred Alternative)*

Alternative 2 Option A would reduce the southern red hake ABC to 75% of the MSY proxy for the duration of the rebuilding period. The maximum catch level (ACL) would be substantially less than the ACL currently in place and catch and fishing activity are not expected to change under this alternative. The catch limits are not the primary factor in limiting effort in this fishery, such that even a reduction in ABC, and an associated reduction in ACL, would have a negligible impact on habitat when compared to the Alternative 2 Option B alternative.

Because recent southern red hake catches exceeded the catch limits in place and a post-season accountability measure is expected in the 2021 fishing year, this alternative could theoretically cause shifts in effort from the southern to northern management area. However, even if southern red hake is constraining to small-mesh multispecies fishing operations, large changes in fishing activity are not expected because of restrictive regulations and limited market demand. Restrictive regulations include specific management areas and seasons in the Gulf of Maine and on Georges Bank where small-mesh multispecies can be targeted with small-mesh trawls. Restrictive regulations and limited market demand are the most important factors in determining the impacts to the physical environment and EFH and would not change substantially as a result of this alternative.

If the lower southern red hake ABC does cause vessels to shift their effort into the northern management area, these vessels could end up fishing in exemption areas where raised footrope trawls are required.

These trawls may have lower habitat impacts than small mesh bottom trawls without the raised footrope. Since most of the fishing effort has tended to occur in areas where raised footrope trawls are not required, the potential shifts in geography are unlikely to change the degree to which the small-mesh multispecies fishery impacts EFH.

6.5.1.2.2 Option B – 50% of the Overfishing Limit, or F_{msy} Proxy

Alternative 2 Option B would reduce the southern red hake ABC to 50% of the MSY proxy for the duration of the rebuilding period or until the southern red hake biomass reached the target. The maximum catch level would be substantially less than the ACL currently in place, however, catch and fishing activity are not expected to change under this alternative. Thus, Alternative 2 Option B would have a negligible impact on habitat when compared to the Alternative 2 Option B alternative.

Because recent southern red hake catches exceeded the catch limits in place and a post-season accountability measure is expected in the 2021 fishing year, this alternative could theoretically cause shifts in effort from the southern to northern management area.

However, even if southern red hake is constraining to small-mesh multispecies fishing operations, large changes in fishing activity are not expected because of restrictive regulations and limited market demand. Restrictive regulations include specific management areas and seasons in the Gulf of Maine and on Georges Bank where small-mesh multispecies can be targeted with small-mesh trawls. Restrictive regulations and limited market demand are the most important factors in determining the impacts to the physical environment and EFH and would not change substantially as a result of this alternative.

If the lower southern red hake ABC does cause vessels to shift their effort into the northern management area, these vessels could end up fishing in exemption areas where raised footrope trawls are required. These trawls may have lower habitat impacts than small mesh bottom trawls without the raised footrope. Since most of the fishing effort has tended to occur in areas where raised footrope trawls are not required, the potential shifts in geography are unlikely to change the degree to which the small-mesh multispecies fishery impacts EFH.

6.5.2 Management Alternatives – Possession Limits

The following set of management alternatives were developed based on the assumption that reduced, or more restrictive possession limits, could lead to a decreased exploitation rate and result in an increase in survey biomass. A substantial increase in the spring survey biomass was observed from 2006 – 2011 (Figure 7). This increase in survey biomass was associated with a substantial decrease in the 3-year average relative F during the same time period. Under these alternatives, the impacts to the physical environment are likely low negative, as similar levels of fishing activity will continue to degrade the quality of the habitats with which the fishery already interacts.

6.5.2.1 Alternative 1 – No Action

Under Alternative 1 No Action, the 5,000 lb. possession limit would be maintained but there would also be a 40.4% post-season AM that is expected to take effect in the 2021 fishing year. This post-season AM would reduce the TAL trigger for southern red hake from 90% of the TAL to 40.4% to account for an overage of 49.6% of the TAL in the previous fishing year. Given the recent performance of the fishery, considering that southern red hake is not typically targeted, and considering the gear types used to execute the whiting fishery, Alternative 1 No Action would be expected to have low negative impacts on EFH. This is because with similar levels of fishing activity, habitat quality and quantity will continue to be degraded by gear in the same areas in which the fishery already interacts.

Effort and therefore habitat impacts in the small-mesh multispecies fishery are capped by the overall TAL and effort controls including accountability measures. If effort were to increase, then the possession limit would serve as a ceiling for maximum allowed catch. Maintaining the 5,000 lb. possession limit and post-season AM would be unlikely to change fishing effort and behavior (e.g., number of trips).

6.5.2.2 Alternative 2 – Status Quo

Under Alternative 2 Status Quo, the 2018 fishing year regulations would be in place: 5,000 lb. possession limit and AMs in place reducing the southern red hake possession limit to 400 lb. when landings reach an in-season trigger of 90% of the TAL. The impacts of Alternative 2 Status Quo on the physical environment and EFH would likely be low negative. This is because with similar levels of fishing activity, habitat quality and quantity will continue to be degraded by gear in the same areas in which the fishery already interacts. Relative to Alternative 1, the difference in impacts of Alternative 2 would likely be negligible.

Similar to Alternative 1 No Action, Alternative 2 is not likely to cause a change in fishing effort and behavior. If effort were to increase, then the possession limit, and the overall TAL, would serve as a ceiling for maximum allowed catch. There would likely be the same number of trips, however. The number of tows and area fished are not expected to change substantially from current operating conditions.

6.5.2.3 Alternative 3 – Year-Round Possession Limits for All Gear and Fisheries

Alternative 3 would reduce year-round southern red hake possession limits which could result in a low negative habitat impact. Because 60-80% of southern red hake are currently discarded due to lack of marketability, the reduced opportunity to land southern red hake would most likely not change fishing behavior and catch. All options in Alternative 3 would result in negligible to low negative impacts relative to Alternative 1 No Action and Alternative 2 Status Quo, and negligible impacts relative to Alternative 4.

Since the different possession limits are not expected to result in markedly different fishing activity, no differences in impacts to EFH are expected across the four options presented below. Similarly, vessels could fish for a longer duration to make up for lost revenue from southern red hake landings, which could result in a slight additional negative habitat impacts, however, this is also unlikely except in certain statistical areas (537, 539, 611), where the southern red hake revenue is highest. Vessels may also alter their gear to avoid catching southern red hake, which is likely and could result in a low negative habitat impact because fishing activity would likely remain similar to previous year and would continue to degrade habitat quality. Under any of Alternative 3 options, the fishery is expected to continue to operate in a similar manner and continue to disturb habitat similar to past levels and in similar regions, thus, the difference between these impacts is negligible.

6.5.2.3.1 Option A – 0 lb. Possession Limit

Alternative 3 Option A would ban southern red hake landings year-round, which could result in any catch being converted to discards. The impacts of Alternative 3 Option A on the physical environment and EFH would likely be low negative. Reducing the possession limits to zero landings could cause a small change in fishing behavior. There would likely be the same number of whiting trips as southern red hake is not typically targeted by the whiting fishery, but southern red hake discards would increase to 100%. The number of bottom trawls, tow or soak times, and area fished are not expected to change substantially from current operating conditions. This is because with similar levels of fishing activity, habitat quality will continue to be degraded by gear in the same areas in which the fishery already interacts. The difference in habitat impacts of Alternative 3 Option A would likely be negligible relative to Alternative 3 Options B, C, and D.

6.5.2.3.2 Option B – 400 lb. Possession Limit

Alternative 3 Option B would have a 400 lb. possession limit in place throughout the entire fishing year, even if an in-season accountability measure is not in effect. The impacts of Alternative 3 Option B on the physical environment and EFH would likely be low negative. Decreasing the possession limits would not likely cause a change in fishing behavior as southern red hake is typically not targeted. There would likely be the same number of whiting trips because southern red hake is not typically targeted, but southern red hake discards would increase relative to No Action and Status Quo as catch that normally would be caught would be converted to discards. The number of tows and area fished are not expected to change substantially from current operating conditions. This is because with similar levels of fishing activity, habitat quality will continue to be degraded by gear in the same areas in which the fishery already interacts. The difference in habitat impacts of Alternative 3 Option A would likely be negligible relative to Alternative 3 Options A, C, and D.

6.5.2.3.3 Option C – 600 lb. Possession Limit

Alternative 3 Option C would have a 600 lb. possession limit in place, unless superseded by the 400 lb. accountability measure. The impacts of Alternative 3 Option C on the physical environment and EFH would likely be low negative. Decreasing the possession limits would not likely cause a change in fishing behavior as southern red hake is typically not targeted. There would likely be the same number of whiting trips because southern red hake is not typically targeted, but southern red hake discards would increase relative to No Action and Status Quo as catch that normally would be caught would be converted to discards. The number of tows, tow or soak times, and area fished are not expected to change substantially from current operating conditions. This is because with similar levels of fishing activity, habitat quality will continue to be degraded by gear in the same areas in which the fishery already interacts. The difference in habitat impacts of Alternative 3 Option A would likely be negligible relative to Alternative 3 Options A, B, and D.

6.5.2.3.4 Option D – 1,000 lb. Possession Limit

Alternative 3 Option D would have a 1,000 lb. possession limit in place, unless superseded by the 400 lb. accountability measure. The impacts of Alternative 3 Option D on the physical environment and EFH would likely be low negative. Decreasing the possession limits would not likely cause a change in fishing behavior as southern red hake is typically not targeted. There would likely be the same number of whiting trips because southern red hake is not typically targeted, but southern red hake discards would increase relative to No Action and Status Quo as catch that normally would be caught would be converted to discards. The number of tows, tow or soak times, and area fished are not expected to change substantially from current operating conditions. This is because with similar levels of fishing activity, habitat quality will continue to be degraded by gear in the same areas in which the fishery already interacts. The difference in habitat impacts of Alternative 3 Option A would likely be negligible relative to Alternative 3 Options A, B, and C.

6.5.2.4 Alternative 4 - Dual 1,000 lb./600 lb. Year-Round Possession Limit *(Preferred Alternative)*

Alternative 4 would reduce the year-round southern red hake possession limit to 1,000 lb. when using more selective gear types (large-mesh or selective small-mesh gear types) and to 600 lb. when using small-mesh gear, which could result in a low negative habitat impact. For observed trips landing over 1,000 lb. of southern red hake, 45% used standard small-mesh trawls and would have a 600 lb. possession limit or would be able to land 1,000 lb. of red hake by switching to a selective trawl. These trips represent 50% of the observed red hake catch (Table 57). Fishing activity would likely remain similar to previous years and would continue to degrade habitat quality because southern red hake is typically not targeted, so the incentive to land the higher possession limit would not be substantial enough to reduce habitat impact. Alternative 4 would result in negligible to low negative impacts relative to Alternative 1 No Action and Alternative 2 Status Quo and negligible impacts relative to Alternative 3.

Given the higher possession limit, Alternative 4 could incentivize the use of more selective small-mesh trawl gears including raised footrope trawls, large-mesh belly panel trawls, and rope trawls which would reduce habitat impacts. However, the higher possession limit could mean additional effort (more tows, longer trips, etc.) in order to land the higher possession limit compared to the lower 600 lb. possession limit. Southern red hake is not typically targeted, however, and the reduced opportunity to land this stock would most likely not substantially change fishing behavior and catch. The potential decrease in habitat impact from the more selective gear type under the higher possession limit could be offset by the habitat impact from the standard small-mesh trawl gear under the lower possession limit.

6.6 Impacts on Human Communities

When examining potential economic and social impacts of management measures, it is important to consider impacts on the following: the fishing fleet (vessels grouped by fishery, primary gear type, and/or size); vessel owners and employees (captains and crew); small-mesh multispecies dealers and processors; final users of small-mesh multispecies; community cooperatives; fishing industry associations; cultural components of the community; and fishing families. While some management measures may have a short-term negative impact on some communities, this should be weighed against potential long-term benefits to all communities which can be derived from a sustainable whiting fishery. When regulations increase revenues (e.g., by increasing landings), the social and economic impacts become positive.

***Economic Impacts*.** In general, the economic effects of regulations can be categorized into regulations that change costs, including transaction costs such as search, information, bargaining, and enforcement costs or revenues, by changing market prices or by changing the quantities supplied. These economic effects may be felt by the directly regulated entities or by related industries.

***Social Impacts*.** The social impact factors outlined below help describe the small-mesh multispecies fishery, its sociocultural and community context and its participants. These factors or variables are considered relative to the management alternative and used as a basis for comparison between alternatives. Use of these kinds of factors in social impact assessment is based on NMFS guidance (NMFS 2007) and other texts (e.g., Burdge 1998). Longitudinal data describing these social factors region-wide and in comparable terms are limited. While this analysis does not quantify the impacts of the management alternatives relative to the social impact factors, qualitative discussion of the potential changes to the factors characterizes the likely direction and magnitude of the impacts. The factors fit into five categories:

1. *Size and Demographic Characteristics* of the fishery-related workforce residing in the area; these determine demographic, income, and employment effects in relation to the workforce as a whole, by community and region.
2. The *Attitudes, Beliefs, and Values* of fishermen, fishery-related workers, other stakeholders and their communities; these are central to understanding the behavior of fishermen on the fishing grounds and in their communities.
3. The effects of the preferred alternative on *Social Structure and Organization*; that is, changes in the fishery’s ability to provide necessary social support and services to families and communities.

4. The *Non-Economic Social Aspects* of the preferred alternative; these include lifestyle, health, and safety issues, and the non-consumptive and recreational uses of living marine resources and their habitats.
5. The *Historical Dependence on and Participation* in the fishery by fishermen and communities reflected in the structure of fishing practices, income distribution, and rights (NMFS 2007).

General Impact of Southern Red Hake Rebuilding on Human Communities

Human communities are impacted by southern red hake rebuilding as the rebuilding plan adjusts the harvest levels for the fishery. Decreasing the southern red hake ABC (and associated possession limits, as contemplated in this action) would likely have negative short-term impacts on fishing communities. Likewise, lowering allowable harvests could result in short-term revenue reductions, which may, in turn, have negative impacts on employment and the size of the small-mesh multispecies fishery within fishing communities, with ripple effects on the communities involved in the fisheries that harvest southern red hake as a non-target species while directing on other whiting fishery species. Additionally, declines in fishing earnings may decrease job satisfaction among fishermen (e.g., Pollnac & Poggie 2008; Pollnac et al. 2015), which may reduce the well-being of fishermen, their families, and their communities (e.g., Pollnac et al. 2015; Smith & Clay 2010). In the long term, ensuring continued, sustainable harvest of the resource benefits all fisheries.

Changes in fishing effort may result in an in-season accountability measure, further reducing the possession limit of southern red hake, as in previous fishing years. These changes could result from new or inactive vessels entering the fishery, or existing vessels could increase the number or duration of their trips. An in-season accountability measure could occur earlier in the fishing season and a reduction in the possession limit may have a slight negative impact on human communities.

The specific communities that may be impacted by this action are identified in Section 5.6.2. This includes 9 ports with the greatest whiting landings in the small-mesh multispecies fishery (e.g., New Bedford, Point Judith, Gloucester, Montauk) within a list of 19 Communities of Interest from Maine to New York that are important to the small-mesh multispecies. The communities more involved in the small-mesh multispecies fishery are likely to experience more direct impacts of this action, though indirect impacts may be experienced across all these Communities of Interest. As the reduced ABC and reduction in southern red hake possession limit affects stock-wide harvest levels, impacts would likely occur across the communities that participate in the small-mesh fishery and catch southern red hake as a non-target species in the whiting fishery and other potentially affected fisheries, proportional to their degree of participation.

6.6.1 Rebuilding Southern Red Hake

6.6.1.1 Alternative 1 – No Action / Status Quo

The No Action alternative would not specify a rebuilding schedule for southern red hake and therefore would not adjust the ABC, which is related to the ACL, the TAL, and thereby effort in the fishery, which would result in low positive human communities' impact in the short term but low negative human communities' impact in the long term. Adopting Alternative 1 is not expected to change fishing effort or behavior, however as previously mentioned, the catch limits are not the primary factor in limiting effort in this fishery.

The economic impacts of Alternative 1 would likely be low negative in the long term if southern red hake rebuilding does not occur as the current management strategy would continue. If the southern red hake stock does not rebuild, then in-season AMs could continue to be put in place before the end of the fishing season resulting in a slight loss of revenue relative to Alternative 2.

The social impacts of Alternative 1 would likely be low negative relative to Alternative 2 options because Alternative 1 would not set a rebuilding plan for southern red hake and current fishing management would remain. If the southern red hake stock does not rebuild, then AMs could continue to be put in place before the end of the fishing season, which could result in marginal declines in fishing revenues and a decrease in job satisfaction among fishermen. This may reduce the well-being of fishermen, their families, and their communities. Alternative 1 may slightly constrain operations and limit income potential long term, which would contribute to those feelings of frustration. Alternative 1 would likely not facilitate long-term sustainability of the resource, thus, there could be low negative social impacts in the long term on the historical dependence on and participation in the small-mesh multispecies fishery.

6.6.1.2 Alternative 2 – Rebuilding Estimates and Maximum Mortality

Alternative 2 would establish a rebuilding plan and would reduce the southern red hake ABC which could result in a low negative human communities' impact in the short term due to a slight loss in revenue but could result in a low positive human communities' impact in the long term due to sustainably managing the resource. Alternative 2 could result in a slightly higher biomass, thus, slightly higher revenue and slightly more positive human communities' impact relative to Alternative 1 No Action.

6.6.1.2.1 Option A – 75% of the Overfishing Limit, or F_{msy} Proxy *(Preferred Alternative)*

Alternative 2 Option A would reduce the southern red hake ABC to 75% of the MSY proxy for the duration of the rebuilding period. The maximum catch level (ACL) would be substantially less than the ACL currently in place, however, catch and fishing activity are not expected to increase under this alternative (i.e., remain similar to current levels of fishing activity). Thus, the impacts to human communities would be low negative in the short term and low positive in the long term. The catch limits are not the primary factor in limiting effort in this fishery, such that even a reduction in ABC, and an associated reduction in ACL, would have a low positive impact on human communities in the long term relative to No Action.

The economic impacts of Alternative 2 Option A would likely be low negative in the short term and low positive impacts in the longer term, if rebuilding of southern red hake occurs. The 75% Fmsy proxy would likely result in the higher rebuilt biomass but in a lower timeframe, thus slightly lower revenue relative to 50% Fmsy proxy (Alternative 2 Option B).

The social impacts of Alternative 2 Option A would likely be low negative in the short term and low positive in the longer term, if rebuilding of southern red hake occurs. Compared to Alternative 2 Option B, Alternative 2 Option A would likely result in the higher rebuilt biomass increase but over a longer time period, thus, a slightly lower income for fishermen in the short term, which may translate into negative social impacts on the size and demographic characteristics of the fishery-related workforce in the short term. Alternative 2 Options A and B long term impacts would likely be similar since both options would contribute similarly to rebuilding but just at different rates, thus, the short-term impacts would differ slightly.

6.6.1.2.2 Option B – 50% of the Overfishing Limit, or F_{msy} Proxy

Alternative 2 Option B would reduce the southern red hake ABC to 50% of the MSY proxy for the duration of the rebuilding period or until the southern red hake biomass reached the target. The maximum catch level would be significantly less than the ACL currently in place, however, catch and fishing activity are not expected to increase under this alternative (i.e., remain similar to current levels of fishing activity). Thus, the impacts to human communities would be low negative in the short term and low positive in the long term. Alternative 2 Option B would have a low positive impact on human communities when compared to the No Action alternative.

The economic impacts of Alternative 2 Option B would likely be low negative in the short term and low positive in the longer term, if and once rebuilding of southern red hake occurs. The 50% Fmsy proxy would likely result in the higher rebuilt biomass but in a faster timeframe, thus slightly higher revenue relative to 75% Fmsy proxy.

The social impacts of Alternative 2 Option B would likely be slight negative in the short term and slight positive in the longer term, if rebuilding of southern red hake occurs. Compared to Alternative 2 Option A, Alternative 2 Option B would likely result in the higher rebuilt biomass increase but over a shorter time period, thus, a slightly higher income for fishermen in the short term, which may translate into slight positive social impacts on the size and demographic characteristics of the fishery-related workforce in the short term.

6.6.2 Management Alternatives – Possession Limits

This framework adjustment to rebuild southern red hake includes No Action and Status quo as specified in the current 3-year specification period (Table 59), an alternative with four year-round possession limit options, and an alternative with dual possession limits based on gear selectivity:

- Alt. 1 No Action (AM at 40.4%)
- Alt. 2 Status quo (AM at 90%)
- Alt. 3
  - 1,000 lb. with a 400 lb. AM
  - 600 lb. with a 400 lb. AM
  - 400 lb.
  - 0 lb.
- Alt. 4 Dual 1,000 lb. PL/600 lb. PL with a 400 lb. AM

Table 59. Southern red hake annual quota along with Status Quo and No Action levels during 3-year specification periods (FY2018-FY2020 in the southern management area). *

Annual Quota (MT)	Annual Quota (lb.)	Status Quo lb. (AM at 90%)	No Action lb. (AM at 40.4%)
305	672,409.9	605,169	271,654

*Accountability Measures (AM) is applied at 400 pounds on a trip once the SQ or NA quota is hit until the end of fishing year. However, AM is also applied at 400 pounds on a trip for the possession limit alternatives only after cumulative landings reach the TAL trigger of 40.4% trigger, 271,654 pounds quota until the end of fishing year as a second-tier measure within a possession limit alternative.

Economic evaluation of the alternative measures involves estimating potential loss of landings and revenues for each alternative measure. Losses in net income or fishing profit are not measured since there are no cost-earning data available relevant for the vessels involved in southern red hake landing. Moreover, red hake is largely bycatch and landed in very small volume relative to annual vessel or permit value. Therefore, assessing the potential losses in gross revenue from red hake landings will provide a good sense to evaluate the alternatives. Loss in landings and revenues are simulated on the FY2018 landing data, as that is the only available information pertinent to the 3-year specifications on southern red hake quotas. FY2019 data for all months are not available yet. In FY2018, there were 4,572 trips that landed about 759,299 pounds red hake in southern management. Possession limits apply to all fisheries in the southern management area on these trips with red hake landings.

The in-season AM was utilized in the analysis of alternatives in assessing the economic impacts of each alternative. Possession limits are applied from the very first day of the fishing year, but the TAL is triggered at 40.4% of ACL, resulting in a reduction of possession limits to 400 lb. Thus, the procedure for the possession limit alternatives is as below:

Step 1: Apply first tier of southern red hake possession limit at 1,000 lb., 600 lb., 400 lb., or 0 lb. possession limit depending on the alternative on a trip from day 1 of a fishing year until the in-season AM is put in place when the TAL is triggered at 40.4% of southern red hake ACL, i.e., ACL trigger quota at 271,654 pounds. Any catches in a trip in excess of the possession limit would be subject to AM as in step 2.

Step 2: Apply second tier of possession limit of 400 lb. per trip once the in-season AM is put in place. However, the in-season AM is not put in place for the 0 lb. and 400 lb. possession limit alternatives, but for the possession limit alternatives greater than 400 lb. Thus, the 600 lb. and 1,000 lb. possession limit alternatives will have a second tier of possession limit at 400 lb. once the TAL is triggered at 40.4% of ACL.

This approach is similarly applied for Alternative 4 with the dual possession limits of 1,000 lb. for more selective gear and 600 lb. for less selective gear, namely standard small-mesh gear. Measure the landings and corresponding revenues that potentially could have been lost in a fishing year for each alternative.

Economic Evaluation of Alternative Measures

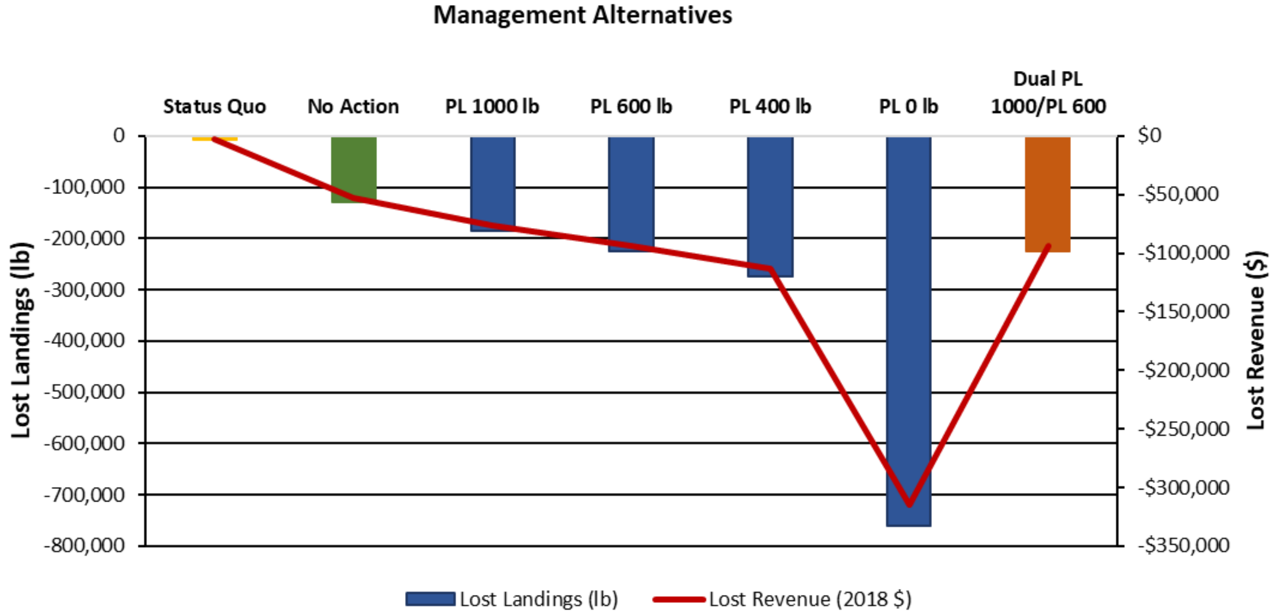
By applying the measures in the alternatives, the lost southern red hake pounds and corresponding lost revenues were estimated simulating the FY2018 in the southern management area. The number of trips and vessels thus affected are also noted. Table 60 and Figure 23 summarize economic analysis of the proposed alternatives in managing southern red hake.

Table 60. Economic analysis of proposed alternatives (simulated for FY2018 in southern area).

Alternative measures		Total Loss of Landings and Revenues by southern red hake discards			Total trips w/ southern red hake	No. of affected trips w/ the measure	No. of affected permits w/ the measure	Date of AM implementation	Cumulative landings when AM is in place	Landings (lb.) by end of FY
		Lost Landing LB.	Lost Revenue (2018 $)	Percent Loss						
Alt. 2 Status Quo (AM @ 90%)		7,568	$3,141	1.00%	4,572	54	26	12/27/2018	605,282	751,731
Alt. 1 No Action (AM @ 40.4%)		128,072	$53,150	16.9%	4,572	284	57	8/9/2018	271,654	631,227
Alt. 3 Possession Limits (PL)	Option D [PL 1,000 lb. (AM @ 40.4%)]	184,445	$76,545	24.29%	4,572	300	54	9/18/2018	271,655	574,854
	Option C [PL 600 lb. (AM @ 40.4%)]	225,722	$93,675	29.73%	4,572	336	55	10/9/2018	271,656	533,577
	Option B [PL 400 lb.]	273,701	$113,586	36.05%	4,572	439	65	-	-	485,598
	Option A [PL 0 lb.]	759,299	$315,109	100%	4,572	4,572	184	-	-	0
Alt. 4 Dual PL 1,000/PL 600 (AM @ 40.4%)		225,322	$93,509	29.68%	4,572	336	55	10/8/2018	271,656	533,977

Note: 'Date of AM implementation' is the date in which southern red hake landings trigger the AM threshold (at 90% or 40.4% of the TAL, depending on the alternative) whereby possession limits are reduced to 400 lb. The AM would not be in place when the year-round possession limit is 400 lb. or when there is a ban on southern red hake landings.

Figure 23. Estimated loss of southern red hake landings (lb.) and revenues (in 2018$) by management alternative (simulated for FY2018).



Note: The four bar colors represent the estimated lost southern red hake landings that could occur under each of the four management alternatives.

Table 61. Comparison of impacts on revenue losses or differences in revenue impacts for each ith alternative against another jth alternative (i.e., row alternative minus column alternative).

		Alternatives in COLUMN						
		Alt. 2 Status Quo	**Alt. 1 No Action**	**Alt. 3 PL 1,000**	**Alt. 3 PL 600**	**Alt. 3 PL 400**	**Alt. 3 PL 0**	**Alt. 4 PL 1,000/PL 600**
Alternatives in ROW	**Alt. 2 Status Quo**	$0						
	Alt. 1 No Action	($50,009)	$0					
	Alt. 3 Option D [PL 1,000 lb.]	($73,404)	($23,395)	$0				
	Alt. 3 Option C [PL 600 lb.]	($90,534)	($40,525)	($17,130)	$0			
	Alt. 3 Option B [PL 400 lb.]	($110,445)	($60,436)	($37,041)	($19,911)	$0		
	Alt. 3 Option A [PL 0 lb.]	($311,968)	($261,959)	($238,564)	($221,434)	($201,523)	$0	
	Alt. 4 Dual PL 1,000 lb./PL 600 lb.	($90,368)	($40,359)	($16,964)	$166	$20,077	$221,600	$0

Note: PL = possession limit; number in bracket indicates a negative value.

6.6.2.1 Alternative 1 – No Action

Under Alternative 1 No Action, the 5,000 lb. possession limit would be maintained but there would also be a reactive AM resulting in a possession limit reduction to 400 lb. In FY 2021, due to a 49.6% overage in a prior year, a 40.4% reduction in the TAL trigger is expected. Alternative 1 would have a low negative impact to human communities in the short term because even though fishermen would be able to land the higher possession limit, the TAL is substantially reduced because of the previous TAL overage and could result in an in-season AM in place earlier in the fishing year, thereby reducing the socioeconomic benefits. In the long term, there would be a low negative impact to human communities because if no action is taken, then that will negatively impact the overfished resource and not contribute to recovery and rebuilding so economic and social impacts will be low negative in the future if southern red hake continues to decline.

The economic impacts of Alternative 1 No Action would likely be low negative in the short term and low negative in the long term because this alternative would likely not contribute to rebuilding the overfished southern red hake stock. The alternative could potentially result in a loss of 128,072 pounds of southern red hake landings valued at $53,150, beginning in FY2021 when the reduced TAL trigger becomes effective (Table 60). The loss represents about 16.9% of the total landings or value, affecting about 284 trips and 57 vessels that would have otherwise continued fishing if the TAL was not triggered at 40.4% of the ACL.

The social impacts of Alternative 1 No Action would likely be low negative as this alternative could result in an AM of a 400 lb. possession limit put in place earlier in the fishing year relative to the Status Quo alternative. In the long term, the social impacts of Alternative 1 would likely be low negative because this alternative would likely not contribute to rebuilding the overfished southern red hake stock. This could result in reduced income for fishermen and may translate into negative social impacts in the short and long term on the size and demographic characteristics of the fishery-related workforce. There could be reduced business opportunities for shoreside service providers, impacting employment in the wider fishing community. The small-mesh multispecies fishery could result in a change in fishing behavior to avoid catching southern red hake, however. Alternative 1 would be more negative than Alternative 2 because the TAL trigger in place is higher under Alternative 2, thus, the fishery is likely to reach the TAL trigger later in the fishing season under Alternative 2, realizing more socioeconomic benefits as a result. Alternative 1 would not realize the reduction in southern red hake possession limits under Alternative 3 and Alternative 4, thus, the low negative impacts of Alternative 1 would be less negative than those in Alternative 3 and Alternative 4 because the limits are less restrictive.

6.6.2.2 Alternative 2 – Status Quo

Under Alternative 2 Status Quo, the 2018 fishing year regulations would be in place: 5,000 lb. possession limit and AMs in place reducing the southern red hake possession limit to 400 lb. when landings reach an in-season trigger of 90% of the TAL. Alternative 2 would have a low positive to low negative impact to human communities in the short term because even though fishermen would be able to land the higher possession limit and have the higher TAL trigger, the AM could still be put in place before the end of the fishing season as in years past, resulting in lost revenue and increase in discarding. In the long term, there would be a low negative impact to human communities because if status quo is taken, then that will negatively impact the overfished resource and not contribute to recovery and rebuilding so economic and social impacts will be low negative in the future if southern red hake continues to decline. Fishing behavior and levels of effort are generally expected remain similar to current conditions. Alternative 2 would have a low positive impact on human communities in the short term when compared to the No Action alternative because of the higher AM threshold, thus, greater ability to fish longer before the TAL trigger is reached, though would have a low negative impact in the long term if Alternative 2 does not contribute to recovery or rebuilding of the overfished resource. Alternative 2 would have a low positive impact on human communities in the short term when compared to Alternative 3 and Alternative 4 because of Alternative 2's higher possession limits, allowing for higher revenue and less discarding of southern red hake but would have a low negative impact in the long term if Alternative 2 does not contribute to recovery or rebuilding of the overfished resource.

The economic impacts of Alternative 2 Status Quo would likely be low negative in the short term if an AM is put in place, similar to what has happened in years past and low negative in the long term because this alternative would likely not contribute to rebuilding the overfished southern red hake stock. During the next fishing year, the alterative could result in a loss of 7,568 pounds of southern red hake landings valued at $3,141 relative to existing fishing conditions FY2018-2020 (Table 60). This alternative's possession limit would reduce the southern red hake landings by <1% of southern red hake landings, affecting 54 trips and 26 vessels that would have otherwise continued landing southern red hake.

The social impacts of Alternative 2 would likely be low positive in the short term because the FY2018 fishing regulations would be in place and would have the higher TAL trigger threshold, meaning fishermen would be able to fish longer in the fishing season without increasing discarding of southern red hake. In the long term, the social impacts of Alternative 2 would likely be low negative because this alternative would likely not contribute to rebuilding the overfished southern red hake stock. The small-mesh multispecies fishery would continue to fish under the higher possession limits despite the stock being overfished, however, the fishery could still trigger the TAL, resulting in a lower possession limit, which has occurred in recent fishing years. If the TAL is triggered, reduced income for fishermen could translate into negative social impacts in the short term on the size and demographic characteristics of the fishery-related workforce.

6.6.2.3 Alternative 3 – Year-Round Possession Limits for All Gear and Fisheries

Alternative 3 would reduce year-round southern red hake possession limits which could result in a low negative human communities' impact in the short term due to a slight loss in revenue from lower possession limits but could result in a low positive human communities' impact in the long term due to sustainably managing the resource. The short-term impacts and analyses for each of the Alternative 3 options are included in the following paragraphs while the rest of this paragraph is focused on the long-term impacts. If the stock is sustainably managed through a reduction in southern red hake possession limit which could lead to increase revenue potential in the future, the long-term impacts would likely be low positive for all Alternative 3 options. Fishing behavior and levels of effort are not expected to substantially change relative to current fishing activity, however. Alternative 3 Option A would likely have the highest low positive impact because of the more restrictive management regulations with the lowest southern red hake possession limit followed by Option B, followed by Option C, and followed by Option D, which would have the lowest low positive impact relative to the other options because this option is the least restrictive option, meaning sustainably managing the southern red hake resource wouldn't occur as quickly as the other options. Alternative 3 could result in a lower revenue and thus, low negative human communities' impact relative to Alternative 1 No Action and Alternative 2 Status Quo; relative to Alternative 4, the impacts are likely negligible (Table 60).

6.6.2.3.1 Option A – 0 lb. Possession Limit

Alternative 3 Option A would ban southern red hake landings year-round, so any catch would be discarded. Thus, Alternative 3 Option A would have a low negative impact on human communities. A 100% reduction in southern red hake catch would be expected under this alternative because of the prohibition of landings (Table 60). Fishermen who no longer would be able to land red hake may have a couple of incentives to reduce red hake catch including the desire to not discard fish unnecessarily and to prevent future constraints on other valuable fishing because of restrictions that could result from failure to rebuild the southern red hake stock. Vessels could fish for a longer duration to make up for lost revenue from southern red hake landings, however, this is also unlikely except in a few statistical areas (537, 539, 611), where the southern red hake revenue is highest, and therefore the human community impact would be low negative. Fishing behavior and levels of effort are not expected to substantially change relative to current fishing activity, however.

The economic impacts of Alternative 3 Option A would likely be low negative. During the next fishing year, the alternative could potentially result in a loss of 759,299 pounds of southern red hake landings valued at $315,109 compared to Alternative 2 Status Quo (Table 60). There would be 100% reduction in southern red hake revenue, affecting 4,572 trips and 184 vessels that would have otherwise caught southern red hake. Alternative 3 Option A would represent the highest loss in southern red hake revenue, therefore would have the most negative impacts compared to Alternative 3 Options B, C, and D which have higher year-round southern red hake possession limits (Table 61, Figure 23).

The social impacts of Alternative 3 Option A would likely be low negative. This option would require 100% discarding of southern red hake, thus, Alternative 3 Option A would likely produce low negative social impacts and the most negative impacts on the small-mesh multispecies fishery relative to Alternative 3 Options B, C, and D given the higher possession limits. Converting all landings to discards could decrease job satisfaction among fishermen, which could decrease the well-being of fishermen, their families, and their communities. Discarding could be seen as wasteful and result in a negative attitude towards fishery management. Also, time spent discarding could be redirected toward catching more of the target species, improving efficiency, and the overall bottom line. Because southern red hake is not typically targeted, a disruption in the supply chain would not be expected.

6.6.2.3.2 Option B – 400 lb. Possession Limit

Alternative 3 Option B would have a 400 lb. possession limit in place throughout the entire fishing year, even if an accountability measure is not put in place. Alternative 3 Option B would have a low negative impact on human communities. An estimated 36% reduction of southern red hake catch would be expected under this alternative (Table 60). Fishermen who no longer would be able to land red hake may have a couple of incentives to reduce red hake catch including the desire to not discard fish unnecessarily and to prevent future constraints on other valuable fishing because of restrictions that could result from failure to rebuild the southern red hake stock. Vessels could fish for a longer duration to make up for lost revenue from southern red hake landings, however, this is also unlikely except in certain statistical areas (537, 539, 611), where the southern red hake revenue is highest, and therefore the human community impact would be low negative. Fishing behavior and levels of effort are not expected to substantially change relative to current fishing activity, however.

The economic impacts of Alternative 3 Option B would likely be low negative. During the next fishing year, the alternative could result in a loss of 273,701 pounds of southern red hake landings, valued at $113,586 compared to Alternative 2 Status Quo (Table 60). This alternative's possession limit would reduce the southern red hake landings by 36%, affecting about 439 trips and 65 vessels which would have otherwise continued to catch southern red hake. Alternative 3 Option B would have a higher negative revenue loss, therefore higher negative impact, compared to Alternative 3 Options C and D given the higher possession limits while Alternative 3 Option B would have a lower loss in revenue, thus, lower negative impact, compared to Alternative 3 Option A given the ban on southern red hake landings (Table 61, Figure 23).

The social impacts of Alternative 3 Option B would likely be low negative. This alternative represents a level consistent with unavoidable incidental catch in the whiting fishery and accommodates most catches on trips using large-mesh trawls and other gears. Alternative 3 Option B would likely produce slight to low negative social impacts, thus, the most negative impacts on the small-mesh multispecies fishery relative to Options C and D given the higher possession limits but low positive social impacts, thus, the least negative impact, relative to Option A given the lower possession limit. This alternative could result in more landings being converted to discards which may decrease job satisfaction among fishermen, which may decrease the well-being of fishermen, their families, and their communities. Discarding could be seen as wasteful and result in a negative attitude towards fishery management. Also, time spent discarding could be redirected toward catching more of the target species, improving efficiency, and the overall bottom line. Because southern red hake is not typically targeted, a disruption in the supply chain would not be expected.

6.6.2.3.3 Option C – 600 lb. Possession Limit

Alternative 3 Option C would have a 600 lb. possession limit in place, unless superseded by the 400 lb. accountability measure. Alternative 3 Option C would have a low negative impact on human communities. An estimated 29.7% reduction of southern red hake catch would be expected under this alternative (Table 60), similar to the reduction expected under Alternative 4. Fishermen who no longer would be able to land red hake may have a couple of incentives to reduce red hake catch including the desire to not discard fish unnecessarily and to prevent future constraints on other valuable fishing because of restrictions that could result from failure to rebuild the southern red hake stock. Vessels could fish for a longer duration to make up for lost revenue from southern red hake landings, however, this is also unlikely except in certain statistical areas (537, 539, 611), where the southern red hake revenue is highest, and therefore. the human community impact would be low negative. Fishing behavior and levels of effort are not expected to substantially change relative to current fishing activity, however.

The economic impacts of Alternative 3 Option C would likely be low negative. During the next fishing year, the alternative could result in a loss of 225,722 pounds of southern red hake landings valued at $93,675 compared to Alternative 2 Status Quo (Table 60). This alternative's possession limit would reduce the southern red hake landings by 30%, affecting 336 trips and 55 vessels that would have otherwise continued to land southern red hake. Alternative 3 Option C would have a higher negative economic impact from higher loss in revenue, thus, higher negative impact, compared to Alternative 3 Option D given the higher possession limits while Alternative 3 Option C would have a lower loss in revenue, thus lower negative economic impact compared to Alternative 3 Options A and B given the lower southern red hake possession limits (Table 61, Figure 23).

The social impacts of Alternative 3 Option C would likely be low negative. The small-mesh multispecies fishery would likely result in a low loss of income from fishermen not being able to land the higher possession limit that is in place under Alternative 1 No Action and Alternative 2 Status Quo. Alternative 3 Option C would likely produce slight to low negative social impacts, thus, the most negative impact on the small-mesh multispecies fishery relative to Option D given the lower possession limits but low positive social impacts, thus, most positive impact relative to Options A and B given the lower possession limits. This alternative may result in more landings being converted to discards which may decrease job satisfaction among fishermen, which may decrease the well-being of fishermen, their families, and their communities. Discarding could be seen as wasteful and result in a negative attitude towards fishery management. Also, time spent discarding could be redirected toward catching more of the target species, improving efficiency, and the overall bottom line. Because southern red hake is not typically targeted, a disruption in the supply chain would not be expected.

6.6.2.3.4 Option D – 1,000 lb. Possession Limit

Alternative 3 Option D would have a 1,000 lb. possession limit in place, unless superseded by the 400 lb. accountability measure. Alternative 3 Option D would have a low negative impact on human communities. An estimated 24% reduction of southern red hake catch would be expected under this alternative (Table 60). Fishermen who no longer would be able to land red hake may have a couple of incentives to reduce red hake catch including the desire to not discard fish unnecessarily and to prevent future constraints on other valuable fishing because of restrictions that could result from failure to rebuild the southern red hake stock. Vessels could fish for a longer duration to make up for lost revenue from southern red hake landings, however, this is also unlikely except in certain statistical areas (537, 539, 611), where the southern red hake revenue is highest. Fishing behavior and levels of effort are not expected to substantially change relative to current fishing activity, however.

The economic impacts of Alternative 3 Option D would likely be low negative. During the next fishing year, the alternative could result in a loss of 184,445 pounds of southern red hake landings, valued at $76,545 compared to Alternative 2 Status Quo (Table 60). This alternative's possession limit would reduce the southern red hake landings by 24%, affecting 300 trips and 54 vessels that would have otherwise continued to land southern red hake. Alternative 3 Option D would have the lowest loss in revenue, thus, the lowest negative impact, compared to Alternative 3 Options A, B, and C given this alternative would have the highest southern red hake possession limits (Table 61, Figure 23).

The social impacts of Alternative 3 Option D would likely be low negative. This alternative would represent the lowest cost option and the least negative impact relative to Alternative 3 Options A, B, and C, thus, has the least negative social impact in the short term on the size and demographic characteristics of the fishery-related workforce. This alternative could result in some landings being converted to discards which may decrease job satisfaction among fishermen, which may decrease the well-being of fishermen, their families, and their communities. Discarding could be seen as wasteful and result in a negative attitude towards fishery management. Also, time spent discarding could be redirected toward catching more of the target species, improving efficiency, and the overall bottom line. Because southern red hake is not typically targeted, a disruption in the supply chain would not be expected.

6.6.2.4 Alternative 4 - Dual 1,000 lb./600 lb. Year-Round Possession Limit *(Preferred Alternative)*

Alternative 4 would reduce the year-round southern red hake possession limit to 1,000 lb. when using more selective gear types (large-mesh or selective small-mesh gear types) and to 600 lb. when using small-mesh gear, which could result in a low negative human communities' impact in the short term due to a slight loss in revenue from lower possession limits but could result in a low positive human communities' impact in the long term due to sustainably managing the resource. If the stock is sustainably managed through a reduction in southern red hake possession limit which could lead to increase revenue potential in the future, the long-term impacts would likely be low positive. The higher possession limit of 1,000 lb. could mean additional effort (more tows, longer trips, etc.) in order to land the higher possession limit compared to the lower 600 lb. possession limit but based on observer data in 2018, only one trip with large mesh landed >1,000 pounds. Of the observed small- and large-mesh trawl trips, 60% would have a 1,000 lb. southern red hake possession limit. For observed trips landing over 1,000 lb. of southern red hake, 45% used standard small-mesh trawls and would have a 600 lb. possession limit or would be able to land 1,000 lb. of red hake by switching to a selective trawl (Table 56). These trips represent 50% of the observed red hake catch. Southern red hake is not typically targeted, however, and the reduced opportunity to land this stock would most likely not substantially change fishing behavior and catch. Thus, fishing behavior and levels of effort are not expected to substantially change relative to current fishing activity. The cost of replacing or modifying the gear to make it more selective (and therefore to get the higher 1,000 lb. possession limit) is unlikely to cause fishermen to switch gear. The potential slight increase in revenue and slight decrease in discards from the more selective gear type under the higher possession limit could be offset by the slight decrease in revenue and slight increase in discards from the standard small-mesh trawl gear under the lower possession limit. Thus, Alternative 4 impacts are likely negligible relative to Alternative 3. Alternative 4 could result in a lower revenue and thus, low negative human communities' impact relative to Alternative 1 No Action and Alternative 2 Status Quo.

The economic impacts of Alternative 4 would likely be low negative. Table 35 shows that in FY2018, only 3% of southern red hake landings and $8,285 are associated with large mesh gear, which fall under the higher 1,000 lb. possession limit, while the majority of landings and revenue are comprised of small-mesh gear (61%, $163,519), which fall under the 600 lb. possession limit. The remainder of landings caught using medium mesh gear and/or have missing gear code. Most trips that use large mesh gear land <100 pounds of southern red hake (Table 36). Based on the observer data, only one trip using large mesh in 2018 landed more than 1,000 lb. of southern red hake, which is why the total loss of landings and revenue in Alternative 4 is similar to Alternative 3 Option C (Table 61, Figure 23). The large mesh trips with landings between 600 and 1,000 lb. would be able to land the entire amount because the trip would be under the higher possession limit which would not occur under Alternative 3 Option C 600 lb. possession limit, however, the impact difference between Option C and Option D would still be negligible. The cost to modify or invest in more selective gear such as raised footrope (which cost $8k-$9k) would take at least 6 years to break even on this gear investment, based on an average of $1,574 annual revenue from southern red hake. This estimate does not include costs associated to repairs and maintenance nor any potential revenue increase from any increased catch of other species. The investment in more selective gear type is voluntary, thus, the alternative's impacts depend upon fishermen's adoption to the more selective gear and the performance of that gear. Although based on the landings and cost data, under Alternative 4, vessels may not have a strong financial incentive to switch to larger mesh gear under either option, the 1,000 lb. year-round possession limit, they would have less incentive to target southern red hake under either possession limit option, compared to the 5,000 lb. possession limit under the No Action and Status Quo alternatives. A couple of these incentives include the desire to not discard fish unnecessarily and to prevent future constraint on other valuable fishing because of red hake. Fishing behavior and levels of effort are not expected to substantially change relative to current fishing activity. A 29.7% reduction of southern red hake catch would be expected under this alternative (Table 60), similar to the reduction expected under Alternative 3 Option C.

The social impacts of Alternative 4 would likely be negligible. The ability to land the higher possession limit by fishing with more selective gear could reduce southern red hake catch and unnecessary discarding, which may increase job satisfaction among fishermen. However, this has not been observed based on observer data because southern red hake is typically not a target species and is not expected to occur in the short term. The incentive of the higher possession limit would not likely affect fishing behavior given a change in gear could result in a reduction in catch of target species that comprise most of the revenue. If fishermen do not choose the more selective gear option, then the social impacts would be the same as Status Quo and No Action in terms of gear selectivity.

6.7 CUMULATIVE EFFECTS

6.7.1 Introduction

A cumulative effects assessment (CEA) is a required part of an EIS or EA according to the Council on Environmental Quality (CEQ; 40 CFR part 1508.7) and the NOAA policy and procedures for NEPA, found in NOAA Administrative Order 216-6A (Companion Manual, January 13, 2017). The purpose of the CEA is to integrate into the impact analyses, the combined effects of many actions over time that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective but rather, the intent is to focus on those effects that are truly meaningful. This section serves to examine the potential direct and indirect effects of the preferred alternative (i.e., the suite of preferred alternatives) together with past, present, and reasonably foreseeable future actions that affect the human environment. Predictions of potential synergistic effects from multiple actions, past, present and/or future are generally qualitative.

Valued Ecosystem Components (VEC)

The valued ecosystem components for the small-mesh multispecies fishery are generally the "place" where the impacts of management actions occur, and are identified as noted in Section 6.1:

1. Target species (Southern red hake) (Section 6.2);
2. Non-target species (Section 6.3);
3. Protected species (Section 6.4);
4. Physical environment and essential fish habitat (Section 6.5); and
5. Human communities (Section 6.6).

The CEA identifies and characterizes the impact on the VECs by the alternatives under consideration when analyzed in the context of other past, present, and reasonably foreseeable future actions. To enhance clarity and maintain consistency, terms are as defined in Table 48.

Temporal Scope of the VECs

While the effects of historical fisheries are considered, the temporal scope of past and present actions for regulated groundfish stocks, non-groundfish species, habitat and the human environment is primarily focused on actions that have taken place since implementation of the initial Small-mesh Multispecies FMP. An assessment using this timeframe demonstrates the changes to resources and the human environment that have resulted through management under the Council process and through prosecution of the U.S. fishery rather than foreign fleets. For 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. The temporal scope of future actions for all VECs extends about five years (2026) beyond the expected implementation of this action. The dynamic nature of resource management for these species and lack of information on projects that may occur in the future make it difficult to predict impacts beyond this timeframe with any certainty.

Geographic Scope of the VECs

The geographic scope of the impacts to species is their range in the western Atlantic Ocean, as described in the Affected Environment (Section 5.0). The physical environment, including habitat and EFH, is bounded by the range of the small-mesh multispecies fishery, from the GOM through the Mid-Atlantic Bight, and includes adjacent upland areas (from which non-fishing impacts may originate). For protected species, the geographic range is the Northwest Atlantic Ocean. The geographic range for human communities focuses on the Northeast U.S.

Analysis of Total Cumulative Effects

A cumulative effects assessment ideally makes effect determinations based on the combination of: 1) impacts from past, present and reasonably foreseeable future actions; 2) the baseline condition of the VECs (the combined effects from past, present and reasonably foreseeable future actions plus the present condition of the VEC; and 3) impacts of the preferred alternative.

6.7.2 Past, Present and Reasonably Foreseeable Future Actions

A synopsis of the most applicable past, present, and reasonably foreseeable future actions that have the potential to interact with the current action is summarized below. Details on the past, present, and foreseeable future actions that may impact this action, and a complete history of the Small-Mesh Multispecies FMP are in Amendment 19 (NEFMC 2013).

6.7.2.1 Fishing Effects – Past and Present Actions

Most of the actions affecting the VECs come from fishery-related activities (e.g., Federal fishery management actions), which have straightforward effects on environmental conditions, and were, are, ore will be taken, in large part, to improve those conditions. The reason for this is the statutory basis for Federal fisheries management, the reauthorized Magnuson-Stevens Act (SFA 2996). That legislation was enacted to promote long-term positive impacts on the environment in the context of fisheries activities. More specifically, the MSA stipulates that management comply with a set of National Standards that collectively serve to optimize the conditions of the human environment. Under this regulatory regime, the cumulative impacts of past, present, and future Federal fishery management actions on the VECs should likely result in positive long-term outcomes. Nevertheless, these actions are often associated with offsetting impacts. For example, constraining fishing effort frequently results in negative short-term socioeconomic impacts on fishery participants. However, these impacts are usually necessary to bring about the long-term sustainability of a given resource, and as such, should, in the long-term, promote positive effects on human communities, especially those that are economically dependent upon the managed resource. Generally, these actions have had low negative impacts on habitat due to continued fishing operations; however, some actions have had direct or indirect long-term positive impacts on habitat through designating or protecting important habitats. FMP actions have also had a range of impacts on protected species, including generally low negative impacts on ESA-listed species, and a range of impacts on non-ESA listed marine mammals from low negative to low positive, depending on the species.

The FMPs that have had the greatest impact on small-mesh fishery VECs, other than the Small-Mesh Multispecies FMP, are the Northeast Multispecies, Monkfish, Atlantic Sea Scallop, and Atlantic Squid FMPs because of the spatial overlap of the fisheries and the relatively high level of incidental catch of southern red hake in those fisheries.

<u>*Past and Present Actions*</u>

Small-Mesh Multispecies. The 2018-2020 Whiting Specifications document established allowable catch limits for each stock within the fishery to control overfishing while allowing optimum yield, consistent with the Magnuson-Stevens Fishery Conservation and Management Act.

Northeast Multispecies. FW59 set 2020 TACs for U.S./Canada management units of Eastern GB cod, Eastern GB haddock, and GB yellowtail flounder stock, set 2020-2022 specifications for 15 other groundfish stocks, address commercial/recreational allocation issues if needed, and revise the GB cod incidental catch TAC.

Monkfish. The Council developed Monkfish Framework 12, which set specifications for FYs 2020-2022 and is expected to be implemented in summer 2020.

Atlantic Sea Scallops. FW32 established scallop specifications for fishing years 2020 and 2021 and considered measures to mitigate scallop fishery impacts to Georges Bank yellowtail flounder.

Atlantic Squid. Amendment 20 through the Mid-Atlantic Fishery Management Council reduced latent directed permits, created limited access incidental permits, and lowered Trimester 2 post-closure trip limit to 250 pounds to discourage directed fishing after closures.

Essential Fish Habitat. The Council recently developed a deep-sea coral amendment to protect deep sea coral habitats throughout New England from the negative impacts of fishing gears. The proposed rule published on August 26, 2019, and NMFS approved the amendment on November 20, 2019. The proposed rule was published on January 2, 2020. Once implemented, the amendment will designate a broad coral zone between the US/Canada EEZ boundary, the boundary between the NEFMC and MAFMC regions, and the seaward boundary of the US EEZ, with the landward boundary at the 600 m contour. The zone will be a closure to all bottom-tending gears, with an exemption for the red crab pot fishery. The deep-sea coral zones are not expected to have direct impacts on any of the managed resources.

<u>*Reasonably Foreseeable Future Actions*</u>

Small-Mesh Multispecies. The Council will initiate Whiting specifications for FY2021 – FY2023 in the fall of 2020.

Northeast Multispecies. Amendment 23 (under development since February 2017), intends to implement measures to improve reliability and accountability of catch reporting and to ensure a precise and accurate representation of catch (landings and discards).

Atlantic Sea Scallops. Amendment 21, initiated in February 2019, would address the Northern Gulf of Maine Management Area measures, the Limited Access General Category (LAGC) individual fishing quota (IFQ) possession limits, and the ability for Limited Access vessels with LAGC IFQ to transfer the quota to vessels that only hold these permits.

6.7.2.2 Non-Fishing Effects: Past, Present, and Reasonably Foreseeable Future Actions

Non-fishing activities that occur in the marine environment and connected watersheds can cause the loss or degradation of habitat and/or affect the species that reside therein. The impacts of most nearshore human-induced non-fishing activities tend to be localized in the nearshore areas and marine project areas where they occur. The following discussion of impacts is based on past assessments of activities and assume these activities will likely continue as projects are proposed.

Examples of these activities include point and non-point source pollution, shipping, dredging, storm events, wind energy development, oil and gas development, and construction. The impacts from these non-fishing activities primarily stem from habitat loss due to human interaction and alteration or natural disturbances. These activities are widespread and can have localized impacts on habitat related to the accretion of sediments from at-sea disposal areas, oil and mineral resource exploration, aquaculture, construction of at-sea windfarms, bulk transportation of petrochemicals, and significant storm events. For protected species, primary concerns associated with non-fishing activities include vessel strikes, dredge interactions (especially for sea turtles and sturgeon), and underwater noise. These activities have both direct and indirect impacts on protected species. 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 these VECs to the impacts of fishing effort. Direct negative impacts that have been observed to target, non-target, and protected species resulting 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 have no impact to low negative impacts.

Non-fishing activities permitted under other federal agencies (e.g. beach nourishment, offshore wind facilities, etc.) require examinations of potential impacts on the VECs. The MSA imposes an obligation on other Federal agencies to consult with the Secretary of Commerce on actions that may adversely affect EFH (50 CFR 600.930). NMFS and the eight regional fishery management councils engage in this review process by commenting on and recommending federal and state actions that may affect habitat for their managed species and by commenting on actions likely to adversely impact EFH. This helps minimize the extent and magnitude of indirect negative impacts those actions could have on resources under NMFS jurisdiction. In addition to guidelines mandated by the MSA, NMFS reviews some non-fishing 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. Non-fishing activities must also meet the mandates under the ESA, specifically Section 7(a)(2)[7], which ensures that agency actions do not jeopardize the continued existence of endangered species and their critical habitat.

In recent years, offshore wind energy and oil and gas exploration have become more relevant activities in the Greater Atlantic region. They are expected to impact all VECs, as described below.

6.7.2.2.1 Impacts of offshore wind energy development on Biological Resources (Target species, Non-target species, Protected Species) and the Physical Environment

Construction activities may have both direct and indirect impacts on marine resources, ranging from temporary changes in distribution to injury and mortality. Impacts could occur from changes to habitat in the areas of wind turbines and cable corridors and increased vessel traffic to and from these areas. Species that reside in affected wind farms year-round may experience different impacts than species that seasonally reside in or migrate through these areas. Species that typically reside in areas where wind turbines are installed may return to the area and adapt to habitat changes after construction is complete. Inter-array and electricity export cables will generate electromagnetic fields, which can affect patterns of movement, spawning, and recruitment success for various species. Effects will depend on cable type, transmission capacity, burial depth, and proximity to other cables. Substantial structural changes in habitats associated with cables are not expected unless cables are left unburied (see below). However, the cable burial process may alter sediment composition along the corridor, thereby affecting infauna and emergent biota. Taormina et al. (2018) provide a recent review of various cable impacts, and Hutchinson et al. (2020) and Taormina et al. (2020) examine the effects of electromagnetic fields in particular.

The full build out of offshore wind farms will result in broad habitat alteration. The wind turbines will alter hydrodynamics of the area, which may affect primary productivity and physically change the distribution of prey and larvae. It is not clear how these changes will affect the reproductive success of marine resources. Scour and sedimentation could have negative effects on egg masses that attach to the bottom. Benthic habitat will be altered due to the placement of scour protection at wind turbine foundations, and over cables that are not buried to target depth in the sediment, converting soft substrates into hard substrates. This could alter species composition and predator/prey relationships by increasing favorable habitat for some species and decreasing habitat for others. The placement of wind turbines will also establish new vertical structure in the water column, which could serve as reefs for bottom species, fish aggregating devices for pelagic species, and substrate for the colonization of other species, e.g. mussels. Various authors have studied these types of effects (e.g. Bergström et al. 2013, Dannheim et al. 2019, Degraer et al. 2019, Langhamer 2012, Methratta and Dardick 2019, Stenberg et al. 2015).

Elevated levels of sound produced during site assessment activities, construction, and operation of offshore wind facilities will impact the soundscape[16]. Temporary, acute, noise impacts from construction activity could impact reproductive behavior and migration patterns; the long-term impact of operational noise from turbines may also affect behavior of fish and prey species, through both vibrations in the immediate area surrounding them in the water column, and through the foundation into the substrate. Depending on the sound frequency and source level, noise impacts to species may be direct or indirect (Finneran 2015; Finneran 2016; Nowacek et al. 2007; NRC 2000; NRC 2003; NRC 2005; Madsen et al. 2006; Piniak 2012; Popper et al. 2014; Richardson et al. 1995; Thomsen et al. 2006). Exposure to underwater noise can directly affect species via behavioral modification (avoidance, startle, spawning) or injury (sound exposure resulting in internal damage to hearing structures or internal organs) (Bailey et al. 2010; Bailey et al. 2014;Bergström et al. 2014; Ellison et al. 2011; Ellison et al. 2018; Forney et al. 2017; Madsen et al. 2006; Nowacek et al. 2007; NRC 2003; NRC 2005; Richardson et al. 1995; Romano et al. 2004; Slabbekoorn et al. 2010; Thomsen et al. 2006; Wright et al. 2007). Indirect effects are likely to result from changes to the acoustic environment of the species, which may affect the completion of

16 See NMFS Ocean Noise Strategy Roadmap: https://cetsound.noaa.gov/Assets/cetsound/documents/Roadmap/ONS_Roadmap_Final_Complete.pdf

essential life functions (e.g., migrating, breeding, communicating, resting, foraging)[17] (Forney et al. 2017; Richardson et al. 1995; Slabbekoorn et al. 2010;Thomsen et al. 2006).

Wind farm survey and construction activities and turbine/cable placement will substantially affect NMFS scientific research surveys, including stock assessment surveys for fisheries and protected species[18] and ecological monitoring surveys. Disruption of such scientific surveys could increase scientific uncertainty in survey results and may significantly affect NMFS' ability to monitor the health, status, and behavior of marine resources and protected species and their habitat use within this region. Based on existing regional Fishery Management Councils' acceptable biological catch control rule processes and risk policies (e.g., 50 CFR §§ 648.20 and 21), increased assessment uncertainty could result in lower commercial quotas and recreational harvest limits that may reduce the likelihood of overharvesting and mitigate associated biological impacts on fish stocks. However, this would also result in lower associated fishing revenue and reduced recreational fishing opportunities, which could result in indirect negative impacts on fishing communities.

6.7.2.2.2 Impacts of Offshore Wind Energy Development on Socioeconomic Resources

One offshore wind pilot project off Virginia installed two turbines in 2020**.** Several potential offshore wind energy sites have been leased or identified for future wind energy development in federal waters from Massachusetts to North Carolina (see leasing map below – Map 6). According to BOEM, approximately 22 gigawatts (close to 2,000 wind turbines based on current technology) of Atlantic offshore wind development via 17 projects are reasonably foreseeable along the east coast (BOEM 2020a). As the number of wind farms increases, so too would the level and scope of impacts to affected habitats, marine resources, and human communities.

Offshore wind energy development is being considered in parts of the outer continental shelf that overlap with the red hake resource, specifically in the southern region of New England (Map 6). The whiting fishery has been active in New England at present and is expected to be for the near future (Section 5.0). The social and economic impacts of offshore wind energy on fisheries could be generally negative due to the overlap of wind energy areas with productive whiting fishing grounds. Impacts may vary by year based on species availability. It is worth noting that this analysis represents only a rough approximation of potential effects from the areas; however, because this productive region of the resource would be expected to support whiting fishing in the future in the absence of offshore wind energy development, any restriction of fishing access to this region as a result of offshore wind energy development would be perceived as a negative overall effect to the fishery. In some cases, effort could be displaced to another area, which could compensate for potential economic losses if vessel operators choose not to operate in the wind energy areas.

There could also be social and economic benefits in the form of jobs associated with construction and maintenance, and replacement of some electricity generated using fossil fuels with renewable sources (AWEA 2020).

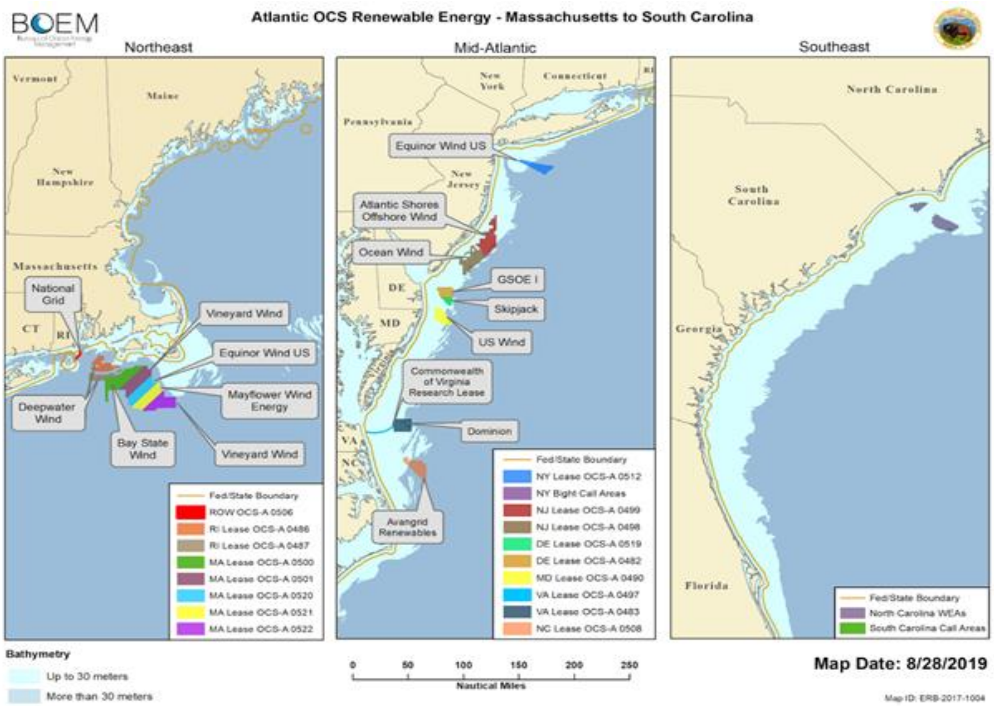
It remains unclear how fishing or transiting to and from fishing grounds (whether or not those grounds are within a wind farm) might be affected by the presence of a wind farm. While no offshore wind developers have expressed an intent to exclude fishing vessels from wind turbine arrays once construction is complete, it could be difficult for operators to tow bottom-tending mobile gear or transit amongst the

17 See NMFS Ocean Noise Strategy Roadmap (footnote #2)

18 Changes in required flight altitudes due to proposed turbine height would affect aerial survey design and protocols (BOEM 2020a).

wind turbines, depending on the spacing and orientation of the array and weather conditions.[19] If vessel operators choose to avoid fishing or transiting within wind farms, effort displacement and additional steaming time could result in negative socioeconomic impacts to affected communities, including increased user conflicts, decreased catch and associated revenue, safety concerns, and increased fuel costs. If vessels elect to fish within wind farms, effects could be negative due to reduced catch and associated revenue, user conflicts, gear damage/loss, and increased risk of allision or collision.

Map 6. Map of BOEM Wind Planning areas, Wind Energy Areas, and Wind Leasing Areas on the Atlantic Outer Continental Shelf.



6.7.2.2.3 Impacts of Oil and Gas Development on Biological and Socioeconomic Resources

For oil and gas, this timeframe could include leasing and possible surveys, depending on the direction of BOEM's 5-year planning process in the North and Mid-Atlantic regions. (Note that there are fewer oil and gas development activities in the region than offshore wind; therefore, the non-fishing impacts focus more heavily on offshore wind.) Seismic surveys to detect and quantify mineral resources in the seabed impact marine species and the acoustic environment within which marine species live. These surveys have uncertain impacts on fish behaviors that could cumulatively lead to negative population level impacts. For protected species (sea turtle, fish, small cetacean, pinniped, large whale), the severity of these behavioral or physiological impacts is based on the species' hearing threshold , the overlap of this threshold with the frequencies emitted by the survey, as well as the duration of time the surveys would operate, as these factors influence exposure rate (Ellison et al. 2011; Ellison et al. 2018; Finneran 2015; Finneran 2016; Madsen et al. 2006; Nelms et al. 2016;Nowacek et al. 2007; Nowacek et al. 2015; NRC 2000; NRC 2003; NRC 2005; Piniak 2012; Popper et al. 2014; Richardson et al. 1995; Thomsen et al.

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19 The United States Coast Guard has considered transit and safety issues related to the Massachusetts and Rhode Island lease areas in a recent port access route study, and has recommended uniform 1 mile spacing in east-west and north-south directions between turbines to facilitate access for fishing, transit, and search and rescue operations. Future studies in other regions could result in different spacing recommendations (UCSG 2020).

2006; Weilgart 2013). If fishery resources are affected by seismic surveys, then so in turn the fishermen targeting these resources would be affected. However, such surveys could increase jobs, which may provide some positive effects on human communities (BOEM 2020b). It is important to understand that seismic surveys for mineral resources are different from surveys used to characterize submarine geology for offshore wind installations, and thus these two types of activities are expected to have different impacts on marine species.

6.7.2.2.4 Offshore Energy Summary

The overall impact of offshore wind energy and oil and gas exploration on the affected species and their habitats at 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. The individual project phases (site assessment, construction, operation, and decommissioning) as well as different aspects of the technology (foundations, cables/pipelines, turbines) will have varying impacts on resources. Mitigation efforts, such as habitat conservation measures, time of year construction restrictions, layout modifications, and fishery compensation funds could lessen the magnitude of negative impacts as well. The overall impact on socioeconomic resources is likely slight positive to moderate negative, potentially positive due to a potential increase in jobs and recreational fishing opportunities, but negative due to displacement and disruption of commercial fishing effort.

Climate Change. Global climate change affects 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. The rates of physical and chemical changes in marine ecosystems have been most rapid in recent decades (Johnson et al. 2019). 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). The general trend of changes can be explained by warming causing increased ocean stratification, which reduces primary production, lowering energy supply for higher trophic levels and changing metabolic rates. Different responses to warming can lead to altered food-web structures and ecosystem-level changes. Shifts in spatial distribution are generally to higher latitudes (i.e., poleward) and to deeper waters as species seek cooler waters within their normal temperature preferences. Climate change will also potentially exacerbate the stresses imposed by fishing and other non-fishing human activities and stressors. Survival of marine resources under a changing climate depends on their ability to adapt to change, but also how and to what degree those other human activities influence their natural adaptive capacity.

Results from the Northeast Fisheries Climate Vulnerability Assessment indicate that climate change could have impacts on Council-managed species that range from negative to positive, depending on the adaptability of each species to the changing environment (Hare et al. 2016).

Based on this assessment for red hake,

- Target species level of vulnerability to climate change is low (94% certainty from bootstrap analysis)
- Target species level of exposure to effects of climate change is high based on two contributing factors: ocean surface temperature (expert score of 3.9) and ocean acidification (expert score of 4.0). All life stages of red hake use marine habitats.
- The directional effect of climate change on red hake is estimated to be neutral (66-90% certainty in expert scores). Abundance in the southern portions may be decreasing, but the region-wide affects are unclear.

- Distributional vulnerability rank is high (94% certainty from bootstrap analysis); adults are habitat generalists and mobile. Eggs and larvae are planktonic.
- Habitat specialization has a low expert score of 1.8, meaning this is a low sensitivity attribute.
- Biological sensitivity of red hake to climate change is low; dispersal of early life stages may be partially limited as juveniles are commensal with Atlantic sea scallops.

Overall vulnerability results for additional Greater Atlantic species, including most of the non-target species identified in this action, are shown in Figure 24 (Hare et al. 2016). While the effects of climate change may benefit some habitats and the populations of species through increased availability of food and nutrients, reduced energetic costs, or decreased competition and predation, a shift in environmental conditions outside the normal range can result in negative impacts for those habitats and species unable to adapt. This, in turn, may lead to higher mortality, reduced growth, smaller size, and reduced reproduction or populations. Thus, already stressed populations are expected to be less resilient and more vulnerable to climate impacts. Climate change is expected to have impacts that range from positive to negative depending on the species. However, future mitigation and adaptation strategies to climate change may mitigate some of these impacts. The science of predicting, evaluating, monitoring and categorizing these changes continues to evolve. The social and economic impacts of climate change will depend on stakeholder and community dependence on fisheries, and their capacity to adapt to change. Commercial and recreational fisheries may adapt in different ways, and methods of adaptation will differ among regions. In addition to added scientific uncertainty, climate change will introduce implementation uncertainty and other challenges to effective conservation and management.

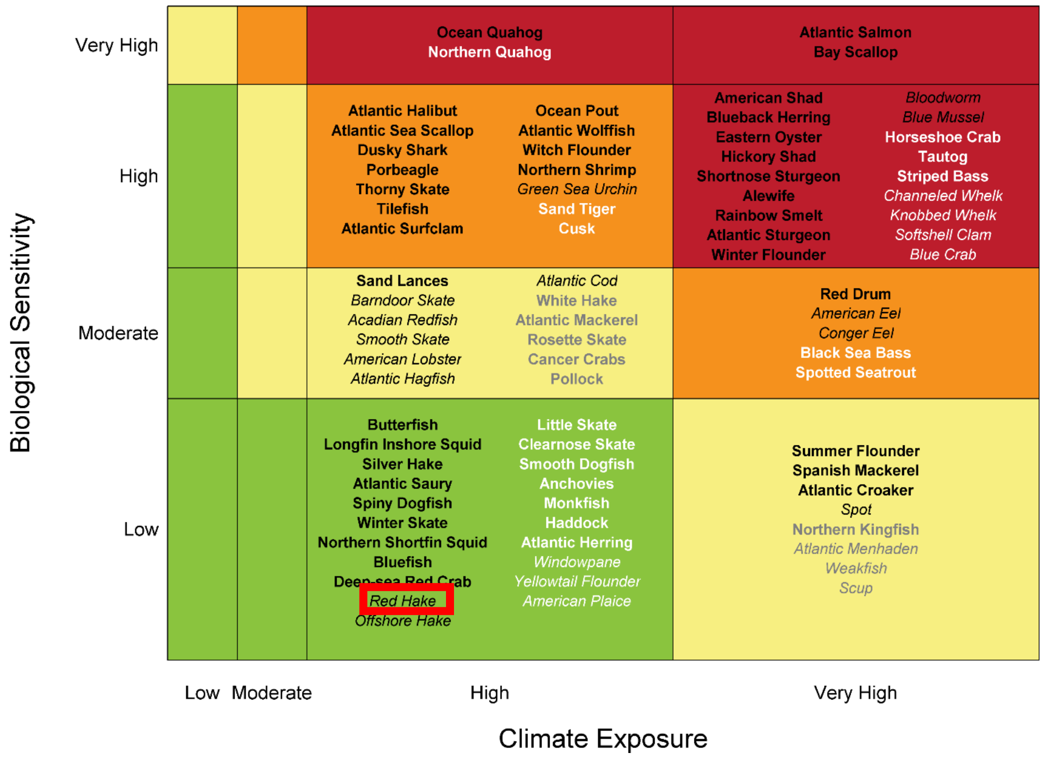

Figure 24. Overall climate vulnerability score for Greater Atlantic species, with surfclam and ocean quahog highlighted with black boxes. Overall climate vulnerability is denoted by color: low (green), moderate (yellow), high (orange), and very high (red). Certainty in score is denoted by text font and text color: very high certainty (>95%, black, bold font), high certainty (90–95%, black, italic font), moderate certainty (66–90%, white or gray, bold font), low certainty (<66%, white or gray, italic font). Figure source: Hare et al. 2016.

6.7.3 Baseline Conditions for Resources and Human Communities

The CEA baseline conditions for resources and human communities is the combined effects of the past, present, and foreseeable future actions (Section 6.7.2) plus the present condition of the VECs (Section 5.0). Straightforward quantitative metrics of the baseline conditions are available for the managed resources, non-target species, and protected resources. The conditions of the habitat and human communities VECs are complex and varied (Sections 5.5 and 5.6, respectively).

Table 62. Baseline conditions of the VECs.

<table>
<tr><th colspan="2">VEC</th><th>Status/Trends
(Section 5.0)</th><th>Effects of Past, Present Reasonably Foreseeable Future Actions</th><th>Combined Effects of Past, Present, Future Actions</th></tr>
<tr><td colspan="2"></td><td>A</td><td>B</td><td>A+B</td></tr>
<tr><td colspan="2">Target Species (Southern red hake)</td><td>Southern red hake is overfished but not experiencing overfishing</td><td>Positive
Stocks are being managed for sustainability</td><td>Short-term Negative: overharvesting in the past contributed to southern red hake being overfished
Long-term Positive: stocks are being managed for sustainability and adjustments are being made to help prevent overfishing and rebuild southern red hake</td></tr>
<tr><td colspan="2">Non-target Species</td><td>Effort controls in the small-mesh multispecies fishery help control bycatch / discards.</td><td>Positive
Continued effort controls under the small-mesh multispecies FMP and other FMPs with overlapping effort</td><td>Positive
Discards also controlled in other FMPs</td></tr>
<tr><td rowspan="7">Protected Species</td><td>Sea Turtles</td><td>Endangered or threatened</td><td rowspan="7">Low Positive
Continued effort controls along with past regulations will likely help stabilize protected species interactions</td><td rowspan="7">Mixed
Continued catch and effort controls are likely to reduce gear encounters through effort reductions. Additional management actions taken under ESA/MMPA should also help mitigate the risk of gear interactions</td></tr>
<tr><td>Large Whales</td><td>Endangered or MMPA protected</td></tr>
<tr><td>Small Cetaceans and Pinnipeds</td><td>MMPA protected</td></tr>
<tr><td>Giant Manta Ray</td><td>Threatened</td></tr>
<tr><td>Atlantic Sturgeon</td><td>Endangered or threatened</td></tr>
<tr><td>Atlantic Salmon</td><td>Endangered</td></tr>
<tr><td>Seabirds</td><td>Low-high conservation concern</td></tr>
<tr><td colspan="2">Physical Environment and Essential Fish Habitat</td><td>Fishing impacts are complex/variable and typically adverse; Non-fishing activities have had negative but site-specific habitat effects</td><td>Mixed
Continued management of EFH for an increased quality of habitat but</td><td>Mixed
Reduced habitat disturbance by fishing gear impacts from non-fishing activities could</td></tr>
</table>

		non-fishing impacts expected to increase	increase and have negative impact
Human Communities	Small-mesh multispecies revenues have been relatively stable and may decrease slightly with a decrease in possession limit	**Positive** Continued management will likely control effort for a sustainable fishery and thus fishery and non-fishery related activities will continue	**Short-term Negative**: Potential for decreased revenues with decrease in possession limit until stock is fully rebuilt **Long-term Positive**: Sustainable resources should support viable communities and economies

6.7.4 Cumulative Effects Analysis

To determine the magnitude and extent of cumulative impacts of the preferred alternative, the incremental impacts of the direct and indirect impacts should be considered, on a VEC-by-VEC basis, in addition to the effects of all actions (those identified and described relative to the past, present, and reasonably foreseeable future actions of both fishing and non-fishing actions). Table 63 summarizes likely effects of the management alternatives contained in this action. The CEA baseline (Table 62) represents the sum of the past, present, and reasonably foreseeable future (identified hereafter as "other") actions and conditions of each VEC. When an alternative has a positive effect on a VEC (e.g., reduced fishing mortality on a managed species), it has a positive cumulative effect on the stock size of the species when combined with the other actions that were also designed to increase stock size. In contrast, when an alternative has a negative effect on a VEC (e.g., increased fishing mortality on a managed species), the cumulative effect on the VEC would be negative and tend to reduce the positive effects of the "other" actions. The cumulative effects are described below for each VEC.

The preferred alternatives, in combination, are unlikely to result in significantly increased levels of fishing effort (Section 6.0). The proposed reduction in year-round southern red hake possession limit may slightly decrease targeted whiting trips.

Table 63. Summary of Framework 62 impacts expected on each VEC (preferred alternatives shaded).

Alternatives			Target Species	Non-target Species	Protected Resources	Physical Env. (EFH)	Human Communities
Rebuilding	**Alt. 1 – No Action / Status Quo**		High -	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low + Long term: Low -
	Alt. 2 – Rebuilding Estimates	**Option A – 75% of F_{MSY} proxy**	Moderately +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
		Option B – 50% of F_{MSY} proxy	Moderate +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
Management Alternatives	**Alt. 1 – No Action**		Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low - Long term: Low -
	Alt. 2 – Status Quo		Low -	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low + to low - Long term: Low -
	Alt. 3 – Year-round Possession Limits with AM	**Option A - 0 lb.**	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low - Long term: Low +
		Option B - 400 lb.	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
		Option C - 600 lb.	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
		Option D - 1,000 lb.	Low +	Stocks not overfished: Low + to Overfished stocks: Low -	Low – to low +	Low -	Short term: Low – Long term: Low +
	Alt. 4 - Dual 1,000 lb./600 lb. Year-round Possession Limit with AM		Low +	Stocks not overfished: Low + to Overfished stocks: Negligible	Low – to low +	Low -	Short term: Low – Long term: Low +

Target Species (Southern Red Hake Resource)

When the direct and indirect effects of the preferred alternative are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), *the cumulative effects would likely yield non-significant low positive impacts on the southern red hake resource.*

Past fishery management actions taken through the Small-Mesh Multispecies FMP and the triennial specifications process ensure that stocks are managed sustainably and that measures are consistent with the objectives of the FMP under the guidance of the MSA. The impacts of triennial specification of management measures largely depend on how effective those measures are in meeting the objectives of preventing overfishing and achieving optimum yield, and on the extent to which mitigating measures (e.g., incidental possession limits, AMs) are effective. These actions have generally had a mixed cumulative effect on the southern red hake resource. The combined impacts of past federal fishery management actions have led to short-term impacts that result in an overfished status for southern red hake. However, the rebuilding plan and management measures that would reduce possession limit of the overfished stock through a dual possession limit based on gear selectivity are expected to yield rebuilt sustainable southern red hake stock in the future. Overall, the past, present, and reasonably foreseeable future actions in the southern red hake stock have had mixed cumulative effects.

The preferred alternatives are unlikely to significantly change levels of fishing effort and behavior (Section 6.2). The preferred alternatives would rebuild the southern red hake stock.

Non-Target Species

When the direct and indirect effects of the preferred alternative are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), *the cumulative effects would likely yield non-significant slight low positive (non-overfished species) to slight low negative (overfished species) impacts on non-target species.*

The preferred alternatives are unlikely to significantly increase levels of fishing effort or change in behavior (Section 6.3). Catches of non-target species in the small-mesh multispecies fishery is primarily monitored and controlled through other FMPs. Depending on the non-target species, the preferred alternative is expected to have a low positive effect for non-target species that tend to co-occur with red hake because stocks are not overfished and overfishing is not occurring. Trips using more selective trawls would reduce bycatch of other species that have similar characteristics and behavior as red hake but could be less effective for the species being targeted. The preferred alternatives could have a low negative impact on other species if they are overfished or are experiencing overfishing as the preferred alternatives are expected to continue with similar levels of fishing effort and behavior as current conditions.

Past fishery management actions taken through the FMP and annual specifications process have had a positive cumulative effect on non-target species and bycatch. In particular, the small-mesh multispecies fishery is managed through specific exemptions from large-mesh multispecies regulations in such a way to minimize interactions with non-target species and bycatch. Specifically, these regulations include exemption areas and seasons in the northern management area that through prior experimental fishing permits have been shown to have acceptably low bycatch rates of large-mesh groundfish. In the southern management area, vessels may target red, silver, and offshore hakes year-round, but operate in areas where large-mesh multispecies catches are low. Concern about these species is however changing, particularly for distressed or overfished species like yellowtail and windowpane flounders.

Protected Resources

When the direct and indirect effects of the preferred alternative are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions*), the cumulative effects would likely yield non-significant low negative to low positive impacts (MMPA non-ESA listed species range from low negative to low positive impacts; ESA listed species with low negative impacts).*

Past and present actions in fisheries that catch small-mesh multispecies have had low negative to low positive effects on protected resources. The preferred alternatives are unlikely to significantly change levels of fishing effort (Section 6.4). Therefore, impacts to protected resources are unlikely to change relative to current conditions under the preferred alternatives and therefore, are expected to be low negative for ESA listed species and low negative to low positive impacts to MMPA non-ESA listed species. Management measures and/or take reduction plans have also been implemented to reduce incidental injuries and deaths of sea turtles or specific species/stocks of marine mammals due to interactions with commercial fishing gear; this has resulted in low positive to positive effects to these species/stocks. Future positive impacts are likely as well.

For sea turtles, changes to both their marine and terrestrial environment due to climate change pose a challenge. Recent studies suggest that warming temperatures at nesting beaches could have the strongest impacts on sea turtle populations due to reduced nest success and recruitment (Santidrian-Tomillo et al. 2012; Saba et al. 2012). Additionally, increased severity of extreme weather events may create erosion and damage to turtle nest and nesting sites (Goldenberg et al 2011; Wester et al 2005, IPCC 2007), resulting in a further reduction in nest success and recruitment. These potential declines in the success of nesting could have profound effects on the abundance and distribution of sea turtles. Moreover, warming air temperature can also affect the demography of sea turtle populations because the sex ratio of hatchling sea turtles is determined by the temperature during incubation in nesting beaches. Female offspring are produced at warmer temperatures and thus climate change could lead to a lower ratio of males in the population. Changes in water circulation near nesting beaches could affect the early life history stages of sea turtles by transporting passively-drifting hatchlings to waters that may have increased predation rates (Shillinger et al. 2012). Furthermore, prey availability and quality may also be affected by climate change, but these projections are far less certain.

Marine mammals are subject to impacts from global climate change through climate variability, water temperature changes, changes to ocean currents, changes in impact primary productivity and prey species availability. For example, shifts in zooplankton patch formation, which have already been observed, could affect the feeding opportunities and therefore populations of North Atlantic Right Whales (www.neaq.org). Susceptibility to disease, changes in toxicant exposure, and decreased reproductive success with rising ocean temperatures and related climate-ecosystem changes is also of concern (Burek et. al, 2008). Species that migrate to feeding grounds in polar regions (including many baleen whale populations) may be more susceptible to climate change in the near-term since conditions in the polar regions are changing more rapidly than in temperate regions.

Fish are also sensitive to changes in water temperature due to climate change. Changes in water temperature could impact spawning activities of Atlantic sturgeon, including cues for migration and timing of spawning. Foraging behavior of Atlantic sturgeon may also be impacted by changes in water temperature because of changes in food (forage fish) distribution. Changes in salinity in riverine spawning areas could impact spawning activities and survivability of juvenile Atlantic sturgeon who are sensitive to salinity levels. Atlantic salmon are also sensitive to changes in temperature across life stages. Water temperatures can affect growth of juvenile salmon and the final weight of individual salmon if conditions in overwintering grounds are affected.

Given that giant manta rays are migratory and considered ecologically flexible (e.g., low habitat specificity), they may be less vulnerable to the impacts of climate change compared to other sharks and rays (Chin 2010). However, giant manta rays frequently rely on coral reef habitat for important life history functions (e.g., feeding, cleaning), and depend on planktonic food resources for nourishment. As coral reef habitat and planktonic organisms (e.g., zooplankton) are both highly sensitive to environmental changes (Guinder 2013; Brainard 2011), climate change is likely to have an impact on the distribution and behavior of the giant manta ray. Coral reef degradation from anthropogenic causes, particularly climate change, is projected to increase through the future (Miller 2017). There is insufficient information to indicate how, and to what extent, changes in the reef community structure will affect the status of the giant manta ray. The projected increase in coral habitat degradation may potentially lead to a decrease in the abundance of manta ray cleaning fish (e.g., *Labroides* spp., *Thalassoma* spp., and *Chaetodon* spp.), as well as an overall reduction in the number of cleaning stations available to manta rays within these habitats. Decreased access to cleaning stations may negatively impact the fitness of the mantas by hindering their ability to reduce parasitic loads and dead tissue, which in turn, could lead to an increase in diseases and a decline in reproductive fitness and survival.

Changes in climate and oceanographic conditions, such as acidification, are also known to affect zooplankton structure (size, composition, diversity), phenology, and distribution (Guinder 2013). As such, the migration paths and locations of both resident and seasonal aggregations of manta rays, which depend on these animals for food, may similarly be altered (Government 2012; Couturier 2012). It is likely that those manta ray populations that exhibit site-fidelity behavior will be most affected by these changes. As research to understand the exact impacts of climate change on marine phytoplankton and zooplankton communities is still ongoing, the severity of this threat to manta rays has yet to be fully determined.

Historically, the implementation of FMPs has resulted in reductions in fishing effort and as a result, past fishery management actions are thought to have had a slightly positive impact on strategies to protect protected species. Gear entanglement continues to be a source of injury or mortality, resulting in some adverse effects on most protected species to varying degrees. One of the goals of future management measures will be to decrease the number of ESA listed and MMPA protected species interactions with commercial fishing operations. The cumulative result of these actions to meet mortality objectives will be slightly positive for protected resources. The effects from non-fishing actions are expected to be low negative to negative as the potential for localized harm to VECs exists. The combination of these past actions along with future initiatives to reduce protected species interactions when considered with the preferred alternative would not result in significant cumulative impacts.

Physical Environment/Habitat/EFH

When the direct and indirect effects of the preferred alternative are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), *the cumulative effects would likely yield non-significant low negative impacts (related to interaction of mobile bottom tending gear with habitat).*

The management measures described above in the NE Multispecies, Scallop, and Small-Mesh Multispecies FMPs largely have positive effects on habitat due to reduced fishing efforts, consequently reducing gear interaction with habitat. The other FMP actions that reduce fishing effort generally result in fewer habitat and gear interactions, resulting in low positive effects on habitat. The ALTWTRP resulted in low negative to negligible effects on habitat due to the possibility of groundline sweep on the bottom and “ghost gear.” The preferred alternatives would possibly have negligible to low negative effects on habitat because even though effort is not expected to significantly change, gear is still expected to continue to degrade the quality of the habitat with which the fishery already interacts.

The cumulative effect of past, present, and reasonably foreseeable future fishing actions has resulted in low positive effects on habitat. Climate change is expected to impact 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 (NEFSC 2019b) which influences salinity, water column stratification, transport of nutrients, and food web processes. All 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). While the impact analysis in this action is focused on direct and indirect impacts to the physical environment and EFH, there are several non-fishing impacts that must be considered when assessing cumulative impacts. Many of these activities are concentrated near-shore and likely work either additively or synergistically to decrease habitat quality. Other non-fishing factors such as climate change and ocean acidification are also thought to play a role in the degradation of habitat. The effects of these actions, combined with impacts resulting from years of commercial fishing activity, have negatively affected habitat.

The preferred alternatives would likely have low negative impacts on the physical environment and EFH, because of interactions of mobile bottom tending gear with habitat. The preferred alternatives are unlikely to significantly change levels of fishing effort because southern red hake is not typically a targeted stock (Section 6.5). Therefore, when considering the cumulative effects of this action in combination with past, present, and reasonably foreseeable future actions, impacts will remain low negative and no significant impacts to the physical environment, habitat or EFH from the preferred alternatives are expected.

Human Communities

When the direct and indirect effects of the preferred alternative are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), *the cumulative effects would likely yield non-significant low negative impacts in the short term and low positive impacts in the long term on human communities overall.*

The preferred alternatives' management measures designed to reduce the southern red hake possession limit could result in low negative economic impacts to human communities in the short term due to low loss of revenue and a potential increase in southern red hake discards. However, the implementation of a rebuilding plan and year-round possession limits with an AM could increase revenue and positive economic impacts in the long term if the stock rebuilds and management restrictions are potentially loosened. Southern red hake accounts for a minor portion of the total small-mesh multispecies landings and revenue so any changes in fishing effort are not expected to significantly impact human communities (Section 6.6). Overall, the cumulative effects of past, present, and reasonably foreseeable future fishing actions has resulted in low positive effects on human communities.

Despite the potential for negative short-term effects on fishing-related businesses and communities, the expectation is that there would be a positive long-term effect on them due to the long-term sustainability of red, silver, and offshore hake stocks. By providing revenue and contributing to the overall functioning of and employment in coastal communities, the small-mesh multispecies fishery has both direct and indirect social impacts. As previously described, the preferred alternatives are unlikely to result in a substantial change to the level of fishing effort or the character of that effort relative to the current conditions. Through implementation of this action, the Council seeks to achieve the primary objective of the MSA, which is to achieve OY from the managed fisheries.

7.0 APPLICABLE LAWS/EXECUTIVE ORDERS

7.1 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

7.1.1 National Standards

Section 301 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires that regulations implementing any fishery management plan or amendment be consistent with ten national standards. Below is a summary of how this action is consistent with the National Standards and other required provisions of the Magnuson-Stevens Act.

The Council continues to meet the obligations of National Standard 1 by adopting measures designed to end overfishing on the southern red hake stock that was declared overfished in January in 2018. This action adjusts management measures to maximize optimum yield while establishing a rebuilding plan. For overfished fisheries, the Magnuson-Stevens Act defines optimum yield as the amount of fish which provides for rebuilding to a level consistent with producing the maximum sustainable yield from the fishery. The management measures in this action are designed to achieve the fishing mortality rates and yields necessary to rebuild the overfished stock and keep fishing mortality below overfishing levels for the remaining stocks in the whiting fishery that are not in a rebuilding program. The measures in Section 4.2 adjust trip possession limits on southern red hake to ensure that the appropriate fishing mortality rates are implemented.

The Preferred Alternatives are based on Council using the best scientific information available (National Standard 2). Specifically, this action was informed by fisheries-independent data from several surveys, commercial fishery landings data, stock assessments, and other scientific data sources. The rebuilding plan and management measure alternatives are supported by the best available scientific information. The supporting science and analyses, upon which the preferred alternatives are based, are summarized and described in Sections 5.0 and 6.0 of this document.

The Council manages the small-mesh multispecies throughout its range and the preferred alternatives apply to the entire range of the southern red hake stock (National Standard 3). In addition, the small-mesh multispecies fishery management measures are designed and evaluated for their impact on the fishery as a whole.

The preferred alternatives do not discriminate between residents of different states; the measures are intended to be applied equally to small-mesh multispecies permit holders of the same category, regardless of homeport or location (National Standard 4). Although any fishing mortality control (e.g., possession limits) result in the allocation of fishery resources, the measures in the preferred alternatives are reasonably expected to rebuild the overfished southern red hake stock and continue to prevent overfishing of the small-mesh multispecies fishery stocks.

The preferred alternatives are not expected to significantly reduce the efficiency of vessels. These measures are considered practicable since they allow rebuilding of the overfished southern red hake stock and have considered efficiency to the greatest extent possible. The preferred alternatives should promote efficiency in the use of fishery resources through appropriate measures intended to provide access to the small-mesh multispecies fishery for both current and historical participants while minimizing the race to fish in any of the small-mesh multispecies management areas, and they do not have economic allocation as their sole purpose (National Standard 5).

The measures proposed account for variations in the small-mesh multispecies fishery (National Standard 6). The action was developed with input from small-mesh multispecies fisherman and processors and accounts for the market-driven nature of the fishery by updating the TAL consistent with changes in the fishery, allowing flexibility to reach the TAL without exceeding it.

As always, the Council considered the costs and benefits associated with the proposed southern red hake rebuilding plan and changes to the stock's possession limits. Any costs incurred as a result of the management action proposed in this document are necessary to achieve the goals and objectives of the Small-Mesh Multispecies FMP and are viewed to be outweighed by the benefits of taking the management action. Consistent with National Standard 7, the management measures proposed in this document are not duplicative and were developed in close coordination with NMFS and other interested entities and agencies to minimize duplicity.

Consistent with the requirements of the Magnuson-Stevens Act to rebuild overfished stocks and to prevent overfishing, the preferred alternatives may restrict fishing activity through the implementation of year-round possession limits with an AM for the southern red hake stock in order to achieve a rebuilt southern red hake stock (National Standard 8). Analyses of the impacts of these measures show that landings and revenues are likely to slightly decline for some participants in upcoming years due to the rebuilding program in place for the southern red hake stock. In the short term, these slight declines will probably have slightly negative impacts on fishing communities throughout the region, but particularly on those ports that rely heavily on small-mesh multispecies stocks, especially southern red hake; however, they are needed for the long-term sustainability and benefit of these communities.

This action also considers National Standard 9; Section 5.3 of this document has comprehensive information related to bycatch in the small-mesh multispecies fishery. The preferred alternatives are not expected to have any significant impact on bycatch of red, silver, or offshore hakes, or other species.

Finally, this action is consistent with National Standard 10 to promote the safety of human life at sea. The Council has the utmost concern regarding safety and understands how important safety is when considering allocations for the southern red hake ACL. The proposed rebuilding plan and management measures ensure that access to the whiting fishery is provided for vessels of all sizes and gear types.

7.1.2 Other MSA Requirements

This action is also consistent with the fourteen additional required provisions for FMPs. Section 303 (a) of MSA contains required provisions for FMPs.

1. *Contain the conservation and management measures, applicable to foreign fishing …*

   foreign fishing is not allowed under this management plan or this action, so specific measures are not included to specify and control allowable foreign catch.

2. *Contain a description of the fishery …*

   An updated description of the fishery is included in the Annual Monitoring Report for Fishing Year 2018 (NEFMC 2018a).

3. *Assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from the fishery …*

   The preferred alternatives would set a rebuilding plan and alter possession limits that are consistent with sustainable and optimum yield (Section 5.2). The information utilized to make this decision is summarized in the Annual Monitoring Report for Fishing Year 2018. Information related to the small-mesh multispecies stock assessment and biological reference points are summarized in Section 5.2 of this document.

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); etc.*

   Vessels operating in the fishery and those that have been permitted to fish for small-mesh multispecies have the capacity to harvest optimum yield. Existing regulatory restrictions to manage large-mesh multispecies bycatch and limits on domestic and foreign market demand limit catch.

5. *Specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter fishing in the fishery …*

   Data regarding the type and quantity of fishing gear used, catch by species, areas fished, season, sea sampling hauls, and domestic harvesting/processing capacity are updated in the Affected Environment (Section 5.5.3) of this document. Vessels on small-mesh multispecies trips must submit Vessel Trip Reports (VTRs) for each fishing trip. Dealers are also required to submit reports on the purchases of small-mesh multispecies from permitted vessels.

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 …*

   The preferred alternatives do not alter any adjustments made in the Small-Mesh Multispecies FMP that address opportunities for vessels that would otherwise be prevented from harvesting because of weather or other ocean conditions affecting safety aboard fishing vessels. Therefore, consultation with the U.S. Coast Guard was not required relative to this issue. The safety of fishing vessels and life at-sea is a high priority issue for the Council and was considered throughout the development of the management measures proposed in Amendment 12 to this FMP (2000).

7. *Describe and identify essential fish habitat for the fishery …*

   Essential fish habitat has been identified for red, silver, and offshore hakes in the Small-Mesh Multispecies FMP and has been addressed through all subsequent related management actions in a manner consistent with the MSA. Amendment 12 updated the description of the physical environment and EFH (NEFMC 2000) and evaluated the impacts on EFH of the preferred alternatives and other alternatives (Section 5.5). Nothing in this action changes those descriptions and evaluations.

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) assess and specify the nature and extent of scientific data which is needed for effective implementation of the plan;*

   Scientific and research needs are not required for a framework adjustment. Current research needs are identified in Amendment 12 (NEFMC 2000).

9. *Include a fishery impact statement for the plan or amendment*

   Any additional impacts from measures proposed in this action are evaluated in Section 6.0 of this document.

10. *Specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished …*

    The Amendment 19 to the NE Multispecies FMP (NEFMC 2011) established criteria to determine whether the small-mesh multispecies stocks were either in an overfished condition, subject to overfishing, or both. This action does not change those criteria.

11. *Establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery …*

In 2015, NMFS approved a Standardized Bycatch Reporting Methodology (SBRM) amendment submitted by the Councils. This action does not include changes to this amendment. This methodology is expected to assess the amount and type of bycatch in the small-mesh multispecies fishery and help identify ways the fishery can minimize bycatch and mortality of bycatch which cannot be avoided.

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 …*

    Recreational catches are a very small proportion of total catches of red and silver hakes and are almost non-existent for offshore hake. As such, the catches are accounted for within the 5% allowance for management uncertainty but were estimated in the Annual Monitoring Report for Fishing Year 2018 (NEFMC 2018a).

13. *Include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery …*

    Amendment 19 as updated by the SAFE Report (NEFMC 2014) provides a description of the commercial small-mesh multispecies fishery. There is no recreational or charter fishing that targets small-mesh multispecies but red and silver hake are often captured for bait, particularly in the fishery that targets bluefin tuna.

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.*

    The preferred alternatives do not allocate harvest restrictions or stock benefits to the fishery. Such allocations were adopted in Amendment 12 where any vessel may currently enter the fishery by obtaining a Multispecies Category K permit, while this action adjusts management measures for the southern red hake stock within the existing allocation structure.

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 mechanism for establishing annual catch limits was adopted by Amendment 12 (2000). This action uses that mechanism to specify ACLs for future fishing years.

7.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) provides a mechanism for identifying and evaluating the full spectrum of environmental issues associated with federal actions and for considering a reasonable range of alternatives to avoid or minimize adverse environmental impacts. This document is designed to meet the requirements of the MSA and NEPA. The Council on Environmental Quality has issued regulations specifying the requirements for NEPA documents (40 CFR 1500 – 1508), as has NOAA in its policy and procedures for NEPA (NAO 216-6A §5.04b.1). All those requirements are addressed in this action, as described below.

7.2.1 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?

The proposed action is not expected to result in significant impacts on any of the VECs, nor will it result in overall significant effects, either beneficial or adverse. The proposed action establishes a rebuilding plan and adjusts possession limits for southern red hake that are consistent with FMP. This action is expected to have low positive impacts on target species, because it would likely result in a catch level that is substantially below the OFL, and would thus leave a high amount of southern red hake SSB in the water to maintain and potentially expand the stock in future years to a rebuilt status (Section 6.2). Depending on the non-target species, the proposed action is expected to have a low positive effect for non-target species that tend to co-occur with red hake because the stocks are not overfished and overfishing is not occurring. The proposed action could also have a low negative impact on non-target species that are overfished or experiencing overfishing if induced changes increase selectivity to non-target species (Section 6.3). The impacts to protected resources would likely be negligible to low negative because entanglement in some fishing gears for some protected species continues to be a source of mortality; the decrease in southern red hake possession limit would likely not decrease directed fishing effort or interactions with protected species (Section 6.4). The impacts to the physical environment/EFH would likely be low negative because fishing effort would likely be similar to past fishing years and thus, continue to degrade the quality of habitat (Section 6.5). The impacts to human communities would likely be low negative in the short term due to a slight loss in revenue from lower possession limits but could result in a low positive human communities' impact in the long term due to sustainably managing the resource (Section 6.6).

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

The proposed action does not alter the way the industry conducts fishing activities for the target species. Therefore, no changes in fishing behavior are anticipated that would affect safety. The overall effect of the proposed action on these fisheries, including the communities in which they operate, will not 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?

Historic or cultural resources (e.g., shipwrecks) may be present in the area where the small-mesh multispecies fishery occurs. However, vessels try to avoid fishing too close to wrecks due to the possible loss or entanglement of fishing gear. Therefore, it is unlikely that the proposed action would result in substantial impacts to unique areas.

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

The impacts of the proposed action on the human environment are described in Section 6.0. The proposed action primarily establishes a rebuilding plan for and alters the possession limits of southern red hake as part of the small-mesh multispecies fishery. The proposed action is based upon measures contained in the FMP which have been in place for years. In addition, the scientific information upon which the annual quotas are based has been peer-reviewed and is the most recent information available. Therefore, the measures contained in this action are not expected to be highly controversial.

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

The impacts of the proposed action on the human environment are described in Section 6.6. The proposed action establishes a rebuilding plan for and alters the possession limit for the southern red hake stock. The proposed action is not expected to substantially alter fishing methods or activities and is not expected to substantially increase fishing effort or the spatial and/or temporal distribution of current fishing effort. The measures contained in this action are not expected to have highly uncertain, unique, or unknown risks on the human environment.

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 is not likely to establish precedent for future actions with significant effects. The proposed action adopts measures designed to reduce fishing mortality and possession limits for southern red hake to achieve fishing mortality targets for this action and subsequent framework actions. As such, these measures will address a specific problem and are not intended to represent a decision about future management actions that may adopt different measures.

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

The impacts of the proposed action on the biological, physical, and human environment are described in Section 6.0. The cumulative effects of the proposed action presented in Section 6.7 of this document considers the impacts of the proposed action in combination with relevant past, present, and reasonably foreseeable future actions and concludes that no additional significant cumulative impacts are expected from the proposed action.

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?

Although shipwrecks may be 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. Therefore, it is unlikely that the proposed action would adversely affect the historic resources listed above.

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 substantially alter fishing methods or activities. It is not expected to substantially increase fishing effort or substantially modify the spatial and/or temporal distribution of current fishing effort (Section 6.2). Some redistribution of fishing effort may occur, but this redistribution is likely minor in time and space relative to the seasonal distribution of endangered or threatened species and marine mammals. Also, existing measures to protect endangered or threatened species, marine mammals, and critical habitat for these species would continue (Section 6.4.1). Therefore, this action is not expected to be significant or adversely affect endangered or threatened species, marine mammals, or critical habitat in any manner not previously considered.

This action falls within the range of impacts considered in the Batched Fisheries Biological Opinion for the Multispecies Fishery (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, the 2017 memo determined that allowing this fishery 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 listed species above the amount that would otherwise occur if consultation had not been reinitiated, because allowing these fisheries to continue does not entail making any changes to any fishery during the reinitiation period that would cause an increase in interactions with whales, sea turtles, sturgeon, or Atlantic salmon. Because of this, the continuation of the Multispecies fishery during the reinitiation period would not be likely to jeopardize the continued existence of any whale, sea turtle, Atlantic salmon, or sturgeon species." Until replaced, the small-mesh multispecies fishery is currently covered by the October 17, 2017, memo.

As described in Section 5.4.2, the proposed action is not likely to adversely affect any designated critical habitat. Specifically, the small-mesh multispecies fishery will not affect the essential physical and biological features of North Atlantic right whale or loggerhead (Northwest Atlantic Ocean DPS) sea turtle 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?

The proposed action is intended to implement measures that would offer further protection of marine resources and would not threaten a violation of Federal, state, or local law or requirement to protect the environment. The proposed measures have been found to be consistent with other applicable laws as addressed in Section 7 of this document.

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

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 in a manner that would increase interaction rates with marine mammals. Based on this and the information provided in Section 6.4, this action is not expected to adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act.

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

The proposed action cannot reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action. With respect to the target species in the small-mesh multispecies fishery, the proposed action adopts management measures that are consistent with target fishing mortality rates that promote rebuilding and/or sustaining stock sizes. For fishery resources that are caught incidental to the small-mesh multispecies fishing activity, there is no indication in the analyses that the alternatives will threaten sustainability. The fishery does not currently jeopardize non-target species and it is not likely that these alternatives will change that status.

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 cannot reasonably be expected to cause substantial damage to the oceans and coastal habitats and/or essential fish habitat. Analyses described in Section 6.5 indicate that this action is not expected to substantially change fishing methods and behavior and that habitat impacts are similar to those that currently occur in the fishery.

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

The proposed action is not expected to allow substantial damage to vulnerable marine or coastal ecosystems beyond what has been analyzed in previous actions (Section 6.7). This action would likely not change total fishing effort because any southern red hake that would have been landed under the current higher possession limit would be discarded under the dual lower possession limit. Thus, fishing would continue to degrade the quantity and quality of habitat, similar to previous fishing years.

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

The proposed action establishes a rebuilding plan and alters the possession limit for southern red hake. It is not expected to have a substantial impact on biodiversity and ecosystem function within the affected area. The action is not expected to substantially alter fishing methods or activities or fishing effort or the spatial and/or temporal distribution of current fishing effort.

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

This action would not result in the introduction or spread of any non-indigenous species as it would not result in any vessel activity outside of the Northeast region. Fishing effort is not expected to change under this action because any southern red hake that would have been landed under the current higher possession limit would be discarded under the lower possession limit. No nonindigenous species would be used or transported during fishing activities. Therefore, the proposed action would likely not result in the introduction or spread of a non-indigenous species.

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for Framework 62 of the Small-Mesh Multispecies Fishery Management Plan, it is hereby determined that the proposed actions 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.

____________________________________ __________________

Regional Administrator, Greater Atlantic Region, NMFS Date

7.2.2 Environmental Assessment

The required elements of an Environmental Assessment (EA) are specified in 40 CFR 1508.9(b). They are included in this document as follows:

- The need for this action is in Section 3.0;
- The alternatives that were considered are in Section 4.0;
- The environmental impacts of the proposed action are in Section 6.0;
- A determination of significance is in Section 7.2.1; and,
- The agencies and persons consulted on this action are in Sections 7.2.4.

While not required for the preparation of an EA, this document includes the following additional sections that are based on requirements for an Environmental Impact Statement (EIS).

- An executive summary is in Section 1.0;
- A table of contents is in Section 2.0;
- Background and purpose are in Section 3.0;
- A summary of the document is in the executive summary, Section 1.0;
- A brief description of the affected environment is in Section 5.0;
- Cumulative impacts of the proposed action are in Section 6.7;
- A list of preparers is in Section 7.2.5.

7.2.3 Point of Contact

Questions concerning this document may be addressed to:

Mr. Thomas A. Nies, Executive Director
New England Fishery Management Council
50 Water Street, Mill 2
Newburyport, MA 01950 (978) 465-0492

7.2.4 Agencies Consulted

The following agencies were consulted in preparing this document:

- New England Fishery Management Council,
- National Marine Fisheries Service, NOAA, Department of Commerce

7.2.5 List of Preparers

The following personnel participated in preparing this document:

- ***New England Fishery Management Council***. Andrew Applegate (Whiting Plan Coordinator), Jenny Couture, Naresh Pradhan, Michelle Bachman, Rachel Feeney, Woneta Cloutier, Chris Kellogg, Thomas Nies
- ***National Marine Fisheries Service*.** Larry Alade, Ashleigh McCord, Shannah Jaburek
- ***State agencies*.** Rebecca Peters (ME DMR), Nicole Lengyel (RI DEM)

7.2.6 Opportunity for Public Comment

This action was developed from 2019-2020, and there were 14 public meetings related to this action (Table 64). Opportunities for public comment occurred at Advisory Panel, Committee, and Council meetings. There were more limited opportunities to comment at PDT meetings. Meeting discussion documents and summaries are available at www.nefmc.org.

Table 64. Public meetings related to Framework 62.

Date	Meeting Type	Location
09/26/2019	Initial Framework Adjustment Meeting	Gloucester, MA
11/19/2019	Whiting PDT Conference Call	Conference call
12/05/2019	Council meeting	Newport, RI
01/09/2020	Whiting PDT Conference Call	Conference call
01/15/2020	Whiting PDT Conference Call	Conference call
01/27/2020	Joint Whiting Committee and Advisory Panel meeting	Portsmouth, NH
01/30/2020	Council meeting	Portsmouth, NH
03/03/2020	Whiting PDT Conference Call	Conference call
04/07/2020	Whiting PDT Conference Call	Webinar
04/14/2020	Council meeting	Webinar
05/11/2020	Whiting PDT Conference Call	Webinar
06/01/2020	Whiting PDT Conference Call	Webinar
06/04/2020	Joint Whiting Committee and Advisory Panel meeting	Webinar
06/25/2020	Council meeting	Webinar

7.3 Marine Mammal Protection Act (MMPA)

Section 6.4.1 contains an assessment of the impacts of the proposed action on marine mammals. The New England Fishery Management Council has reviewed the impacts of the proposed southern red hake rebuilding plan on marine mammals and has concluded that the management actions proposed are consistent with the provisions of the MMPA. Although the proposed actions may impact marine mammals occurring in the management unit of the small-mesh multispecies fishery, the specifications will not alter the effectiveness of existing MMPA measures to protect those species, and based on the overall reductions in fishing effort in the Small-Mesh Multispecies FMP, this action is not expected to affect marine mammals in any manner not considered in previous consultations on this fishery. A final determination of consistency with the MMPA will be made by the agency when this action is approved.

7.4 Endangered Species Act (ESA)

The small-mesh multispecies fishery, a component of the Northeast Multispecies FMP, was considered in the batched fisheries Opinion (Opinion) issued by NMFS on December 16, 2013. The Opinion concluded that the actions considered would not jeopardize the continued existence of any ESA-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 memorandum, 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 the analysis of the proposed action into consideration, the proposed action, in conjunction with other activities, is not expected to result in jeopardy for 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 MSA 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.

7.5 Administrative Procedure Act (APA)

Sections 551-553 of the Administrative Procedure Act established procedural requirements applicable to informal rulemaking by federal agencies. The purpose is to ensure public access to the federal rulemaking process, and to give public notice and opportunity for comment. The Council did not request relief from notice and comment rule making for this action and expects that NOAA Fisheries will publish proposed and final rule making for this action.

7.6 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to minimize paperwork burden for individuals, small businesses, nonprofit institutions, and other persons resulting from the collection of information by or for the Federal Government. It also ensures that the Government is not overly burdening the public with information requests. This action does not propose to modify any existing collections, or to add any new collections; therefore, no review under the Paperwork Reduction Act is necessary.

7.7 Coastal Zone Management Act (CZMA)

Section 307 of the Coastal Zone Management Act (CZMA) is known as the federal consistency provision. Federal Consistency review requires that "federal actions, occurring inside or outside of a state's coastal zone, that have a reasonable potential to affect the coastal resources or uses of that state's coastal zone, to be consistent with that state's enforceable coastal policies, to the maximum extent practicable." The Council previously made determinations that the FMP was consistent with each state's coastal zone management plan and policies, and each coastal state concurred in these consistency determinations (in the Small-Mesh Multispecies FMP). Since the proposed action does not propose any substantive changes from the FMP, the Council has determined that this action is consistent with the coastal zone management plan and policies of the coastal states in this region. Once the Council has adopted final measures and submitted Framework 62 to NMFS, NMFS will request consistency reviews by CZM state agencies directly.

7.8 Information Quality Act (IQA)

Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554, also known as the Data Quality Act or Information Quality Act) directed the Office of Management and Budget (OMB) to issue government-wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies." OMB directed each federal agency to issue its own guidelines, establish administrative mechanisms allowing affected persons to seek and obtain correction of information that does not comply with the OMB guidelines, and report periodically to OMB on the number and nature of complaints. The NOAA Section 515 Information Quality Guidelines require a series of actions for each new information product subject to the Data Quality Act. Information must meet standards of utility, integrity and objectivity. This section provides information required to address these requirements.

Utility of Information Product

Framework 62 and the proposed southern red hake rebuilding plan and management measures include: a description of the management issues to be addressed, statement of goals and objectives, a description of the proposed action and other alternatives/options considered, analyses of the impacts of the proposed specifications and other alternatives/options on the affected environment, and the reasons for selecting the preferred specifications. These proposed modifications implement the FMP's conservation and management goals consistent with the Magnuson-Stevens Fishery Conservation and Management Act as well as all other existing applicable laws.

Utility means that disseminated information is useful to its intended users. "Useful" means that the content of the information is helpful, beneficial, or serviceable to its intended users, or that the information supports the usefulness of other disseminated information by making it more accessible or easier to read, see, understand, obtain or use. The information presented in this document is 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. The intended users of the information contained in this document are participants in the small-mesh multispecies fishery and other interested parties and members of the general public. The information contained in this document may be useful to owners of vessels holding a small-mesh multispecies permit as well as small-mesh multispecies dealers and processors since it serves to notify these individuals of any potential changes to management measures for the fishery. This information will enable these individuals to adjust their fishing practices and make appropriate business decisions based on the new management measures and corresponding regulations.

Until a proposed rule is prepared and published, this document is the principal means by which the information herein is publicly available. The information provided in this document is based on the most recent available information from the relevant data sources, including detailed and relatively recent information on the whiting resource and, therefore, represents an improvement over previously available information. This document will be subject to public comment through proposed rulemaking, as required under the Administrative Procedure Act and, therefore, may be improved based on comments received.

This document is available in several formats, including printed publication, and online through the NEFMC's web page (www.nefmc.org). 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 (www.greateratlantic.fisheries.noaa.gov), and through the Regulations.gov website. The Federal Register documents will provide metric conversions for all measurements.

Integrity of Information Product

Integrity refers to security – the protection of information from unauthorized access or revision, to ensure that the information is not compromised through corruption or falsification. 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 NMFS 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 of Information Product

Objective information is presented in an accurate, clear, complete, and unbiased manner, and in proper context. The substance of the information is accurate, reliable, and unbiased; in the scientific, financial, or statistical context, original and supporting data are generated and the analytical results are developed using sound, commonly accepted scientific and research methods. "Accurate" means that information is within an acceptable degree of imprecision or error appropriate to the kind of information at issue and otherwise meets commonly accepted scientific, financial, and statistical standards.

For purposes of the Pre-Dissemination Review, this document is a "Natural Resource Plan." Accordingly, the document adheres to the published standards of the MSA; the Operational Guidelines, Fishery Management Plan Process; the Essential Fish Habitat Guidelines; the National Standard Guidelines; and NOAA Administrative Order 216-6, Environmental Review Procedures for Implementing NEPA. This information product uses information of known quality from sources acceptable to the relevant scientific and technical communities. Several data sources were used in the development of this action, including, but not limited to, historical and current landings data from the Commercial Dealer database, vessel trip report (VTR) data, and fisheries independent data collected through the NMFS bottom trawl surveys. The analyses herein were prepared using data from accepted sources and have been reviewed by members of the Small-Mesh Multispecies Plan Development Team and by the SSC where appropriate.

Despite current data limitations, the conservation and management measures considered for this action were selected based upon the best scientific information available. The analyses important to this decision used information from the most recent complete calendar years, generally through 2018. The data used in the analyses provide the best available information on the number of permits, both active and inactive, in the fishery, the catch (including landings and discards) by those vessels, the landings per unit of effort (LPUE), and the revenue produced by the sale of those landings to dealers, as well as data about catch, bycatch, gear, and fishing effort from a subset of trips sampled at sea by government observers. Specialists (including professional members of PDTs, 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 the small-mesh multispecies fishery. The proposed action is supported by the best available scientific information. The policy choice is clearly articulated in Section 4.0, the management alternatives considered in this action.

The supporting science and analyses, upon which the policy choice was based, are summarized and described in the Annual Fishing Monitoring Report for Fishing Year 2018 and Section 6.0 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 involves the responsible Council, the NEFSC, GARFO, and NOAA Fisheries Service Headquarters. The NEFSC's technical review is conducted by senior-level scientists specializing in population dynamics, stock assessment, population biology, and social science.

The Council review process involves public meetings at which affected stakeholders have opportunity to comment on the document. Review by staff at GARFO is conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. The Council also uses its SSC to review the background science and assessment to approve the Overfishing Limits (OFLs) and Allocable Biological Catch (ABCs), including the effects those limits would have on other specifications in this document. The SSC is the primary scientific and technical advisory body to the Council and is made up of scientists that are independent of the Council. A list of current committee members can be found at https://www.nefmc.org/committees/scientific-and-statistical-committee.

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 Service Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget. In preparing this action for the Small-Mesh Multispecies FMP, NMFS, the Administrative Procedure Act, the Paperwork Reduction Act, the Coastal Zone Management Act, the Endangered Species Act, the Marine Mammal Protection Act, the Information Quality Act, and Executive Orders 12630 (Property Rights), 12866 (Regulatory Planning), 13132 (Federalism), and 13158 (Marine Protected Areas). The Council has determined that the proposed action is consistent with the National Standards of the MSA and all other applicable laws.

7.9 Executive Order 13158 (Marine Protected Areas)

Executive Order (EO) 13158 on Marine Protected Areas (MPAs) requires each federal agency whose actions affect the natural or cultural resources that are protected by an MPA to identify such actions, and, to the extent permitted by law and to the maximum extent practicable, in taking such actions, avoid harm to the natural and cultural resources that are protected by an MPA. The EO directs federal agencies to refer to the MPAs identified in a list of MPAs that meet the definition of MPA for the purposes of the EO. The EO requires that the Departments of Commerce and the Interior jointly publish and maintain such a list of MPAs. A list of MPA sites has been developed and is available at: http://marineprotectedareas.noaa.gov/nationalsystem/nationalsystemlist/. No further guidance related to this EO is available at this time.

7.10 Executive Order 13132 (Federalism)

Executive Order 131321 on federalism established nine fundamental federalism principles for Federal agencies to follow when developing and implementing actions with federalism implications. However, no federalism issues or implications have been identified relative to the measures proposed in this action, thus preparation of an assessment under EO 13132 is unwarranted. The affected states have been closely involved in the development of the proposed action 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.

7.11 Executive Order 12898 (Environmental Justice)

Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations provides guidelines to ensure that potential impacts on these populations are identified and mitigated, and that these populations can participate effectively in the NEPA process (EO 12898 1994). The NOAA NAO 216-6, at Section 7.02, states that "consideration of E.O. 12898 should be specifically included in the NEPA documents for decision-making purposes." Agencies should also encourage public participation, especially by affected communities, during scoping, as part of a broader strategy to address environmental justice issues. Minority and low-income individuals or populations must not be excluded from participation in, denied the benefits of, or subjected to discrimination because of their race, color, or national origin.

Although the impacts of this action may affect communities with environmental justice concerns, the proposed actions should not have disproportionately high effects on low income or minority populations. The proposed actions would apply to all participants in the affected area, regardless of minority status or income level. The existing demographic data on participants in the small-mesh multispecies fishery (i.e., vessel owners, crew, dealers, processors, employees of supporting industries) do not allow identification of those who live below the poverty level or are racial or ethnic minorities. Thus, it is impossible to fully determine how the actions within this specification document may impact these population segments. The public comment process is an opportunity to identify issues that may be related to environmental justice, but none have been raised relative to this action. The public has never requested translations of documents pertinent to the small-mesh multispecies fishery.

For the top port communities relevant to this action (Section 5.6, Table 39), poverty and minority rate data at the state and county levels are in Table 65. Generally, their minority population rates are below those of all states' averages. Only Essex and Suffolk counties in Massachusetts have minority rates higher than the states' averages. Similarly, counties important for small-mesh multispecies fishing have poverty rates generally lower than the state averages. Bristol and Suffolk counties in Massachusetts have poverty rates higher than the state average.

With respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence. GARFO tracks these issues, but there are no federally recognized tribal agreements for subsistence fishing in federal waters off New England.

Table 65. Demographic Data for Small-Mesh Multispecies Fishing Communities (counties).

State/County	Minority Rate[a]	Poverty Rate[b]
New Hampshire	7.8%	7.8%
Rockingham	6.0%	4.7%
Massachusetts	23.6%	10.5%
Barnstable	8.6%	7.5%
Bristol	13.5%	11.3%
Essex	24.3%	10.1%
Suffolk	38.5%	17.5%
Rhode Island	23.5%	12.2%
Washington	7.9%	7.4%
Connecticut	20.0%	10.4%
New London	16.4%	9.8%
New York	30.3%	13.6%
Suffolk	15.6%	7.3%

Source: U.S. Census Bureau, 2010, http://quickfacts.census.gov/qfd/states.html
[a] Persons other than those who report as White persons not Hispanic.
[b] Persons below poverty level, 2006-2010.

7.12 Regulatory Flexibility Act (RFA)

The purpose of the Regulatory Flexibility Act (RFA) is to reduce the impacts of burdensome regulations and recordkeeping requirements on small businesses. To achieve this goal, the RFA requires Federal agencies to describe and analyze the effects of proposed regulations, and possible alternatives, on small business entities. To this end, this document contains an RFA, found below, which includes an assessment of the effects that the Proposed Action and other alternatives are expected to have on small entities.

Under Section 603(b) of the RFA, an RFA must describe the impact of the proposed rule on small entities and contain the following information:

1. A description of the reasons why the action by the agency is being considered.
2. A succinct statement of the objectives of, and legal basis for, the proposed rule.
3. A description—and, where feasible, an estimate of the number—of small entities to which the proposed rule will apply.
4. A description of the projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the types of professional skills necessary for preparation of the report or record.
5. An identification, to the extent practicable, of all relevant federal rules that may duplicate, overlap, or conflict with the proposed rule.

7.12.1 Reasons for Considering the Action

The purpose and need for this action are presented in Section 3.0 of this framework.

7.12.2 Objectives and Legal Basis for the Action

The objectives for this action are presented in Section 3.4 of this framework, and the legal basis is in Section 7.0.

7.12.3 Description and Estimate of Small Entities to Which the Rule Applies

For RFA purposes only, NMFS has established a small business size standard for businesses, including their affiliates, whose primary industry is commercial fishing (see 50 CFR § 200.2). A business primarily engaged in commercial fishing (NAICS code 11411) is classified as a small business if it is independently owned and operated, is not dominant in its field of operation (including its affiliates), and has combined annual receipts not in excess of $11 million for all its affiliated operations worldwide.

This rule would affect all permitted small-mesh multispecies vessels; therefore, the direct regulated entity is a firm that owns at least one small-mesh multispecies permit (either an open access or limited access NE multispecies permit). These businesses catch a small fraction of small-mesh multispecies; furthermore, they are minimally affected by the proposed action (Section 6.6).

To estimate the number of commercial entities that may experience impacts from the proposed action, active small-mesh multispecies entities landing southern red hake are defined as those entities containing permits that are directly regulated and that landed southern red hake in 2018 for commercial sale. In 2018, there were 168 business entities landing southern red hake, of which 167 were small business entities that could potentially be affected by the proposed action. However, the proposed action would affect only about 50 small business entities (Table 66). Small entities derived on average about 0.33% of total entity revenue from red hake.

Since the economic impact of the proposed action is negligible negative impact or not shown to have a significant impact on a substantial number of small, regulated entities, the RFA allows Federal agencies to certify the proposed action to that effect to the Small Business Association (SBA). The decision on whether to certify is generally made after the final decision on the preferred alternatives for the action and may be documented at either the proposed rule or the final rule stage.

Table 66. Total number of potentially impacted, directly regulated entities landing southern red hake and number classified as small business entities.

Description	Business Size	Data Year	No. of entities	Average income from commercial fishing per entity	Average revenue from red hake	Percent entity revenue from red hake
Potential Entities (All vessels landing southern red hake)	Large	2018	1	$24,906,797	$83	0.00033%
	Small	2018	167	$550,246	$1,783	0.32%
Affected entities (in preferred alternative)	Small	2018	50	$909,963	$5,182	0.57%

7.12.4 Record Keeping and Reporting Requirements

There are no additional record keeping or reporting requirements associated with this action.

7.12.5 Duplication, Overlap, or Conflict with Other Federal Rules

No relevant Federal rules have been identified that would duplicate or overplay the proposed rule.

7.12.6 Summary of the Proposed Action and Significant Alternatives

During the development of FW62, NMFS and the Council considered ways to reduce the regulatory burden on and provide flexibility to the regulated community. The measures implemented by the FW62 would increase the long-term economic benefits on small entities. The proposed action would establish a rebuilding plan and management measures for the southern red hake stock. More specifically, the action would create a lower, tiered year-round trip possession limit based on gear selectivity for southern red hake with the in-season accountability measure remaining in place.

Overall, FW62 would ensure that catch levels are sustainable and contribute to rebuilding southern red hake stock, and therefore, maximize yield.

The low negative economic loss to small entities from this action are associated with the small decrease in southern red hake possession limit. The preferred alternatives will result in a slight loss in revenue from a slight decrease in southern red hake landings compared to No Action, which would keep the southern red hake possession limit at 5,000 lb. (Section 1). The magnitude in economic loss is low because the stock is not typically targeted.

7.13 Executive Order 12866 (Regulatory Planning and Review)

The purpose of E.O 12866 is to enhance planning and coordination with respect to new and existing regulations. This E.O. requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be “significant.” E.O. 12866 requires a review of proposed regulations to determine whether the expected effects would be significant, where a significant action is any regulatory action that may:

- *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;*
- *Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;*
- *Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or*
- *Raise novel legal or policy issues arising out of legal mandates, the President’s priorities, of the principles set forth in the Executive Order.*

In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, include the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider.

7.13.1 Statement of the Problem/Goals and Objectives

Problem, goals, and objectives are explained in Section 3.2 and 3.4.

7.13.2 Management Alternatives and Rationale

The alternatives under consideration in this Framework are explained in Section 4.0.

7.13.3 Description of the Fishery

A description of the fishery is available in Section 3.0.

7.13.4 Summary of Impacts

The expected effects of each specifications alternative relative to no action for the small-mesh multispecies fishery are discussed throughout Section 6.0 of this document.

7.13.5 Determination of Significance

Based on the analyses provided in this document, Framework 62 is not expected to constitute a "significant regulatory action." This action is not expected to have an impact of $100M or more on the economy, 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. It also, does not raise novel legal and policy issues and does not interfere with an action taken or planned by another agency. Finally, it does not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients.

8.0 GLOSSARY

Area based management – In contrast to resource wide allocations of TAC or days, vessels would receive authorization to fish in specific areas, consistent with that area's status, productivity, and environmental characteristics. Area based management does not have to rotate closures to be effective.

ABC – "Acceptable biological catch" means a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL.

ACL – "Annual catch limit" is the level of annual catch of a stock or stock complex that serves as the basis for invoking accountability measures (AMs).

Adult stage – One of several marked phases or periods in the development and growth of many animals. In vertebrates, the life history stage where the animal is capable of reproducing, as opposed to the juvenile stage.

Adverse effect – Any impact that reduces quality and/or quantity of EFH. May include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include sites-specific of habitat wide impacts, including individual, cumulative, or synergistic consequences of actions.

Aggregation – A group of animals or plants occurring together in a particular location or region.

AMs – "Accountability measures" are management controls that prevents ACLs or sector ACLs from being exceeded, where possible, and correct or mitigate overages if they occur.

Amendment – a formal change to a fishery management plan (FMP). The Council prepares amendments and submits them to the Secretary of Commerce for review and approval. The Council may also change FMPs through a "framework adjustment procedure".

Availability – refers to the distribution of fish of different ages or sizes relative to that taken in the fishery.

Benthic community – Benthic means the bottom habitat of the ocean and can mean anything as shallow as a salt marsh or the intertidal zone, to areas of the bottom that are several miles deep in the ocean. Benthic community refers to those organisms that live in and on the bottom.

Biological Reference Points – specific values for the variables that describe the state of a fishery system which are used to evaluate its status. Reference points are most often specified in terms of fishing mortality rate and/or spawning stock biomass.

Biomass – The total mass of living matter in a given unit area or the weight of a fish stock or portion thereof. Biomass can be listed for beginning of year (Jan-1), Mid-Year, or mean (average during the entire year). In addition, biomass can be listed by age group (numbers at age * average weight at age) or summarized by groupings (e.g., age 1+, ages 4+ 5, etc.). See also spawning stock biomass, exploitable biomass, and mean biomass.

Biota – All the plant and animal life of a particular region.

Bivalve – A class of mollusks having a soft body with plate like gills enclosed within two shells hinged together; e.g., clams, mussels.

Bottom tending mobile gear – All fishing gear that operates on or near the ocean bottom that is actively worked in order to capture fish or other marine species. Some examples of bottom tending mobile gear are otter trawls and dredges.

Bottom tending static gear – All fishing gear that operates on or near the ocean bottom that is not actively worked; instead, the effectiveness of this gear depends on species moving to the gear which is set in a particular manner by a vessel, and later retrieved. Some examples of bottom tending static gear are gillnets, traps, and pots.

B_{MSY} – the stock biomass that would produce maximum sustainable yield (MSY) when fished at a level equal to F_{MSY}. For most stocks, B_{MSY} is about ½ of the carrying capacity.

Bycatch(v.) the capture of non-target species in directed fisheries which occurs because fishing gear and methods are not selective enough to catch only target species; (n.) fish which are harvested in a fishery but are not sold or kept for personal use, including economic discards and regulatory discards but not fish released alive under a recreational catch and release fishery management species in directed fisheries which occurs because fishing gear and methods are not selective enough to catch only target species; (n.) fish which are harvested in a fishery but are not sold or kept for personal use, including economic discards and regulatory discards but not fish released alive under a recreational catch and release fishery management program. Target species in directed fisheries which occurs because fishing gear and methods are not selective enough to catch only target species; (n.) fish which are harvested in a fishery but are not sold or kept for personal use, including economic discards and regulatory discards but not fish released alive under a recreational catch and release fishery management program.

Capacity – the level of output a fishing fleet is able to produce given specified conditions and constraints. Maximum fishing capacity results when all fishing capital is applied over the maximum amount of available (or permitted) fishing time, assuming that all variable inputs are utilized efficiently.

Catch – The sum total of fish killed in a fishery in a given period. Catch is given in either weight or number of fish and may include landings, unreported landings, discards, and incidental deaths.

Coarse sediment – Sediment generally of the sand and gravel classes; not sediment composed primarily of mud; but the meaning depends on the context, e.g. within the mud class, silt is coarser than clay.

Continental shelf waters – The waters overlying the continental shelf, which extends seaward from the shoreline and deepens gradually to the point where the sea floor begins a slightly steeper descent to the deep ocean floor; the depth of the shelf edge varies, but is approximately 200 meters in many regions.

Council – New England Fishery Management Council (NEFMC).

CPUE – Catch per unit effort. This measure includes landings and discards (live and dead), often expressed per hour of fishing time, per day fished, or per day-at-sea.

DAS – A day-at-sea is an allocation of time that a vessel may be at-sea on a fishing trip. For vessels with VMS equipment, it is the cumulative time that a vessel is seaward of the VMS demarcation line. For vessels without VMS equipment, it is the cumulative time between when a fisherman calls in to leave port to the time that the fisherman calls in to report that the vessel has returned to port.

Demersal species – Most often refers to fish that live on or near the ocean bottom. They are often called benthic fish, groundfish, or bottom fish.

Discards – animals returned to sea after being caught; see Bycatch (n.)

Environmental Assessment (EA) – an analysis of the expected impacts of a fishery management plan (or some other proposed federal action) on the environment and on people, initially prepared as a "Draft" (DEA) for public comment. The Final EA is referred to as the Final Environmental Assessment (FEA).

Essential Fish Habitat– Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH designation for most managed species in this region is based on a legal text definition and geographical area that are described in the Habitat Omnibus Amendment (1998). Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH designation for most managed species in this region is based on a legal text definition and geographical area that are described in the Habitat Omnibus Amendment (1998) maturity. The EFH designation for most managed species in this region is based on a legal text definition and geographical area that are described in the Habitat Omnibus Amendment (1998).

Exclusive Economic Zone – for the purposes of the Magnuson-Stevens Fishery Conservation and Management Act, the area from the seaward boundary of each of the coastal states to 200 nautical miles from the baseline.

Exempted fisheries – Any fishery determined by the Regional Director to have less than 5 percent regulated species as a bycatch (by weight) of total catch according to 50 CFR 648.80(a)(7).

Exploitation Rate – the percentage of catchable fish killed by fishing every year. If a fish stock has 1,000,000 fish large enough to be caught by fishing gear and 550,000 are killed by fishing during the year, the annual exploitation rate is 55%.

Fathom – A measure of length, containing six feet; the space to which a man can extend his arms; used chiefly in measuring cables, cordage, and the depth of navigable water by soundings.

Final preferred alternative – The management alternative chosen by the Council in the final amendment, submitted to the Secretary of Commerce for approval and if approved publication as a proposed rule.

Fishing effort – the amount of time and fishing power used to harvest fish. Fishing power is a function of gear size, boat size and horsepower.

Fishing Mortality (F) – (see also exploitation rate) a measurement of the rate of removal of fish from a population by fishing. F is that rate at which fish are harvested at any given point in time. ("Exploitation rate" is an annual rate of removal, "F" is an instantaneous rate.)

F_{MSY} – a fishing mortality rate that would produce the maximum sustainable yield from a stock when the stock biomass is at a level capable of producing MSY on a continuing basis.

FMAX – the fishing mortality rate that produces the maximum level of yield per recruit. This is the point beyond which growth overfishing begins.

FMP (Fishery Management Plan) – a document that describes a fishery and establishes measures to manage it. This document forms the basis for federal regulations for fisheries managed under the regional Fishery Management Councils. The New England Fishery Management Council prepares FMPs and submits them to the Secretary of Commerce for approval and implementation.

Framework adjustments: adjustments within a range of measures previously specified in a fishery management plan (FMP). A change usually can be made more quickly and easily by a framework adjustment than through an amendment. For plans developed by the New England Council, the procedure requires at least two Council meetings including at least one public hearing and an evaluation of environmental impacts not already analyzed as part of the FMP.

$F_{threshold}$ – 1) The maximum fishing mortality rate allowed on a stock and used to define overfishing for status determination. 2) The maximum fishing mortality rate allowed for a given biomass as defined by a control rule.

Growth Overfishing – the situation existing when the rate of fishing mortality is above FMAX and then the loss in fish weight due to mortality exceeds the gain in fish weight due to growth.

Individual Fishing Quota (IFQ) – A Federal permit under a limited access system to harvest a quantity of fish, expressed by a unit or units representing a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by an individual person or entity

Landings – The portion of the catch that is harvested for personal use or sold.

Larvae (or Larval) stage – One of several marked phases or periods in the development and growth of many animals. The first stage of development after hatching from the egg for many fish and invertebrates. This life stage looks fundamentally different than the juvenile and adult stages and is incapable of reproduction; it must undergo metamorphosis into the juvenile or adult shape or form.

Limited Access – a management system that limits the number of participants in a fishery. Usually, qualification for this system is based on historic participation, and the participants remain constant over time (with the exception of attrition).

Limited-access permit – A permit issued to vessels that met certain qualification criteria by a specified date (the "control date").

LPUE – Landings per unit effort. This measure is the same as CPUE but excludes discards.

Maximum Sustainable Yield (MSY) – the largest average catch that can be taken from a stock under existing environmental conditions.

Mesh selectivity (ogive) – A mathematical model used to describe the selectivity of a mesh size (proportion of fish at a specific length retained by mesh) for the entire population. L25 is the length where 25% of the fish encountered are retained by the mesh. L50 is the length where 50% of the fish encountered are retained by the mesh.

Meter – A measure of length, equal to 39.37 English inches, the standard of linear measure in the metric system of weights and measures. It was intended to be, and is very nearly, the ten millionth part of the distance from the equator to the north pole, as ascertained by actual measurement of an arc of a meridian.

Metric ton – A unit of weight equal to a thousand kilograms (1kgs = 2.2 lb.). A metric ton is equivalent to 2,204.6 lb. A thousand metric tons is equivalent to 2.204 million lb.

Minimum Biomass Level – the minimum stock size (or biomass) below which there is a significantly lower chance that the stock will produce enough new fish to sustain itself over the long-term.

Mortality – Noun, either referring to fishing mortality (F) or total mortality (Z).

Multispecies – the group of species managed under the Northeast Multispecies Fishery Management Plan. This group includes whiting, red hake and ocean pout plus the regulated species (cod, winter flounder, witch flounder, American plaice, winter flounder, witch flounder, American plaice, windowpane flounder, white hake and redfish).

Natural Mortality (M) – a measurement of the rate of fish deaths from all causes other than fishing such as predation, cannibalism, disease, starvation, and pollution; the rate of natural mortality may vary from species to species.

Non-preferred alternative - All alternatives in the final amendment that were not chosen as a “final preferred alternative” are by definition non-preferred alternatives.

Northeast Shelf Ecosystem – The Northeast U.S. Shelf Ecosystem has been described as including the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream.

Northern stock area – for red and silver hake, fish are assumed to be in the southern stock area when the catches originate from fishing in statistical areas 464 to 515, or area 561. See map at http://www.nero.noaa.gov/nero/fishermen/charts/stat1.html.

Observer – Any person required or authorized to be carried on a vessel for conservation and management purposes by regulations or permits under this Act

OFL – "Overfishing limit" means the annual amount of catch that corresponds to the estimate of the maximum fishing mortality threshold applied to a stock or stock complex's abundance and is expressed in terms of numbers or weight of fish.

Open access – Describes a fishery or permit for which there is no qualification criteria to participate. Open-access permits may be issued with restrictions on fishing (for example, the type of gear that may be used or the amount of fish that may be caught).

Optimum Yield (OY) – 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.

Overfished – A conditioned defined when stock biomass is below minimum biomass threshold and the probability of successful spawning production is low.

Overfishing – A level or rate of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to produce MSY on a continuing basis.

PDT (Plan Development Team) – a group of technical experts responsible for developing and analyzing management measures under the direction of the Council; the Council has a Whiting PDT that meets to discuss the development of this FMP.

Preferred alternative – An alternative that was favored by the Council in the draft amendment document and DEA based on analysis available at that time and based on input from the Whiting Advisory Panel.

Proposed Rule – a federal regulation is often published in the Federal Register as a proposed rule with a time period for public comment. After the comment period closes, the proposed regulation may be changed or withdrawn before it is published as a final rule, along with its date of implementation and response to comments.

Rebuilding Plan – a plan designed to increase stock biomass to the BMSY level within no more than ten years (or 10 years plus one mean generation period) when a stock has been declared overfished.

Recruitment overfishing – fishing at an exploitation rate that reduces the population biomass to a point where recruitment is substantially reduced.

Recruitment – the amount of fish added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to fishing gear in one year would be the recruitment to the fishery. "Recruitment" also refers to new year classes entering the population (prior to recruiting to the fishery).

Regulated groundfish species – cod, winter flounder, witch flounder, American plaice, winter flounder, witch flounder, American plaice, windowpane flounder, white hake and redfish. These species are usually targeted with large-mesh net gear.

Relative exploitation – an index of exploitation derived by dividing landings by trawl survey biomass. This variable does not provide an estimate of the proportion of removals from the stock due to fishing but allows for general statements about trends in exploitation.

Sediment – Material deposited by water, wind, or glaciers.

Small-mesh multispecies – red hake, silver hake, and offshore hake

Small-mesh trawls – specified trawls that are exempt from large-mesh fishery regulations pertaining to trawl with cod end mesh greater than 5.5- or 6-inches square or diamond.

Southern stock area – for red and silver hake, fish are assumed to be in the southern stock area when the catches originate from fishing in statistical areas 521 to 543, area 562, or areas 611 to 639. See map at http://www.nero.noaa.gov/nero/fishermen/charts/stat1.html.

Spawning stock biomass (SSB) – the total weight of fish in a stock that sexually mature, i.e., are old enough to reproduce.

Status Determination Criteria – objective and measurable criteria used to determine if overfishing is occurring or if a stock is in an overfished condition according to the National Standard Guidelines.

Stock assessment – An analysis for determining the number (abundance/biomass) and status (life-history characteristics, including age distribution, natural mortality rate, age at maturity, fecundity as a function of age) of individuals in a stock

Stock – A grouping of fish usually based on genetic relationship, geographic distribution, and movement patterns. A region may have more than one stock of a species (for example, Gulf of Maine cod and Georges Bank cod). A species, subspecies, geographical grouping, or other category of fish capable of management as a unit.

Surplus production models – A family of analytical models used to describe stock dynamics based on catch in weight and CPUE time series (fishery dependent or survey) to construct stock biomass history. These models do not require catch at age information. Model outputs may include trends in stock biomass, biomass weighted fishing mortality rates, MSY, F_{MSY}, B_{MSY}, K, (maximum population biomass where stock growth and natural deaths are balanced) and r (intrinsic rate of increase).

Surplus production – Production of new stock biomass defined by recruitment plus somatic growth minus biomass loss due to natural deaths. The rate of surplus production is directly proportional to stock biomass and its relative distance from the maximum stock size at carrying capacity (K). B_{MSY} is often defined as the biomass that maximizes surplus production rate.

Survival rate (S) – Rate of survival expressed as the fraction of a cohort surviving the a period compared to number alive at the beginning of the period (# survivors at the end of the year / numbers alive at the beginning of the year). Pessimists convert survival rates into annual total mortality rate using the relationship A=1-S.

Survival ratio (R/SSB) – an index of the survivability from egg to age-of-recruitment. Declining ratios suggest that the survival rate from egg to age-of-recruitment is declining.

TAL – Total allowable landings, which for whiting management is equivalent to the ACL The Federal TAL pertains to landings taken by Federally permitted vessels and excludes landings made by vessel with no Federal permits that fish in state waters. The Federal TAL pertains to landings taken by Federally permitted vessels and excludes landings made by vessel with no Federal permits that fish in state waters

Ten-minute- “squares” of latitude and longitude (TMS) – A measure of geographic space. The actual size of a ten-minute-square varies depending on where it is on the surface of the earth, but in general each square is approximately 70-80 square nautical miles at 40° of latitude. This is the spatial area that EFH designations, biomass data, and some of the effort data have been classified or grouped for analysis.

Total mortality – The rate of mortality from all sources (fishing, natural, pollution) Total mortality can be expressed as an instantaneous rate (called Z and equal to F + M) or Annual rate (called A and calculated as the ratio of total deaths in a year divided by number alive at the beginning of the year)

Year class (or cohort) – Fish that were spawned in the same year. By convention, the “birth date” is set to January 1st and a fish must experience a summer before turning 1. For example, winter flounder that were spawned in February-April 1997 are all part of the 1997 cohort (or year-class). They would be considered age 0 in 1997, age 1 in 1998, etc. A summer flounder spawned in October 1997 would have its birth date set to the following January 1 and would be considered age 0 in 1998, age 1 in 1999, etc.

9.0 REFERENCES

Alade L, Traver M. 2018. 2017 Northern and Southern Silver Hake and Red Hake Stock Assessment Update Report. NEFSC Ref Doc 18-02; 71 p. doi: 10.7289/V5/RD-NEFSC-18-02.

Almeida, F. 1987. Stock definition of silver hake in the New England-Middle Atlantic area. N. Am. J. Fish. Mgt. 7: 169-186.

American Wind Energy Association (AWEA). 2020. *U.S. Offshore Wind Power Economic Impact Assessment*. https://supportoffshorewind.org/wp-content/uploads/sites/6/2020/03/AWEA_Offshore-Wind-Economic-ImpactsV3.pdf. 19 pp.

Ashford, Julian, Eric Robillard, Diego Narvaez, and Nakul Ramanna. Unpublished. Population structure and life history connectivity of red hake (*Urophycis chuss*) along the Northeast United States continental shelf. 47 pp.

Atlantic States Marine Fisheries Commission (ASMFC). 2007. 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 States Marine Fisheries Commission (ASMFC). 2017. 2017 Atlantic sturgeon benchmark stock assessment and peer review report. October 18, 2017. 456 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.

Bailey, H., B. Senior, D. Simmons, J. Rusin, G. Picken , and P. M. Thompson. 2010. Assessing underwater noise levels during pile-driving at an offshore windfarm and its potential effects on marine mammals. *Marine Pollution Bulletin* 60: 888–897.

Bailey, H., K. L Brookes, and P. M. Thompson. 2014. Assessing environmental impacts of offshore wind farms: lessons learned and recommendations for the future. *Aquatic Biosystems* 10(8): 1-13.

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, ME.

Bergström, L., L. Kautsky, T. Malm, R. Rosenberg, M. Wahlberg, N. Å. Capetillo, and D. Wilhelmsson. 2014. Effects of offshore wind farms on marine wildlife—a generalized impact assessment. *Environmental Research Letters* 9(3): 1-12.

Bergström, L., F. Sundqvist and U. Bergström (2013). Effects of an offshore wind farm on temporal and spatial patterns in the demersal fish community. *Marine Ecology Progress Series* 485: 199-210.

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.

Bolles, K.L., and G.A. Begg. 2000. Distinction between silver hake (Merluccius bilinearis) stocks in U.S. waters of the Northwest Atlantic based on whole otolith morphometrics. Fish. Bull. 98: 451-462.

Bowman, R.E. 1984. Food of silver hake, Merluccius bilinearis. Fish. Bull. (U.S.) 82: 21-35.

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. 2004. 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). Mar. Fish. Rev. 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.

Brodziak, J.K.T., E.M. Holmes, K.A. Sosebee, and R.K. Mayo. 2001. Assessment of the silver hake resource in the Northwest Atlantic in 2000. Northeast Fish. Sci. Cent. Ref. Doc. 01-03.

Bureau of Ocean and Energy Management (BOEM). 2020a. Vineyard Wind 1 Offshore Wind Energy Project Supplement to the Draft Environmental Impact Statement. Appendix A.

BOEM. 2020b. Oil and Gas Energy Fact Sheet. https://www.boem.gov/sites/default/files/documents/oil-gas-energy/BOEM_FactSheet-Oil%26amp%3BGas-2-26-2020.pdf. 2 pp.

Caillouet, C.W., S. W. Raborn, D. J. Shaver, N. F. Putman, B. J. Gallaway, and K. L. Mansfield. 2018. Did Declining Carrying Capacity for the Kemp's Ridley Sea Turtle Population Within the Gulf of Mexico Contribute to the Nesting Setback in 2010−2017? *Chelonian Conservation and Biology* 17 (1): 123–133.

Chavez-Rosales, S., M.C. Lyssikatos, and J. Hatch. 2017. Estimates of cetacean and pinniped bycatch in northeast and mid-Atlantic bottom trawl fisheries, 2011-2015. Northeast Fish Sci Cent Ref Doc. 17-16; 18 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.

Clay PM, Colburn LL, Olson J, Pinto da Silva P, Smith SL, Westwood A & Ekstrom J (2007). Community Profiles for the Northeast U.S. Fisheries. Woods Hole, MA: U.S. Department of Commerce; http://www.nefsc.noaa.gov/read/socialsci/communityProfiles.html.

Collette, B.B. and G. Klein-MacPhee, eds. 2002. Bigelow and Schroeder’s fishes of the Gulf of Maine. Washington D.C.: Smithsonian Institute Press; 252-256.

Collins, M. R. and T. I. J. Smith. 1997. Distribution of shortnose and Atlantic sturgeons in South Carolina. N. Am. J. Fish. Mgmt. 17: 995-1000.

Cole, T. V. N., P. Hamilton, A. G. Henry, P. Duley, R. M. Pace III, B. N. White, T. Frasier. 2013a. Evidence of a North Atlantic right whale Eubalaena glacialis mating ground. Endang Species Res 21: 55–64.

Cole, T.V.N. and A.G., Henry. 2013b. Serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2007-2011. Northeast Fish Sci Cent Ref Doc. 13-24; 14 p.

Colton, J.B., Jr., and R.F. Temple. 1961. The enigma of Georges Bank spawning. Limnol. Oceanogr. 6: 280-291.

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 turtleCaretta 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.

Conover, J., R. Fritz, and M. Viera. 1961. A morphometric study of silver hake. US Fish and Wildlife Special Scientific Report. Fisheries 368.

Colvocoresses, J.A. and J.A. Musik. 1984. Species associations and community composition of middle Atlantic bight continental shelf demersal fishes. Fish. Bull. 82(2):295-313.

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.

Dannheim, J., L. Bergström, S. N. R. Birchenough, R. Brzana, A. R. Boon, J. W. P. Coolen, J.-C. Dauvin, I. De Mesel, J. Derweduwen, A. B. Gill, Z. L. Hutchison, A. C. Jackson, U. Janas, G. Martin, A. Raoux, J. Reubens, L. Rostin, J. Vanaverbeke, T. A. Wilding, D. Wilhelmsson, S. Degraer and J. Norkko (2019). Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. *ICES Journal of Marine Science.*

Davis, G.E., M.F. Baumgartner, J.M. Bonnell, J. Bell, C. Berchok, J.B. Thornton, S. Brault, G. Buchanan, R.A. Charif, D. Cholewiak, C.W. Clark, P. Corkeron, J. Delarue, K. Dudzinski, L. Hatch, J. Hildebrand, L. Hodge, H. Klinck, S. Kraus, B. Martin, D.K. Mellinger, H. Moors-Murphy, S. Nieukirk, D.P. Nowacek, S. Parks, A.J. Read, A.N. Rice, D. Risch, A. Širović, M. Soldevilla, K. Stafford, J.E. Stanistreet, E. Summers, S. Todd, A. Warde and S.M. Van Parijs. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (Eubalaena glacialis) from 2004 to 2014. Sci. Rep. 7:13460.

Davis, G. E., M. F. Baumgartner, P. J. Corkeron, J. Bell, C. Berchok, J. M. Bonnell, J. B. Thornton, S. Brault, G. A. Buchanan, D. M. Cholewiak, C. W. Clark, J. Delarue, L. T. Hatch, H. Klinck, S. D. Kraus, B. Martin, D. K. Mellinger, H. Moors-Murphy, S. Nieukirk, D. P. Nowacek, S. E. Parks, D. Parry, N. Pegg, A. J. Read, A. N. Rice, D. Risch, A. Scott, M. S. Soldevilla, K. M. Stafford, J. E. Stanistreet, E. Summers, S. Todd, S. M. Van Parijs. 2020. Exploring movement patterns and changing distributions of baleen whales in the western North Atlantic using a decade of passive acoustic data. Glob. Change. Biol. 26: 4812-4840.

Degraer, S., R. Brabant, B. Rumes and L. Vigin (2019). Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Marking a Decade of Monitoring, Research, and Innovation. Memoirs on the Marine Environment, Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management: 134.

DePiper, G. S. 2014. Statistically assessing the precision of self-reported VTR fishing locations. NOAA Technical Memorandum NMFS-NE-229: 16p. URL: https://www.nefsc.noaa.gov/publications/tm/tm229/tm229.pdf.

Dexter, R.W. 1969. Studies on the food habits of whiting, redfish, and pollock in the Gulf of Maine. J. Mar. Biol. Assoc. India 11: 288-294

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.

Domanevsky, L.N. and Y.P. Nozdrin. 1963. Silver and red hakes. In Fishery resources and reproduction of fish stocks. Atlantic NIRO, Fish Husbandry 39: 10-13.

Dovel, W.L. and T.J. Berggren. 1983. Atlantic sturgeon of the Hudson River Estuary, New York. NY 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. Fish. Bull. 108:450-465.

Dunton, K. J., Chapman, D., Jordaan, A., Feldheim, K., O'Leary, S. J., McKown, K. A., & Frisk, M. G. 2012. Genetic mixed-stock analysis of Atlantic sturgeon Acipenser oxyrinchus oxyrinchus in a heavily exploited marine habitat indicates the need for routine genetic monitoring. J. Fish Biol. 80(1), 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 turtleDermochelys coriacea) nesting in Florida. Chel. Cons. Biol. 5(2): 239-248.) nesting in Florida. Chel. Cons. Biol. 5(2): 239-248.

Ecosystem Assessment Program. 2012. Ecosystem Status Report for the Northeast Shelf Large Marine Ecosystem - 2011. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-07; 32 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online athttp://nefsc.noaa.gov/publications/

Edwards, R.L. and R.E. Bowman. 1979. Food consumed by continental shelf fishes. In H. Clepper ed. Predator - prey systems in fish communities and their role in fisheries management. p. 387-406. Sports Fishing Institute, Washington, DC.

Eggers, D.M. 1977. Factors in interpreting data obtained by diel sampling of fish stomachs. Journal of the Fisheries Research Board of Canada 34:290-294.

Elliott, J.M., Persson, L. 1978. The estimation of daily rates of food consumption for fish. J.Anim. Ecol. 47: 977-991.

Ellison, W.T., B.L. Southall, C.W. Clark, and A.S. Frankel. 2011. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. *Conservation Biology* 26: 21-28.

Ellison, W.T., B. L. Southall, A. S. Frankel, K. Vigness-Raposa, and C. W. Clark. 2018. Short Note: An Acoustic Scene Perspective on Spatial, Temporal, and Spectral Aspects of Marine Mammal Behavioral Responses to Noise. *Aquatic Mammals* 44(3): 239-243.

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fish. Bull. 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. Bull. Mar. Sci. 56(2):547-568.

Epperly, S.P., J. Braun, and A. Veishlow. 1995c. Sea turtles in North Carolina waters. Cons. Biol. 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 pp.

Finneran, J. J. 2015. Noise-induced hearing loss in marine mammals: a review of temporary threshold shift studies from 1996 to 2015. *J. Acoust. Soc. Am.* 138, 1702–1726. doi: 10.1121/1.4927418

Finneran, J.J. 2016. Auditory Weighting Functions and TTS/PTS Exposure Functions for Marine Mammals Exposed to Underwater Noise, Technical Report 3026, December 2016. San Diego: Systems Center Pacific.

Food and Agriculture Organization of the United Nations (FAO). FAO Major Fishing Areas: Northwest Atlantic (Major Fishing Area 21). Accessed June 1, 2020. URL: http://www.fao.org/fishery/area/Area21/en.

Forney, K.A., B. L. Southall, E. Slooten, S. Dawson, A. J. Read, R. W. Baird, and R. L. Brownell Jr. 2017. Nowhere to go: noise impact assessments for marine mammal populations with high site fidelity. *Endang. Species. Res.* 32: 391–413.

Freidland, Kevin. 1998. Ocean climate influences on critical Atlantic salmon (Salmo salar) life history events. Can. J. Fish. Aq. Sci. 55, suppl. 1: 119-130.

Gabriel W. 1992. Persistence of demersal fish assemblages between Cape Hatteras and Nova Scotia, northwest Atlantic. J. NW Atl. Fish. 14: 29-46.

Garrison, L.P. and J.S. Link. 2000. Dietary guild structure of the fish community in the Northeast United States continental shelf ecosystem. Mar. Ecol. Prog. Ser. 202:231-240. URL: http://www.int-res.com/abstracts/meps/v202/.

Goldenberg, S.B., C.W. Landsea, A.M. Mestas-Nunez, and W.M. Gray. 2001. The recent increase in Atlantic hurricane activity: Causes and implications. Science 293:474–479.

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 utilized by a recovering subpopulation of adult female loggerhead sea turtles: implications for conservation. Mar. Biol. 160: 3071–3086.

Grosslein, M.D. and T.R. Azarovitz. 1982. Fish distribution. MESA New York Bight Atlas Monogr. No. 15, 182 pp.

Hare JA, Morrison WE, Nelson MW, Stachura MM, Teeters EJ, Griffis RB et al. 2016. A vulnerability assessment of fish and invertebrates to climate change on the Northeast U.S. Continental Shelf. PLoS ONE 11(2): e0146756.

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.

Hayes, S.A, E. Josephson, K. Maze-Foley, and P. Rosel. 2019. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessment-2018. NOAA Technical Memorandum NMFS-NE-258.

Hayes, S.A, E. Josephson, K. Maze-Foley, and P. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessment-2019. NOAA Technical Memorandum NMFS-NE-264.

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 Biol. 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). U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment-2017. NOAA Technical Memorandum NMFS-NE-245.

Heinimaa, S. & Heinimaa, P. 2004: Effect of the female size on egg quality and fecundity of the wild Atlantic salmon in the sub-arctic River Teno. Boreal Env. Res. 9: 55–62. URL: https://www.academia.edu/17293941/Effect_of_the_female_size_on_egg_quality_and_fecundity_of_the_wild_Atlantic_salmon_in_the_sub-arctic_River_Teno.

Helser, T. E., F. P. Almeida, and D. E. Waldron. 1995. Biology and fisheries of Northwest Atlantic hake (Silver hake: M. bilinearis), p. 203-237. In Alheit, J. and T.J.Pitcher, eds. Hake: fisheries, products and markets. Chapman and Hall, London.

Heppell, S.S., D.T. Crouse, L.B. Crowder, S.P. Epperly, W. Gabriel, T. Henwood, R. Marquez, and N.B. Thompson. 2005. A population model to estimate recovery time, population size, and management impacts on Kemp's ridley sea turtles. *Chelonian Conservation and Biology* 4 (4): 767-773.

Henry, A.G., T.V.N. Cole, L. Hall, W. Ledwell, D. Morin, and A. Reid. 2014. Mortality determinations for baleen whale stocks along the Gulf of Mexico, United States east coast, and Atlantic Canadian provinces, 2008 - 2012. Northeast Fish Sci Cent Ref Doc. 14-10; 17 p.

Henry, A.G., T.V.N. Cole, L. Hall, W. Ledwell, D. Morin, and A. Reid. 2015. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2009-2013. Northeast Fish Sci Cent Ref Doc. 15-10; 48 p.

Henry, A.G., T.V.N. Cole, L. Hall, W. Ledwell, D. Morin, and A. Reid. 2016. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States east coast, and Atlantic Canadian provinces, 2010-2014. Northeast Fish Sci Cent Ref Doc. 16-10; 51 p.

Henry, A.G., T.V.N. Cole, M.Garron, W. Ledwell, D. Morin, and A. Reid. 2017. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States east coast, and Atlantic Canadian provinces, 2011-2015. Northeast Fish Sci Cent Ref Doc. 17-19; 57 p.

Henry, A., M. Garron, A. Reid, D. Morin, W. Ledwell, and T.V.N. Cole. 2019. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2012-2016. Northeast Fish Sci Cent Ref Doc. 19-13; 54 p.

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

Hutchison, Z.L., A.B. Gill, P. Sigray, H. He, and J.W. King. 2020. Anthropogenic Electromagnetic Fields (EMF) Influence the Behaviour of Bottom-Dwelling Marine Species. Scientific Reports 10 (1): 4219.

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.

Intergovernmental Panel on Climate Change (IPCC). 2013. Fifth Assessment Report on Climate Change. URL: http://www.ipcc.ch/report/ar5/.

James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005. Behavior of leatherback sea turtleDermochelys coriacea, during the migratory cycle. Proc. R. Soc. B, 272: 1547-1555., 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. Biol. Cons. 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., Boelke, C., Chiarella, L.A., and Greene, K. 2019. Guidance for Integrating Climate Change Information in Greater Atlantic Region Habitat Conservation Division Consultation Processes. Greater Atlantic Region Policy Series 19-01. 235p. https://www.greateratlantic.fisheries.noaa.gov/policyseries/index.php/GARPS/article/view/3.

Jones, J. B. 1992. Environmental impact of trawling on the seabed: A review. New Zeal J Mar Fresh 26.

Josephson, E., F.Wenzel, and M.C. Lyssikatos. 2017. Serious injury determinations for small cetaceans and pinnipeds caught in commercial fisheries off the Northeast US coast, 2011-2015. Northeast Fish Sci Cent Ref Doc. 17-15; 32 p.

Josephson, E., F. Wenzel, and M.C. Lyssikatos. 2019. Serious injury determinations for small cetaceans and pinnipeds caught in commercial fisheries off the Northeast US Coast, 2012-2016. Northeast Fish Sci Cent Ref Doc. 19-05; 27 p.

Kaschner, K., & Pauly, D. 2005. Competition between marine mammals and fisheries: Food for thought. In D.J. Salem & A.N. Rowan (Eds.), The state of the animals III: 2005 (pp.95-117). Washington, DC: Humane Society Press.

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. Trans. Am. Fish. Soc. 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.

Langhamer, O. (2012). Artificial Reef Effect in relation to Offshore Renewable Energy Conversion: State of the Art. *The Scientific World Journal*: 8.

Link, Jason S. and Sosebee, Katherine 2008. Estimates and Implications of Skate Consumption in the Northeast U.S. Continental Shelf Ecosystem. N Am J Fish Management. 28(649-662). https://doi.org/10.1577/M07-100.1.

Lock MC and D.B. Packer. 2004. Essential fish habitat source document: Silver hake, Merluccius bilinearis, life history and habitat characteristics, 2nd edition. NOAA Tech Memo NMFS NE 186; 68 p.

Lyssikatos, M.C. 2015. Estimates of cetacean and pinniped bycatch in Northeast and mid-Atlantic bottom trawl fisheries, 2008-2013. Northeast Fish Sci Cent Ref Doc. 15-19; 20 p.

Lyssikatos, M.C., S. Chavez-Rosales, and J. Hatch. 2020. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2013-2017. Northeast Fish Sci Cent Ref Doc. 20-04; 11 p.

Madsen, P.T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. *Mar. Ecol. Prog. Ser.* 309: 279–295.

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. Mar. Biol. 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.

Methratta, E. and W. Dardick (2019). Meta-Analysis of Finfish Abundance at Offshore Wind Farms. *Reviews in Fisheries Science and Aquaculture* 27(2): 242-260.

Mid-Atlantic Fishery Management Council (MAFMC). 1998a. Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan. 496 pp. URL: http://www.mafmc.org/s/SFSCBSB_Amend_12.pdf.

MAFMC. 1998b. Amendment 12 to the Atlantic Surfclam and Ocean Quahog Fishery Management Plan. URL: http://www.mafmc.org/s/SCOQ_Amend_12.pdf.

MAFMC. 1998c. Amendment 1 to the Bluefish Fishery Management Plan. URL: http://www.mafmc.org/s/Bluefish_Amend_1_Vol_1.pdf.

MAFMC. 2008. Amendment 1 to the Tilefish Fishery Management Plan. 496 pp. URL: http://www.mafmc.org/s/Tilefish_Amend_1_Vol_1-y2ij.pdf.

MAFMC. 2011. Amendment 11 to the Atlantic Mackerel, Squid, and Butterfish (MSB) Fishery Management Plan (FMP). URL: http://www.mafmc.org/s/Amendment-11-FEIS-FINAL_2011_05_12.pdf.

MAFMC. 2014. Amendment 3 to the Spiny Dogfish Fishery Management Plan. URL: http://www.mafmc.org/s/Spiny-Dogfish-Amd-3.pdf.

Marine Mammal Stock Assessments – 2018. NOAA Technical Memorandum NMFS-NE-258.

Miller TJ, Das C, Politis PJ, Miller AS, Lucey SM, Legault CM, Brown RW, Rago PJ. 2010. Estimation of Albatross IV to Henry B. Bigelow calibration factors. Northeast Fish Sci Cent Ref Doc. 10-05; 233 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at: https://nefsc.noaa.gov/publications/.

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

Miller, M.H. and C. Klimovich. 2017. Endangered Species Act Status Review Report: Giant Manta Ray (Manta birostris) and Reef Manta Ray (Manta alfredi). Report to National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD. September 2017. 128 pp.

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.

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

Murdoch, P.S., J.S. Baron, and T.L. Miller. 2000. Potential effects of climate change on surface-water quality in North America. J. Am. Water Res. Assoc. 36: 347-366.

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 BycatchCaretta caretta) in US Mid-Atlantic Bottom Otter Trawl Gear, 1996–2004, second ed. US Dep. Commer., Northeast Fish Sci. Cent. Ref. Doc. 08-20, p. 32. <http://www.nefsc.noaa.gov/publications/crd/crd0820>.) in US Mid-Atlantic Bottom Otter Trawl Gear, 1996–2004, second ed. US Dep. Commer., Northeast Fish Sci. Cent. Ref. Doc. 08-20, p. 32. <http://www.nefsc.noaa.gov/publications/crd/crd0820>.

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

Murray KT. 2020. Estimated magnitude of sea turtle interactions and mortality in US bottom trawl gear, 2014-2018. NOAA Tech Memo NMFS NE. 260; 19 p.

Musick, J.A. 1967. Designation of the hakes, Urophycis chuss and Urophycis tenuis, in ICNAF statistics. Int. Comm. Northw. Atl. Fish. Res. Doc. No. 67/76.

National Marine Fisheries Service (NMFS). 1999a. Essential fish habitat source document, red hake, Urophycis chuss, life history and habitat characteristics. NOAA Technical Memorandum NMFS-NE-133. 34pp. https://www.nefsc.noaa.gov/nefsc/habitat/efh/

National Marine Fisheries Service (NMFS). 1999b. Essential fish habitat source document, offshore hake, Merluccius albidus, life history and habitat characteristics. NOAA Technical Memorandum NMFS-NE-133. 32pp. https://www.nefsc.noaa.gov/nefsc/habitat/efh/

NMFS. 2004. Essential fish habitat source document, silver hake, Merluccius bilinearis, life history and habitat characteristics, Second edition. NOAA Technical Memorandum NMFS-NE-130. 68pp. https://www.nefsc.noaa.gov/nefsc/habitat/efh/

NMFS. 2007. Guidelines for the Assessment of the Social Impact of Fishery Management Actions. In: NOAA/NMFS Council Operational Guidelines - Fishery Management Process. Silver Spring, MD: National Oceanic and Atmospheric Administration. NMFSI 01-111-02. 39 p.

NMFS. 2011. 51st Northeast Regional Stock Assessment Workshop (51st SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-02; 856 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

NMFS. 2013. Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries.http://www.greateratlantic.fisheries.noaa.gov/protected/section7/bo/actbiops/batchedfisheriesopinionfinal121613.pdf.

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. 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. 2015 Northeast Groundfish Ope3rational Assessments. NEFSC Ref. Doc. 15-24. http://www.nefsc.noaa.gov/groundfish/operational-assessments-2015/.

NMFS. 2017a. Memo: Reinitiating Section 7 Consultation on the Batched Fisheries, American Lobster, and Atlantic Deep-Sea Red Crab Biological Opinions and associated Fishery Management Plans. NMFS-GARFO, October 17, 2017.

NMFS. 2017b. Assessment update for northern and southern stocks of silver and red hakes. To be published online at https://www.nefsc.noaa.gov/nefsc/saw/.

NMFS. 2017c. Endangered Species Act Section 7 Consultation Biological Opinion for the Tappen Zee Bridge Replacement, NER-2016-13822. 97 pp. URL: https://pcts.nmfs.noaa.gov/pcts-web/dispatcher/trackable/NER-2016-13822.

NMFS. 2017d. Endangered Species Act Biological Opinion for the Worumbo Project, NER-2016-13814. 252 pp. URL: https://pcts.nmfs.noaa.gov/pcts-web/dispatcher/trackable/NER-2016-13814.

NMFS. 2018a. 2018 List of Fisheries Commercial Fishing, Marine Mammal Protection. URL: https://www.fisheries.noaa.gov/national/marine-mammal-protection/2018-list-fisheries#table-2-commercial-fisheries-in-the-atlantic-ocean-gulf-of-mexico-and-caribbean.

National Marine Fisheries Service (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.

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

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

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

NMFS and USFWS. 2005. Recovery plan for the Gulf of Maine distinct population segment of the Atlantic salmon (Salmo salar). NMFS, Silver Spring, MD.

NMFS and USFWS. 2007a. Kemp's ridley sea turtle (Lepidochelys kempii) 5 year review: summary and evaluation. Silver Spring, Maryland: NMFS. 50 pp.

NMFS and USFWS. 2007b. Green sea turtle (Chelonia mydas) 5 year review: summary and evaluation. Silver Spring, Maryland: NMFS. 102 pp.

NMFS and USFWS. 2008. Recovery plan for the Northwest Atlantic population of the loggerhead turtle (Caretta caretta), Second revision. Washington, D.C.: NMFS. 325 pp.

NMFS and USFWS. 2013. Leatherback sea turtle (Dermochelys coriacea) 5 year review: summary and evaluation. Silver Spring, Maryland: NMFS. 91 pp.

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

National Research Council (NRC). 2000. *Marine Mammals and Low-Frequency Sound: Progress Since 1994*. Washington, DC: National Academies Press.

National Research Council. 2003. *Ocean Noise and Marine Mammals*. Washington, DC: National Academies Press.

National Research Council. 2005. *Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects*. Washington, DC: National Academies Press.

Nelms, S. E., Piniak, W. E., Weir, C. R., and Godley, B. J. 2016. Seismic surveys and marine turtles: an underestimated global threat? *Biol. Conserv.* 193, 49–65. doi: 10.1016/j.biocon.2015.10.020

New England Fishery Management Council (NEFMC). 1999. Omnibus Habitat Amendment 1 URL:

NEFMC. 2000. Final Amendment 12 to the Northeast Multispecies FMP. 331 pp. URL: http://s3.amazonaws.com/nefmc.org/GFAmend12.pdf.

NEFMC. 2004. Final Amendment 13 to the Northeast Multispecies FMP. 1728 pp. URL: http://s3.amazonaws.com/nefmc.org/Final-Amendment-13-SEISVol.-I-II.pdf.

NEFMC. 2007. Northeast Region Standardized Bycatch Reporting Methodology: An Omnibus Amendment to the Fishery Management Plans of the Mid-Atlantic and New England Regional Fishery Management Councils. 642 pp. URL: http://s3.amazonaws.com/nefmc.org/SBRM_Omnibus_Amendment_1.pdf.

NEFMC. 2011. Final Amendment 19 to the Northeast Multispecies FMP (Small-mesh Multispecies) Environmental Assessment, Regulatory Impact Review and Initial Regulatory Flexibility Analysis. 310 pp. URL: http://www.nefmc.org/library/amendment-19.

NEFMC. 2012. Final Amendment 19 to the Northeast Multispecies FMP (Small-mesh Multispecies) Environmental Assessment, Regulatory Impact Review and Initial Regulatory Flexibility Analysis. 308 pp. URL: http://s3.amazonaws.com/nefmc.org/Final_Amendment_19.pdf.

NEFMC. 2014a. Omnibus Essential Fish Habitat Amendment 2. URL: https://www.nefmc.org/library/omnibus-habitat-amendment-2.

NEFMC. 2014b. Stock Assessment and Fishery Evaluation (SAFE) Report for Fishing Year 2013. 136 pp. URL: http://s3.amazonaws.com/nefmc.org/SAFE-Report-for-Fishing-Year-2013.pdf.

NEFMC. 2015a. Small-Mesh Multispecies Fishing Year 2015-2017 Specifications Environmental Assessment Regulatory Impact Review and Initial Regulatory Flexibility Analysis. 139 pp. URL: http://s3.amazonaws.com/nefmc.org/2015-2017-Specificatins-Document-2.pdf.

NEFMC. 2015b. Amendment 20 to the Northeast Multispecies Fishery Management Plan "Standardized Bycatch Reporting Methodology: An Omnibus Amendment to the Fishery Management Plans of the Mid-Atlantic and New England Regional Fishery Management Councils". URL: https://www.nefmc.org/library/amendment-20.

NEFMC. 2016. Small-Mesh Multispecies Fishing Year 2016-2017 Specifications Supplemental Information Report (SIR), and Regulatory Flexibility Analysis (RFA). 33 pp. URL: http://s3.amazonaws.com/nefmc.org/2016-2017-Specifications-Supplemental-Information-Report.pdf.

NEFMC. 2017a. Stock Assessment and Fishery Performance Report for Fishing Year 2016, Small-Mesh Multispecies. (August 2017). 87 pp. URL: http://s3.amazonaws.com/nefmc.org/2.2_-Annual-Monitoring-Report-SAFE-Report-for-2016.pdf.

NEFMC. 2017b. Omnibus Essential Fish Habitat Amendment 2. 489 pp. URL: https://www.nefmc.org/library/omnibus-habitat-amendment-2.

NEFMC. 2018a. Annual Monitoring Report for Fishing Year 2018. 67 pp. URL: https://s3.amazonaws.com/nefmc.org/Annual-Monitoring-Report-for-Fishing-Year-2018_web.pdf.

NEFMC. 2018b. Small-Mesh Multispecies Fishing Year 2018-2020 Specifications Environmental Assessment Regulatory Impact Review and Initial Regulatory Flexibility Analysis. 218 pp. URL: https://www.nefmc.org/library/2018-2020-whiting-specifications.

Northeast Fisheries Science Center (NEFSC). 2011. 51st Northeast Regional Stock Assessment Workshop (51st SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-02; 856 p. URL: http://www.nefsc.noaa.gov/publications/crd/crd1102/index.html.

NEFSC (Northeast Fisheries Science Center). 2017. 62nd Northeast Regional Stock Assessment Workshop (62nd SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-03; 822 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/.

NEFSC. 2020a. Final report of red hake stock structure working group. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 20-07; 185 p. URL: https://www.fisheries.noaa.gov/new-england-mid-atlantic/northeast-center-reference-document-series.

NEFSC. 2020b. 2020 State of the Ecosystem: New England. URL: https://s3.amazonaws.com/nefmc.org/5b_SOE-NEFMC-2020-plus2pager-REVISED.pdf.

Northwest Atlantic Leatherback Working Group. 2018. Northwest Atlantic Leatherback Turtle (*Dermochelys coriacea*) Status Assessment (Bryan Wallace and Karen Eckert, Compilers and Editors). Conservation Science Partners and the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). WIDECAST Technical Report No. 16. Godfrey, Illinoise. 36 pp.

Nowacek, D. P., Thorne, L. H., Johnston, D. W., and Tyack, P. L. 2007. Responses of cetaceans to anthropogenic noise. *Mamm. Rev.* 37, 81–115. doi: 10.1111/j.1365-2907.2007.00104.x

Nowacek, D.P., C. W. Clark, D. Mann, P. JO. Miller, H. C. Rosenbaum, J. S. Golden, M. Jasny, J. Kraska, and B. L. Southall. 2015. Marine seismic surveys and ocean noise: time for coordinated and prudent planning. *Front. Ecol. Environ*. 13(7): 378–386. doi:10.1890/130286

Nye, Janet A., Link, J. S., Hare, J. A. & Overholtz, W. J. 2009. Changing spatial distribution of fish stocks in relation to climate and population size on the Northeast United States continental shelf. Mar. Ecol. Progr. Ser. 393, 111–129.

Nye, Janet A., Joyce, T.M, Kwon, Y. and Link, J.S. 2011. Silver hake tracks changes in Northwest Atlantic circulation. Nature Communications 2, Article number: 412 doi:10.1038/ncomms1420

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'Brien, L., J. Burnett, and R. K. Mayo. 1993. Maturation of nineteen species of finfish off the Northeast coast of the United States, 1985-1990. NOAA Tech. Report. NMFS 113, 22-25 p.

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 WJ & Tyler AV. 1985. Long-term responses of the demersal fish assemblages of Georges Bank. Fish. Bull. 83: 507-520.

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. 294 pp.

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.

Popper, A., Hawkins, A., Fay, R., Mann, D., Bartol, S., Carlson, T., et al. 2014. Sound exposure guidelines for fishes and sea turtles: a technical report prepared by ANSI-accredited standards committee S3/SC1 and registered with ANSI. *ASA S3/SC1* 4.

Pratt, S. 1973. Benthic fauna. In: Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. University of Rhode Island, Marine Publication Series No. 2. Kingston, RI. p. 5-1 to 5-70.

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.

Reid, R., F. Almeida, and C. Zetlin. 1999. Essential fish habitat source document: Fishery independent surveys, data sources, and methods. NOAA Tech. Mem. NMFS-NE-122. 39 p.

Richardson, W. J., Greene, C. R. Jr., Malme, C. I., and Thomson, D. H. 1995. *Marine Mammals and Noise*. San Diego, CA: Academic Press.

Romano, T., Keogh, M., Kelly, C., Feng, P., Berk, L., Schlundt, C., et al. 2004. Anthropogenic sound and marine mammal health: measures of the nervous and immune systems before and after intense sound exposure. *Can. J. Fish. Aquat. Sci.* 61, 1124–1134. doi: 10.1139/f04-055.

Rountree, R.A. 1999. Nov. Diets of NW Atlantic fishes and squid. http://fishecology.org. Accessed 17 Aug. 2000.

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. Trans. Am. Fish. Soc. 132: 1-8.

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.

School for Marine Science & Technology (SMAST) UMass Dartmouth. 2020. Bycatch Avoidance Programs. https://www.umassd.edu/smast/bycatch/#:~:text=The%20Bycatch%20Avoidance%20program%20uses,without%20triggering%20bycatch%20accountability%20measures. Accessed 28 July 2020.

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 Tech. Memo. NOAATM-NFMS-SWFSC-539, NMFS Southwest Fisheries Science Center, Miami, Florida.

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.

Sherman, K. N.A. Jaworski, T.J. Smayda (eds.). 1996. The Northeast Shelf Ecosystem: Assessment, sustainability, and management. Blackwell Science, Cambridge, MA. 564p.

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.

Slabbekoorn, H., Bouton, N., van Opzeeland, I., Coers, A., ten Cate, C., and Popper, A. N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends Ecol. Evol. (Amst).* 25, 419–427. doi: 10.1016/j.tree.2010.04.005.

Smith, Laurel A., J.S. Link, S.X. Cadrin, and D.L. Palka. 2015. Consumption by marine mammals on the Northeast U.S. continental shelf. Ecol. Appl. 25(2): 373-389.

Steimle FW and Zetlin C. 2000. Reef habitats in the Middle Atlantic Bight: Abundance, distribution, associated biological communities, and fishery resource use. Mar. Fish. Rev. 62: 24-42.

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. Trans. Am. Fish. Soc. 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. N. Am. J. Fish. Mgmt. 24: 171-183.

Steiner, W.W., J.J. Luczkovich, and B.L. Olla. 1982. Activity, shelter usage, growth and recruitment of juvenile red hake, Urophycis chuss. Mar. Ecol. Prog. Ser. 7: 125-135.

Stenberg, C., J. G. Støttrup, M. van Deurs, C. W. Berg, G. E. Dinesen, H. Mosegaard, T. M. Grome and S. B. Leonhard (2015). Long-term effects of an offshore wind farm in the North Sea on fish communities. *Marine Ecology Progress Series* 528: 257-265.

Stenseth, N.C, Mysterud, A., Otterson, G., Hurrell, J.W., Chan, K., and M. Lima. 2002 Ecological Effects of Climate Fluctuations. Science 297(5585); 1292-1296.

Stevenson D., L. Chiarella, D. Stephan, R. Reid, K. Wilhelm, J. McCarthy, and M. Pentony. 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. Northeast Fisheries Science Center, NOAA Technical Memorandum NMFS-NE-181. NMFS, Woods Hole, MA. 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.

Taormina, B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A Review of Potential Impacts of Submarine Power Cables on the Marine Environment: Knowledge Gaps, Recommendations and Future Directions. Renewable and Sustainable Energy Reviews 96: 380–91.

Taormina, B., C. Di Poi, A. Agnalt, A. Carlier, N. Desroy, R. H. Escobar-Lux, J. D'eu, F. Freytet, and C.M.F. Durif. 2020. Impact of Magnetic Fields Generated by AC/DC Submarine Power Cables on the Behavior of Juvenile European Lobster (*Homarus Gammarus*). Aquatic Toxicology 220: 105401.

Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. 2006. Effects of offshore wind farm noise on marine mammals and fish, biola, Hamburg, Germany on behalf of COWRIE Ltd. https://tethys.pnnl.gov/sites/default/files/publications/Effects_of_offshore_wind_farm_noise_on_marine-mammals_and_fish-1-.pdf.

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 Tech. Memo. 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 Tech. Memo. NMFS-SEFSC-444:1-115.

TEWG (Turtle Expert Working Group). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Tech. Memo. 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 Tech. Memo. NMFS-SEFSC-575:1-131.

Theroux RB & Grosslein MD. 1987. Benthic fauna. In: Georges Bank. Cambridge, MA: MIT Press. p. 283-295.

Theroux RB and Wigley RL. 1998. Quantitative Composition and Distribution of the Macrobenthic Invertebrate Fauna of the Continental Shelf Ecosystems of the Northeastern United States. Woods Hole, MA: U.S. Dept. of Commerce. NOAA Tech. Rpt. 140. 240 p.

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

U.S. Atlantic Salmon Assessment Committee (USASAC). 2004. Annual reports 2001 through 2012. Annual Report of the U.S. Atlantic Salmon Assessment Committee.

U. S. Atlantic Salmon Assessment Committee. 2020. Annual Report of the U.S. Atlantic Salmon Assessment Committee. Report Number 32 - 2019 activities. Portland, Maine 161 pp.

United States Coast Guard (UCSG). 2020. *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study.* https://www.navcen.uscg.gov/pdf/PARS/FINAL_REPORT_PARS_May_14_2020.pdf. 199 pp.

Valentine PC and Lough RG. 1991. The Sea Floor Environment and the Fishery of Eastern Georges Bank. Woods Hole, MA: U.S. Dept. of the Interior and U.S. Geological Survey. Open File Report 91-439. 25 p.

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.

Waldron, D.E. 1993. Diet of silver hake (Merluccius bilinearis) on the Scotian Shelf. J. Northwest Atl. Fish. Sci. 14: 87-101.

Warden, M.L. 2011a. Modeling loggerhead sea turtleCaretta caretta) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. Biol. Cons. 144: 2202–2212.) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. Biol. Cons. 144: 2202–2212.

Warden, M.L. 2011b. Proration of loggerhead sea turtleCaretta caretta) interactions in US Mid-Atlantic bottom otter trawls for fish and scallops, 2005-2008, by managed species landed. NEFSC Ref. Doc. 11-04; 8 pp. http://www.nefsc.noaa.gov/publications/crd/.) interactions in US Mid-Atlantic bottom otter trawls for fish and scallops, 2005-2008, by managed species landed. NEFSC Ref. Doc. 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, ed. 2014. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2013. NOAA Tech Memo NMFS- NE-228. 475 pp.

Waring, G.T., E. Josephson, K. Maze-Foley, P.E. Rosel, ed. 2015a. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2014. NOAA Tech Memo NMFS NE 231; 361 p. doi: 10.7289/V5TQ5ZH0.

Waring, G.T., E. Josephson, M.C. Lyssikatos, and F.W. Wenzel. 2015b. Serious injury determinations for small cetaceans and pinnipeds caught in commercial fisheries off the Northeast U.S. coast, 2012. Northeast Fish Sci Cent Ref Doc. 15-12; 19 p.

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.

Watling, L. 1998. Benthic fauna of soft substrates in the Gulf of Maine. Pp. 20-29 in: Effects of fishing gear on the sea floor of New England, E.M. Dorsey and J. Pederson (eds.). MIT Sea Grant Pub. 98-4.

Webster, P.J., G.J. Holland, J.A. Curry, and H.R. Chang. 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. Science 309:1844 –1846.

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.

Wright, A. J., Soto, N. A., Baldwin, A. L., Bateson, M., Beale, C. M., Clark, C., et al. 2007. Do Marine mammals experience stress related to anthropogenic noise? *Int. J. Comp. Psychol.* 20, 274–316.

Wood, H., J. Spicer, and S. Widdicombe. 2008. Ocean acidification may increase calcification rates, but at a cost. Proc. Royal Soc. Biol. Sci. 275. 1644: 1767-1773.

10.0 INDEX