2023 *Illex* Squid Specifications
Mackerel, Squid, and Butterfish (MSB)
Fishery Management Plan (FMP)

Environmental Assessment (EA)

Prepared by the

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

National Marine Fisheries Service (NMFS)

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The 2019 stock status designation resulting from the 2021 RTA was "Unknown" with respect to both overfished and overfishing, due to the lack of an accepted method of estimating F and B and the lack of appropriate Biological Reference Points for this subannual species. The RTA Review Panel agreed with the RTA WG Report that indications from the various assessment approaches were that the stock was lightly fished in 2019. However, their report stated that the term "lightly fished" should be interpreted with caution because it has no specific definition relating to sustainable exploitation. After evaluating related analyses, the MAFMC's Scientific and Statistical Committee (SSC) recommended continuing the 2022 40,000 metric ton (MT) *Illex* Acceptable Biological Catch (ABC) to start 2023. In March 2023 the SSC will review updated analyses and may revise their 2023 ABC recommendation. Accordingly, this Environmental Assessment (EA) considers a preferred ABC of 40,000 MT and a range 50% lower and 50% higher (20,000 MT and 60,000 MT). No other changes are proposed for this fishery for 2023.

Target Species Impact Summary (Preferred Alternative)

Based on the best scientific information available, the SSC determined that a 40,000 MT ABC should be sustainable with a relatively low chance of high fishing mortality rates. By maintaining a sustainable population, impacts on *Illex* from maintaining the current specifications are expected to be ongoing slightly positive.

Non-Target Species Impact Summary (Preferred Alternative)

Non-target interactions are negligible in the *Illex* fishery and it is not believed that the *Illex* fishery negatively affects any other fish stocks. As such, impacts on non-target species from maintaining the current *Illex* specifications are expected to be negligible.

Habitat Impact Summary (Preferred Alternative)

Bottom trawling can negatively impact some habitats. Since the MAFMC has considered habitat impacts in the past and has already restricted fishing to protect sensitive habitats (e.g. Tilefish habitat canyon closures and deep water coral protections), and because effort would not be expected to substantially change, the impacts on habitat from maintaining the current *Illex* specifications are expected to be ongoing slight negative.

Protected Resources Impact Summary (Preferred Alternative)

While the MSB fisheries have the potential to interact with protected resources, because effort would not be expected to substantially change, protected resource impacts are expected to range from ongoing slight negative (for some Endangered Species Act (ESA)-listed species and marine mammals above Potential Biological Removal (PBR)) to ongoing slight positive (for marine mammals below PBR).

Human Communities Impact Summary (Preferred Alternative)

Socioeconomic impacts are expected to be ongoing moderate positive given the economic activity and associated benefits that fishery participants, associated support industries, and associated fishing communities derive from the continued sustainable harvest of *Illex*.

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2.0 LIST OF COMMON ACRONYMS AND ABBREVIATIONS

ABC	**Acceptable Biological Catch**
ACL	**Annual Catch Limit**
ASMFC	**Atlantic States Marine Fisheries Commission or Commission**
B	**Biomass**
CFR	**Code of Federal Regulations**
CV	**coefficient of variation**
DAH	**Domestic Annual Harvest**
DAP	**Domestic Annual Processing**
EA	**Environmental Assessment**
EEZ	**Exclusive Economic Zone**
EFH	**Essential Fish Habitat**
EIS	**Environmental Impact Statement**
ESA	**Endangered Species Act of 1973**
F	**Fishing Mortality Rate**
FMP	**Fishery Management Plan**
FR	**Federal Register**
GOM	**Gulf of Maine**
M	**Natural Mortality Rate**
MAFMC	**Mid-Atlantic Fishery Management Council**
MMPA	**Marine Mammal Protection Act**
MSA	**Magnuson-Stevens Fishery Conservation and Management Act**
MSB	**Mackerel, Squid, and Butterfish**
MSY	**Maximum Sustainable Yield**
MT (or mt)	**Metric Tons (1 mt equals about 2,204.62 pounds)**
NE	**Northeast**
NEFMC	**New England Fishery Management Council**
NEFSC	**Northeast Fisheries Science Center**
NEPA	**National Environmental Policy Act**

NMFS	**National Marine Fisheries Service (NOAA Fisheries)**
NOAA	**National Oceanic and Atmospheric Administration**
OFL	**Overfishing Level**
OY	**Optimum Yield**
PBR	**Potential Biological Removal**
SSC	**Scientific and Statistical Committee**
U.S.	**United States**
VTR	**Vessel Trip Report**

3.0 LISTS OF TABLES, AND FIGURES

3.1 List of Tables

3.2 List of Figures

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4.0 INTRODUCTION, BACKGROUND, AND PROCESS

4.1 Introduction and Background

Section 4.1 reviews background topics including the 2021 *Illex* Research Track Assessment (RTA), the MAFMC's Risk Policy as it applies to *Illex*, the MAFMC's Ecosystem Approach to Fisheries Management (EAFM), and current *Illex* management measures.

The 2021 *Illex* RTA (NEFSC 2022c)

Attempts to develop a new stock assessment model were not successful and no biological reference points could be specified. Research conducted, particularly on aging and maturation, could lead to better models in the future, but in the meantime the SSC will likely continue to base ABC recommendations on a risk analysis of escapement estimates based on the MAFMC's Risk Policy and candidate reference points used in other squid fisheries. The SSC has recommended continuation of the 2022 ABC of 40,000 MT for 2023 (MAFMC SSC 2022b). In March 2023 the SSC received an updated analysis using data through 2022 and could have revised the 2023 *Illex* ABC recommendation but did not (https://www.mafmc.org/ssc).

The MAFMC's Risk Policy

The risk policy specifies the MAFMC's acceptable tolerance of risk for overfishing. The risk policy works in conjunction with the SSC's application of the MAFMC's acceptable biological catch (ABC) control rule to account for scientific uncertainty to determine an ABC for a specific stock. For a stock like *Illex* where an overfishing level (OFL) has not been quantified, the relevant regulations[1] state that "An ABC for stocks with an OFL that cannot be specified will be determined by using control rules based on biomass and catch history and application of the MAFMC's risk policy found in § 648.21(a) through (d)." § 648.21(d) applies for a "Stock without an OFL or OFL proxy." In such cases, "ABC levels may not be increased until such time that an OFL has been identified." However, "The SSC may deviate from paragraph (d)(1) of this section, provided that the following two criteria are met: Biomass-based reference points indicate that the stock is greater than BMSY and stock biomass is stable or increasing, or if biomass based reference points are not available, best available science indicates that stock biomass is stable or increasing; and the SSC provides a determination that, based on best available science, the recommended increase to the ABC is not expected to result in overfishing. Any such deviation must include a description of why the increase is warranted, description of the methods used to derive the alternative ABC, and a certification that the ABC is not likely to result in overfishing on the stock."

MAFMC's Ecosystem Approach to Fisheries Management (EAFM)

The MAFMC's Ecosystem Approach to Fisheries Management (EAFM) Guidance Document (https://www.mafmc.org/eafm) states "It shall be the policy of the MAFMC to support the maintenance of an adequate forage base in the Mid-Atlantic to ensure ecosystem productivity, structure and function and to support sustainable fishing communities" and "the Council could

[1] https://www.ecfr.gov/current/title-50/chapter-VI/part-648#648.20

adopt biological reference points (overfishing levels or OFL) for forage stocks that are more conservative than the required MSA standard of FMSY." Acknowledging that the science to evaluate the biological and socioeconomic tradeoffs of more precautionary management is lacking, the MAFMC has adopted a policy that it would promote data collection and development of analyses to get to the point where the Council could evaluate the relevant tradeoffs and "establish an optimal forage fish harvest policy."

Current Management Measures

Management measures are overall designed to ensure that the ABC is not exceeded and that optimum yield is caught. The fishery operates under limited access with approximately 75 limited access permits, of which typically less than half participate in any given year. Once the ABC is recommended by the SSC, the MSB Monitoring Committee provides recommendations on discard set-asides and closure provisions, which the MSB Committee and/or MAFMC consider for approval of relevant specifications. If other operational issues become apparent as the previous year's fishery is reviewed, additional measures may be considered as allowed in relevant regulations. Some measures could require a framework adjustment or amendment to modify or create. Currently 4.52% of the ABC is set-aside for likely discards, based on historical data. The remainder (38,192 MT) constitutes the Initial Optimum Yield (IOY), and is also the Domestic Annual Harvest (DAH) and Domestic Annual Processing (DAP) specifications because the domestic fleet can, and has the intention to, catch and process the entire IOY. The fishery is provided a closure notice for a date on which NOAA Fisheries projects that 96% of the quota will be landed. An open access incidental permit allows retention of 10,000 pounds of *Illex*, and if the fishery closes then all vessels are subject to a 10,000-pound trip limit. The specifications may be adjusted by the Regional Administrator, in consultation with the MAFMC, during the fishing year through the Federal Register. Various other regulations are summarized at NOAA Fisheries' website for *Illex*: https://www.fisheries.noaa.gov/species/shortfin-squid, and MAFMC and NOAA fishery regulations are described in full at https://www.ecfr.gov/current/title-50/chapter-VI. The fishery caught its quota from 2017-2021 after not catching the quota for a number of years. Less than half the quota was caught in 2022.

4.2 Process

The specifications process is detailed in the FMP's implementing regulations, but generally begins with a review of assessment findings by the SSC, and the SSC sets an ABC. This took place at the SSC's July 2022 meeting - https://www.mafmc.org/ssc-meetings/2022/july-25-26. The MSB Monitoring Committee then made additional recommendations for the specifications later in July 2022 - https://www.mafmc.org/council-events/2022/msb-mon-com-july28. The MAFMC adopted 2023 *Illex* specifications at its August 2022 meeting: https://www.mafmc.org/briefing/august-2022. Public comments were taken at these meetings. NOAA Fisheries will publish a proposed rule for these specifications, which will also solicit public comments. After reviewing any comments, NOAA Fisheries will publish a final rule.

This EA is being prepared using the 2020 CEQ NEPA Regulations as modified by the Phase 1 2022 regulations. The effective date of the 2022 revisions was May 20, 2022 and reviews begun

after this date are required to apply the 2020 regulations as modified by the Phase 1 revisions unless there is a clear and fundamental conflict with an applicable statute. This EA began in late 2022 and accordingly proceeds under the 2020 regulations as modified by the Phase 1 revisions.

4.3 Purpose and Need

The purpose of this action is to set specifications for the 2023 *Illex* fishery. This action is needed to prevent overfishing and achieve optimum yield. Per the Magnuson-Stevens Fishery Conservation and Management Act (MSA), optimum yield is defined as the amount of fish that will provide the greatest overall benefit to the nation based on the stock's maximum sustainable yield as reduced by relevant economic, social, and/or ecological factors.

4.4 Regulatory Authority

The MSA states that FMPs shall "contain the conservation and management measures… necessary and appropriate for the conservation and management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery." As discretionary provisions of FMPs, the MSA also allows restriction of fishing by gear/area/time/season. Seasonal management based on attainment of quotas has been previously incorporated into the MSB FMP.

4.5 Management Unit and Geographic Scope

The management unit (fish stock definition) in the MSB FMP for *Illex* includes all *Illex* under U.S. jurisdiction in the Northwest Atlantic, with a core fishery management area from Maine to North Carolina.

4.6 FMP History and Management Objectives

Management of the MSB fisheries began through the implementation of three separate FMPs (one each for Atlantic mackerel[2], squids, and butterfish) in 1978. The plans were merged in 1983. Chub mackerel was added in 2020. Over time a wide variety of management issues have been addressed including stock rebuilding, habitat conservation, bycatch minimization, and limiting participation in the fisheries. The history of the plan and its amendments can be found at http://www.mafmc.org/fisheries/fmp/msb. The MAFMC recently updated the goals (see Goals 1-3 below) and objectives of the FMP:

[2] Unless otherwise noted, "mackerel" refers to Atlantic mackerel in this document.

The updated MSB FMP objectives are:

Goal 1: Maintain sustainable MSB stocks.

Objective 1.1: Prevent overfishing and maintain sustainable biomass levels that achieve optimum yield in the MSB fisheries.

Objective 1.2: Consider and, to the extent practicable, account for the roles of MSB species/fisheries in the ecosystem.

Goal 2: Acknowledging the difficulty in quantifying all costs and benefits, achieve the greatest overall net benefit to the Nation, balancing the needs and priorities of different user groups and effects of management on fishing communities.

Objective 2.1: Provide the greatest degree of freedom and flexibility to harvesters and processors (including shoreside infrastructure) of MSB resources consistent with attainment of the other objectives of this FMP, including minimizing additional restrictions.

Objective 2.2: Allow opportunities for commercial and recreational MSB fishing, considering the opportunistic nature of the fisheries, changes in availability that may result from changes in climate and other factors, and the need for operational flexibility.

Objective 2.3: Consider and strive to balance the social and economic needs of various sectors of the MSB fisheries (commercial including shoreside infrastructure and recreational) as well as other fisheries or concerns that may be ecologically linked to MSB fisheries.

Objective 2.4: Investigate opportunities to access international/shared resources of MSB species.

Goal 3: Support science, monitoring, and data collection to enhance effective management of MSB fisheries.

Objective 3.1: Improve data collection to better understand the status of MSB stocks, the role of MSB species in the ecosystem, and the biological, ecological, and socioeconomic impacts of management measures, including impacts to other fisheries.

Objective 3.2: Promote opportunities for industry collaboration on research.

Objective 3.3: Encourage research that may lead to practicable opportunities to further reduce bycatch in the MSB fisheries.

5.0 WHAT ALTERNATIVES ARE CONSIDERED IN THIS DOCUMENT?

The only aspects of *Illex* management under consideration to be changed in this action are the ABC and quota, including measures that close the fishery when the quota is approached (at 96%). Other measures like permitting and reporting would also remain as current, as detailed in the Code of Federal Regulations and summarized at https://www.fisheries.noaa.gov/species/shortfin-squid.

The MAFMC's SSC recommended continuing the current 40,000 MT ABC to start 2023. This ABC emerged from the Council-supported escapement analysis and was associated with an approximately 5% chance of exceeding the ⅔ F:M generic guidance for data poor species. Model results suggest this provides greater than 50% escapement for *Illex* squid (MAFMC SSC 2022b see https://www.mafmc.org/ssc-meetings/2022/july-25-26 for additional detail). In March 2023 the SSC will review updated analyses and may revise their ABC recommendation. Accordingly, this Environmental Assessment (EA) considers a preferred *Illex* ABC of 40,000 MT for 2023 and a range 50% lower or higher (20,000 and 60,000 MT). No other changes are proposed for 2023. Since the MSB FMP provides that the existing measures are maintained until new measures are finalized, "no action" maintains the "status quo," which in this case is also the "preferred alternative."

5.1 ALTERNATIVE 1: NO ACTION, STATUS QUO, AND PREFERRED ALTERNATIVE FOR 2023

Table 1. Alternative 1

Specification	Illex 2023 (MT or %)	Rationale
(a) Overfishing Limit (OFL)	Not available	unknown
(b) Acceptable Biological Catch (ABC)	40,000	From SSC
(c) Commercial Discard Set-Aside[3]	4.52%	from recent observations
(d) Initial Optimum Yield (IOY)/DAH/DAP	38,192	ABC - discard set-aside

[3] Currently, 4.52% of the ABC, or 1,808 MT, is set aside for discards based on historical observations. The Mackerel, Squid, and Butterfish (MSB) Monitoring Committee1 recently (March 2023) observed that discards varied from 315 MT to 1,407 MT from 2012-2021 and that these discard estimates may be impacted by lower observer coverage in 2020-2021 due to COVID-19. Noting the two years before COVID-19 (2018-2019) had discards of 1,407 MT and 1,331 MT, and that those were years when the quota was achieved, the Monitoring Committee concluded that the average, 1,369 MT, would avoid the specifications being exceeded. As such, they recommended this discard set-aside for future specifications. 1,369 MT is 3.42% of 40,000 MT.

5.2 ALTERNATIVE 2: 50% LOWER RANGE FOR 2023

Table 2. Alternative 2

Specification	Illex 2023 (MT or %)	Rationale
(a) Overfishing Limit (OFL)	Not available	unknown
(b) Acceptable Biological Catch (ABC)	20,000	Lower Range
(c) Commercial Discard Set-Aside	4.52%	from recent observations
(d) Initial Optimum Yield (IOY)/DAH/DAP	19,096	ABC - discard set-aside

5.3 ALTERNATIVE 3: 50% HIGHER RANGE FOR 2023

Table 3. Alternative 3

Specification	Illex 2023 (MT or %)	Rationale
(a) Overfishing Limit (OFL)	Not available	unknown
(b) Acceptable Biological Catch (ABC)	60,000	Upper Range
(c) Commercial Discard Set-Aside	4.52%	from recent observations
(d) Initial Optimum Yield (IOY)/DAH/DAP	57,288	ABC - discard set-aside

6.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT AND FISHERIES

6.1 Description of the Managed Resource (*Illex*) and Non-Target Species

Illex (NEFSC 2022c)

Illex inhabits the continental shelf and slope waters of the Northwest Atlantic Ocean between Iceland and the east coast of Florida and constitutes a unit stock throughout its range. The species is highly migratory, growth is rapid and the lifespan is short, up to 217 days for individuals inhabiting the U.S. shelf. Illex illecebrosus is semelparous and females spawn and die within several days of mating. Age data indicate that spawning occurs throughout the year and that the first several months of the U.S. fishery are supported by the winter cohort. The onset and duration of the fisheries occur in relation to annual migration patterns on and off the continental shelf which appear to be highly influenced by environmental conditions.

The 2021 *Illex* Research Track Assessment (RTA) was not able to develop a basis for stock status determination. The 2019 stock status designation resulting from the 2021 RTA was "Unknown" with respect to both overfished and overfishing, due to the lack of an accepted method of estimating F and B and the lack of appropriate Biological Reference Points for this subannual species. The RTA Review Panel agreed with the RTA WG Report that indications from the various assessment approaches were that the stock was lightly fished in 2019. However, although the Panel agreed that this was likely, their report stated that the term "lightly fished" should be interpreted with caution because it has no specific definition relating to sustainable exploitation. In light of the failure of the assessment to produce accepted reference points to guide ABC setting, the SSC had to rely on an ad-hoc approach to setting an ABC that would meet the Council's risk policy to avoid overfishing and achieve optimum yield. Alternative quotas were examined with respect to their consequences for risk of exceeding escapement targets ranging from 40% to 50%, as has been used for other squid fisheries. In addition, harvest rates where F=2/3 M have been used for forage species in various assessments around the world. The methodology allowed the SSC to examine the probability of violating the reference point for various levels of catch limits ranging from 24,000 to 60,000 mt. A 40,000 MT ABC was associated with an approximately 5% chance of exceeding a ⅔ F:M generic guidance for data poor species. Model results suggested a 40,000 MT ABC provided greater than 50% escapement for *Illex* squid, and a catch of 60,000 MT increases the chance of less escapement in some years. Previous SSC review (March 2022) of the analyses allowed them to conclude that:

- Escapement has been relatively high over the last 10 years, suggesting a relatively small impact of the fishery on the component of the stock that is exploited.
- Assumptions regarding parameters that were inputs to the analyses were thought to lead to minimum likely estimates.
- Distributions of the joint estimate of F:M suggests that exploitation rate in the fishery is likely low.
- By comparison to empirical escapement reference points used to manage squid fisheries

elsewhere globally, the current ABC levels are associated with low risks of exceeding those escapement standards.
• A 40,000 MT ABC will lead to a low risk of overfishing.
(MAFMC SSC 2022, MAFMC 2022b)

While *Illex* is biologically a unit stock, the U.S. and Canadian assessments and quotas are currently analyzed, set, and monitored independently (unlike for example Atlantic mackerel where U.S. and Canadian data are integrated into both assessments), so the focus of this EA is on the U.S. component of the fishery. More information on the Canadian component is available at https://www.nafo.int/Science/Stocks-Advice and the potential usefulness of the NAFO assessment for U.S. management was considered previously by the Council's SSC, e.g. https://www.mafmc.org/s/g_NAFO_Didden.pdf at https://www.mafmc.org/ssc-meetings/2020/may-12-13.

Landings and survey information developed for 2022 specifications setting is presented below (Table 4, Figures 1-4).

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Table 4. *Illex* catches and landings limits (TACs) (mt) in NAFO Subareas (SA) 5+6 (within the U.S. EEZ after 1976) and Subareas 3+4 (NAFO and Canadian waters) 1963-2021

	Cape Hatteras to the Gulf of Maine SA 5+6 Landings			SA 3+4	SA 3-6 Total	SA 5+6		SA 3-6 Total			SA 5+6		
Year	Domestic (mt)	International (mt)	**Total (mt)**	Landings (mt)	**Landings (mt)**	Discards (mt)	**Catches (mt)**	**Catches (mt)**	**TAC (mt)** SA 3+4	SA 5+6	% of TAC Harvested	Fishery Closure Dates	% of SA 3-6 Landings
1963	810		**810**	2,222	**3,032**								
1964	358	2	**360**	10,777	**11,137**								
1965	444	78	**522**	8,264	**8,786**								
1966	452	118	**570**	5,218	**5,788**								
1967	707	288	**995**	7,033	**8,028**								
1968	678	2,593	**3,271**	56	**3,327**								
1969	562	975	**1,537**	86	**1,623**								
1970	408	2,418	**2,826**	1,385	**4,211**								
1971	455	6,159	**6,614**	8,906	**15,520**								
1972	472	17,169	**17,641**	1,868	**19,509**								
1973	530	18,625	**19,155**	9,877	**29,032**								
1974	148	20,480	**20,628**	437	**21,065**					71,000			98
1975	107	17,819	**17,926**	17,696	**35,622**					71,000			50
1976	229	24,707	**24,936**	41,767	**66,703**				25,000	30,000	83		37
1977	1,024	23,771	**24,795**	83,480	**108,275**				25,000	35,000	71		23
1978	385	17,207	**17,592**	94,064	**111,656**				100,000	30,000	59		16
1979	1,593	15,748	**17,341**	162,092	**179,433**				120,000	30,000	58		10
1980	299	17,529	**17,828**	69,606	**87,434**				150,000	30,000	59		20
1981	615	14,956	**15,571**	32,862	**48,433**				150,000	30,000	52		32
1982	5,871	12,762	**18,633**	12,908	**31,541**				150,000	30,000	62		59
1983	9,775	1,809	**11,584**	426	**12,010**				150,000	30,000	39		96
1984	9,343	576	**9,919**	715	**10,634**				150,000	30,000	33		93
1985	5,033	1,082	**6,115**	673	**6,788**				150,000	30,000	20		90
1986	6,493	977	**7,470**	111	**7,581**				150,000	30,000	25		99
1987	10,102	0	**10,102**	562	**10,664**	517	**10,619**	**11,181**	150,000	30,000	34		95
1988	1,958	0	**1,958**	811	**2,769**	100	**2,058**	**2,869**	150,000	30,000	7		71
1989	6,801	0	**6,801**	5,971	**12,772**	498	**7,299**	**13,270**	150,000	30,000	23		53
1990	11,670	0	**11,670**	10,975	**22,645**	341	**12,011**	**22,986**	150,000	30,000	39		52
1991	11,908	0	**11,908**	2,913	**14,821**	1,150	**13,058**	**15,971**	150,000	30,000	40		80
1992	17,827	0	**17,827**	1,578	**19,405**	248	**18,075**	**19,653**	150,000	30,000	59		92
1993	18,012	0	**18,012**	2,686	**20,698**	443	**18,455**	**21,141**	150,000	30,000	60		87
1994	18,350	0	**18,350**	5,951	**24,301**	354	**18,704**	**24,655**	150,000	30,000	61		76
1995	13,976	0	**13,976**	1,055	**15,031**	58	**14,034**	**15,089**	150,000	30,000	47		93
1996	16,969	0	**16,969**	8,742	**25,711**	243	**17,212**	**25,954**	150,000	21,000	81		66
1997	13,356	0	**13,356**	15,614	**28,970**	1,002	**14,358**	**29,972**	150,000	19,000	70		46
1998	23,568	0	**23,568**	1,902	**25,470**	586	**24,154**	**26,056**	150,000	19,000	124	8/28	93
1999	7,388	0	**7,388**	305	**7,693**	1,094	**8,482**	**8,787**	75,000	19,000	39		96
2000	9,011	0	**9,011**	366	**9,377**	106	**9,117**	**9,483**	34,000	24,000	38		96
2001	4,009	0	**4,009**	57	**4,066**	466	**4,475**	**4,532**	34,000	24,000	17		99
2002	2,750	0	**2,750**	260	**3,010**	157	**2,907**	**3,167**	34,000	24,000	11		91
2003	6,391	0	**6,391**	1,133	**7,524**	166	**6,557**	**7,690**	34,000	24,000	27		85
2004	26,097	0	**26,097**	2,574	**28,671**	1,402	**27,499**	**30,073**	34,000	24,000	109	9/21	91
2005	12,011	0	**12,011**	578	**12,589**	1,850	**13,861**	**14,439**	34,000	24,000	50		95
2006	13,944	0	**13,944**	6,981	**20,925**	1,556	**15,500**	**22,481**	34,000	24,000	58		67
2007	9,022	0	**9,022**	246	**9,268**	639	**9,661**	**9,906**	34,000	24,000	38		97
2008	15,900	0	**15,900**	534	**16,434**	1,529	**17,429**	**17,963**	34,000	24,000	66		97
2009	18,418	0	**18,418**	718	**19,136**	672	**19,090**	**19,808**	34,000	24,000	77		96
2010	15,825	0	**15,825**	120	**15,945**	569	**16,394**	**16,514**	34,000	24,000	66		99
2011	18,797	0	**18,797**	126	**18,923**	690	**19,487**	**19,613**	34,000	23,328	81		99
2012	11,709	0	**11,709**	47	**11,756**	502	**12,211**	**12,258**	34,000	22,915	51		100
2013	3,792	0	**3,792**	27	**3,819**	315	**4,107**	**4,134**	34,000	22,915	17		99
2014	8,767	0	**8,767**	21	**8,788**	575	**9,342**	**9,363**	34,000	22,915	38		100
2015	2,422	0	**2,422**	14	**2,436**	451	**2,873**	**2,887**	34,000	22,915	11		99
2016	6,684	0	**6,684**	152	**6,836**	320	**7,004**	**7,156**	34,000	22,915	29		98
2017	22,516	0	**22,516**	365	**22,881**	855	**23,371**	**23,736**	34,000	22,915	98	9/15	98
2018	24,117	0	**24,117**	1,545	**25,662**	1,407	**25,524**	**27,069**	34,000	22,915	105	8/15	94
2019	27,164	0	**27,164**	2,914	**30,078**	1,331	**28,495**	**31,409**	34,000	24,825	109	8/21	90
2020	28,447	0	**28,447**	3,099	**31,546**	1,365	**29,812**	**32,911**	34,000	28,644	99	8/31	90
2021	30,886	0	**30,886**	11,455	**42,341**	535	**31,421**	**42,876**	34,000	31,478	98	8/30	73

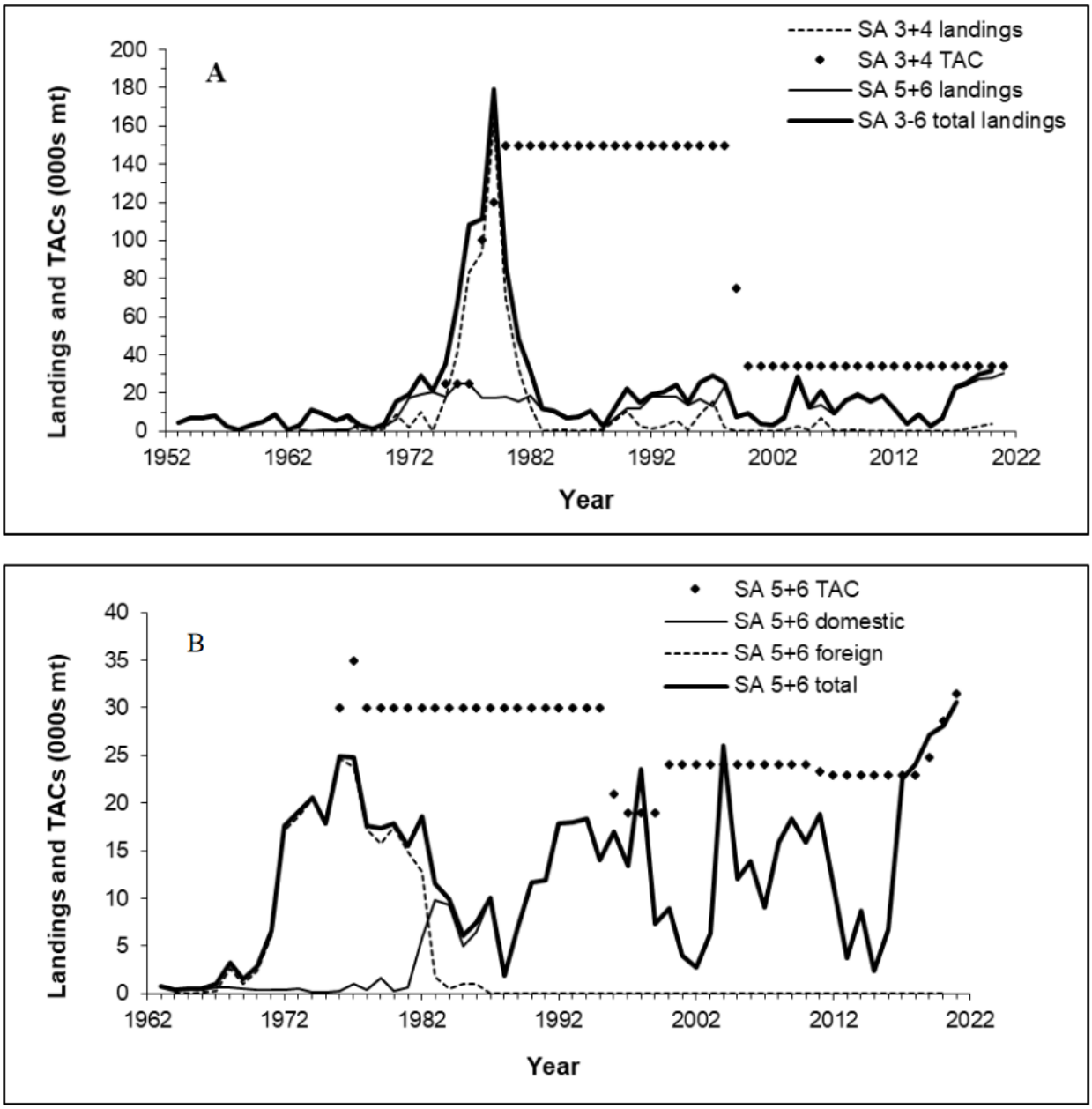

Figure 1. Landings of Illex illecebrosus in (A) NAFO Subareas 3-6 and (B) NAFO Subareas 5+6, with respect to landings limits 1963-2021.

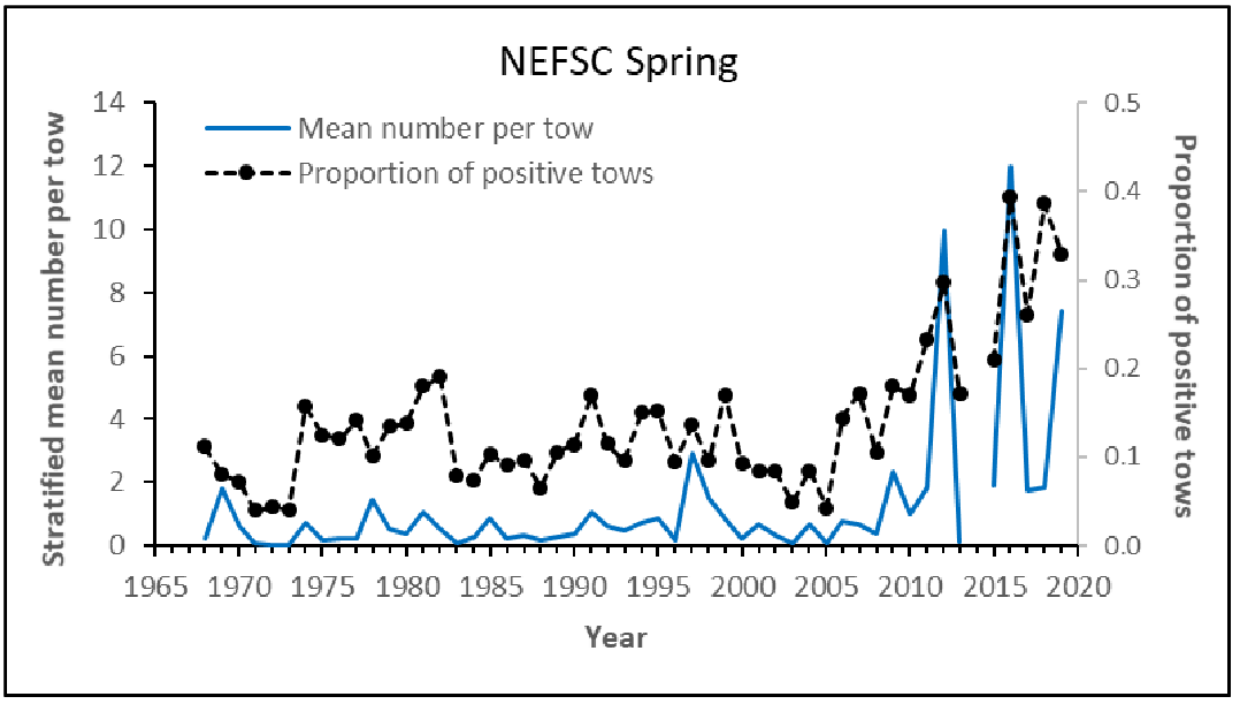

Figure 2. Trends in *Illex* relative abundance indices and the proportion of positive tows derived with data from NEFSC **spring** bottom trawl surveys conducted on the U.S. shelf during 1968-2019.

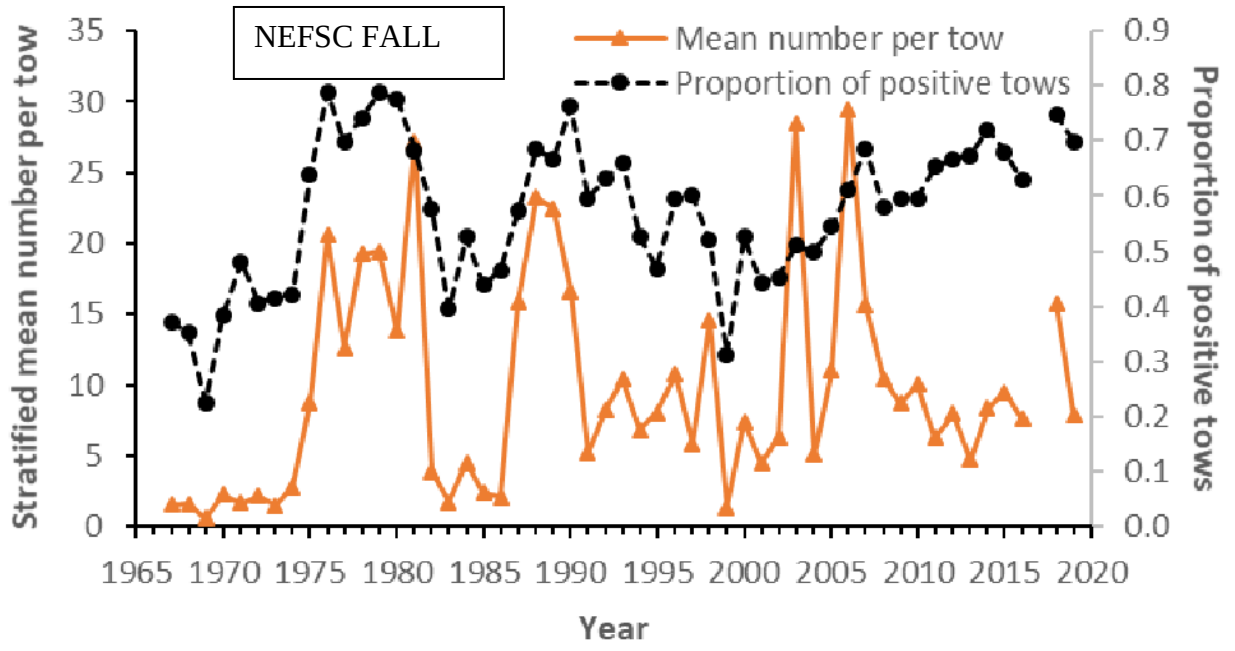

Figure 3. Trends in *Illex* relative abundance indices and the proportion of positive tows derived with data from NEFSC **fall** bottom trawl surveys conducted on the U.S. shelf during 1967-2019.

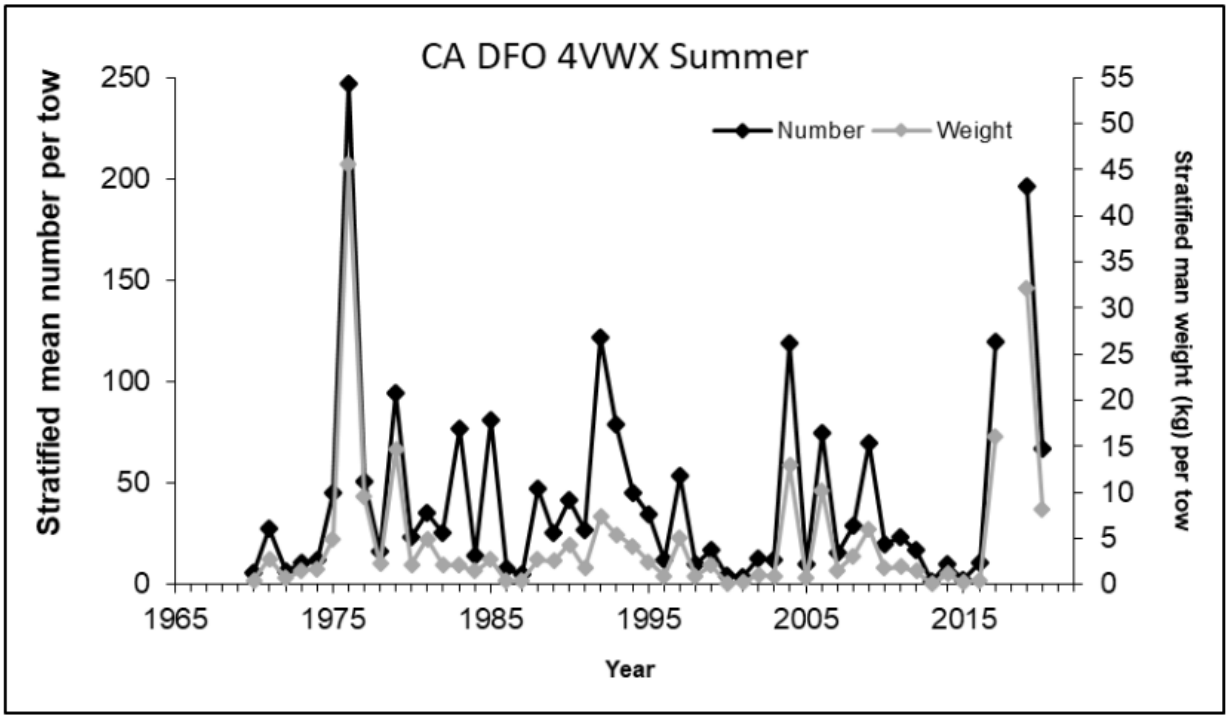

Figure 4. Illex illecebrosus relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) indices derived with data from the Canada DFO summer (July) bottom trawl surveys conducted in Division 4VWX during 1970-2019.*

*Indices were not computed for the 2018 survey because large areas of Illex habitat could not be sampled due to survey vessel mechanical problems.

Non-Target Species

Due to reduced observer coverage in 2020-2022 due to Covid-19, observer data from 2017-2019 still best describe incidental catch in the *Illex* fishery. On the *Illex* trips identified in this analysis, the 2017-2019 overall discard rate was 2%. For non-target species that are managed under their own FMP, incidental catch/discards are also considered as part of the management of that fishery.

The primary database used to assess discarding is the NMFS Observer Program database, which includes data from trips that had trained observers onboard to document discards. One critical aspect of using this database to describe discards is to correctly define the trips that constitute a given directed fishery. A flexible criteria of what captains initially intend to target, how they may adjust targeting over the course of a trip, and what they actually catch would be ideal but is impracticable. From 2017-2019 there were on average 61 observed trips annually where *Illex* accounted for at least 50% of retained catch, and those trips form the basis of the following analysis. These trips made 1,298 hauls of which 93% were observed. Hauls may be unobserved

for a variety of reasons, for example transfer to another vessel without an observer, observer not on station, haul slipped (dumped) in the water before observing, etc.

The observed *Illex* kept on these trips accounted for approximately 15% of the total *Illex* landed (this is the overall coverage rate based on weight). While a very rough estimate, especially given non-accounting for spatial and temporal trends, one can use the information in the table immediately following and the fact that about 24,597 mt of *Illex* were caught annually 2017-2019 to roughly estimate annual incidental catch and discards for the species in the table. Readers are strongly cautioned that while this is a reasonable approach for a quick, rough, and relative estimate given the available data, it is highly imprecise and does not follow the protocol used for official discard estimates. As a minimum threshold, only species estimated to be caught at a level more than 10,000 pounds per year are included (captures 92% of all discards). Species with a "*" are overfished, subject to overfishing, or otherwise considered depleted (none are caught in substantial quantities in the *Illex* fishery).

As listed in the table below the amounts of the various species (that are within this FMP or others) discarded in the *Illex* fishery, while rough approximations, are very low, including for the species noted to be overfished or otherwise depleted (Atlantic mackerel, bluefish, and red hake[4]). The amounts discarded for other species including those in the FMP (*Illex* squid, longfin squid, butterfish, and chub mackerel) all comprise a negligible portion of the catch and/or catch limits for those species.

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[4] The 2023 ABC for Atlantic mackerel is over 17 million pounds, the 2023 bluefish ABC is over 30 million pounds, and the 2023 combined red hake ABCs are over 10 million pounds.

Table 5. Incidental Catch and Discards in the *Illex* Squid Fishery.

NE Fisheries Science Center Common Name	Pounds Observed Caught	Pounds Observed Discarded	Of all discards observed, percent that comes from given species	Percent of given species that was discarded	Pounds of given species caught per mt Illex Kept	Pounds of given species discarded per mt Illex Kept	Rough Annual Catch (pounds) based on 3-year (2017-2019) average of Illex landings (24,597 mt)	Rough Annual Discards (pounds) based on 3-year (2017 2019) average of Illex landings (24,597 mt)
SQUID, SHORT-FIN	24,472,176	236,856	52%	1%	2,226	22	54,757,008	529,970
SQUID, ATL LONG-FIN	137,434	1,266	0%	1%	13	0	307,510	2,833
DORY, BUCKLER (JOHN)	59,564	15,045	3%	25%	5	1	133,275	33,663
MACKEREL, CHUB	50,659	18,909	4%	37%	5	2	113,349	42,310
BUTTERFISH	41,301	37,276	8%	90%	4	3	92,411	83,406
HAKE, SPOTTED	35,344	32,203	7%	91%	3	3	79,082	72,054
DOGFISH, SMOOTH	19,930	19,892	4%	100%	2	2	44,595	44,508
BEARDFISH	14,033	5,541	1%	39%	1	1	31,398	12,398
HAKE, SILVER (WHITING	9,919	8,168	2%	82%	1	1	22,194	18,275
FISH, NK	8,332	8,310	2%	100%	1	1	18,642	18,595
SEA ROBIN, NORTHERN	8,078	8,078	2%	100%	1	1	18,075	18,075
MACKEREL, ATLANTIC *	7,902	5,374	1%	68%	1	0	17,682	12,024
SCUP	7,774	5,561	1%	72%	1	1	17,395	12,443
SQUID, NK	6,020	6,020	1%	100%	1	1	13,470	13,470
BLUEFISH *	5,052	1,836	0%	36%	0	0	11,303	4,108
MONKFISH (GOOSEFISH)	4,742	2,211	0%	47%	0	0	10,609	4,947
HAKE, RED (LING) *	4,637	4,280	1%	92%	0	0	10,376	9,576

The observer program creates individual animal records for some fish species of interest, mostly larger pelagics and/or elasmobranchs, as well as tagged fish. Counts of these individual fish records from the same trips are provided in the table below.

Table 6. Counts of fish in Individual Animal Records on observed *Illex* trips from 2017-2019

COMNAME	count
DOLPHINFISH (MAHI MAH	4
GROUPER, SNOWY	3
MARLIN, WHITE	1
MOLA, NK	4
MOLA, OCEAN SUNFISH	31
MOLA, SHARPTAIL	1
RAY, TORPEDO	37
SHARK, ATL ANGEL	1
SHARK, BASKING	14
SHARK, BLUE (BLUE DOG	1
SHARK, CARCHARHINID,N	4
SHARK, GREENLAND	2
SHARK, HAMMERHEAD, SC	14
SHARK, HAMMERHEAD,NK	7
SHARK, NIGHT	3
SHARK, NK	3
SHARK, SANDBAR (BROWN	48
SHARK, SPINNER	1
SHARK, THRESHER, BIGE	1
SHARK, TIGER	17
STINGRAY, ROUGHTAIL	19
SWORDFISH	108
TUNA, BLUEFIN	1
TUNA, LITTLE (FALSE A	9
TUNA, YELLOWFIN	3
WRECKFISH	1

6.2 Human Communities and Economic Environment

This section describes the performance of the *Illex* fishery to allow the reader to understand its socio-economic importance. The EA for the rejected *Illex* Permit Amendment contains additional detail about the *Illex* fishery, including demographic information on key ports – see https://www.mafmc.org/supporting-documents. Also see NMFS' communities page at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/socioeconomics/socioeconomic-cultural-and-policy-research-northeast.

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

Recent Fishery Performance

This section establishes a descriptive baseline for the fishery with which to compare actual and predicted future socio-economic changes that result from management actions. The 2022 *Illex* Fishery Information Document and 2022 MSB Fishery Performance Report have details on recent commercial *Illex* fishing activity, summarized below. These are available at https://www.mafmc.org/msb. There is negligible recreational catch.

Figure 1 below, from a previous Science Center data update, describes *Illex* catch 1963-2019 and highlights the early foreign fishery and then domestication of the fishery. Figures 2-3 describe domestic landings, ex-vessel revenues, and prices (inflation adjusted) 1996-2021. Data since 1996 is more reliable than previous data due to improvements in reporting requirements. The Gross Domestic Product Implicit Price Deflator was used to report revenues/prices as "2021 dollars." Figure 4 illustrates preliminary weekly 2021 (yellow-orange) and 2022 (blue) landings through the year.

Most 2021 *Illex* landings occurred in RI, NJ, and MA (in that order), but further breakdown may violate data confidentiality rules. Table 3 describes preliminary 2021 *Illex* landings by gear type. Table 4 provides preliminary information on *Illex* landings by statistical area for 2021. Table 5 describes vessel participation over time.

In summary, 33 vessels landed over 10,000 pounds of Illex in 2021, with total *Illex* landings valued at $29.7 million. From 2019-2021 *Illex* ex-vessel revenues varied from $25.3-$29.7 million, averaging $28.2 million (2021 constant dollars). Preliminary 2022 landings totaled 5,410 MT or 11.6 million pounds (unpublished data, NMFS landings databases).

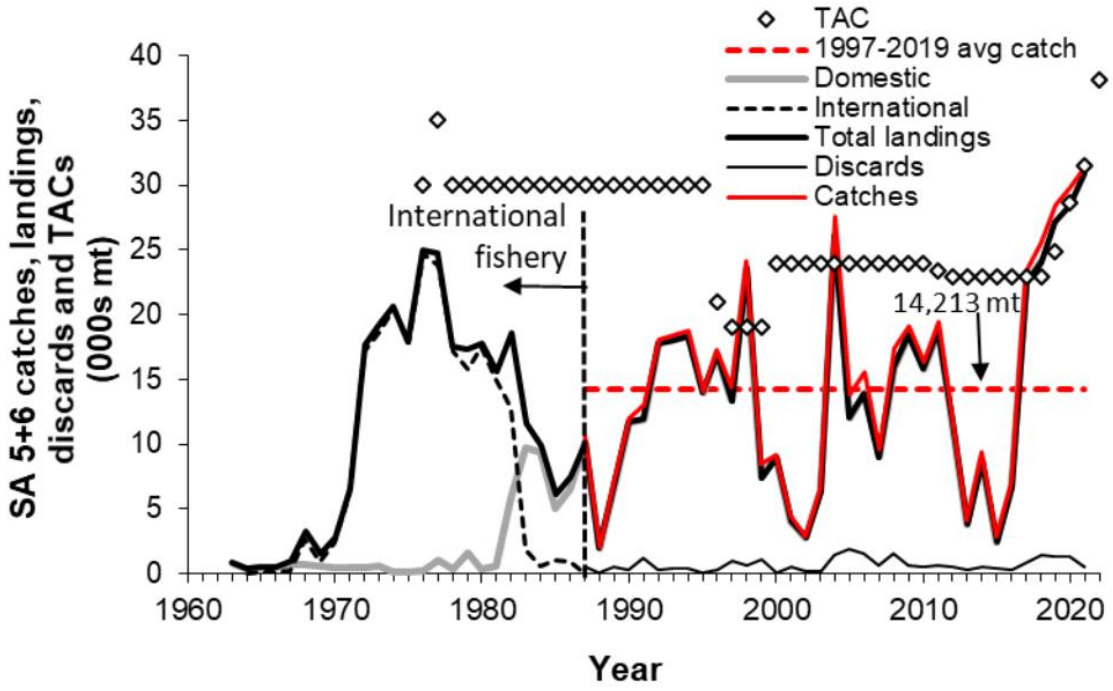

Figure 5. Total annual U.S. *Illex* catches (mt) by the U.S. and other countries for 1963-2021.
Sources: NEFSC *Illex* Data update, available at https://www.mafmc.org/ssc-meetings/2022/july-25-26 and NMFS unpublished dealer data.

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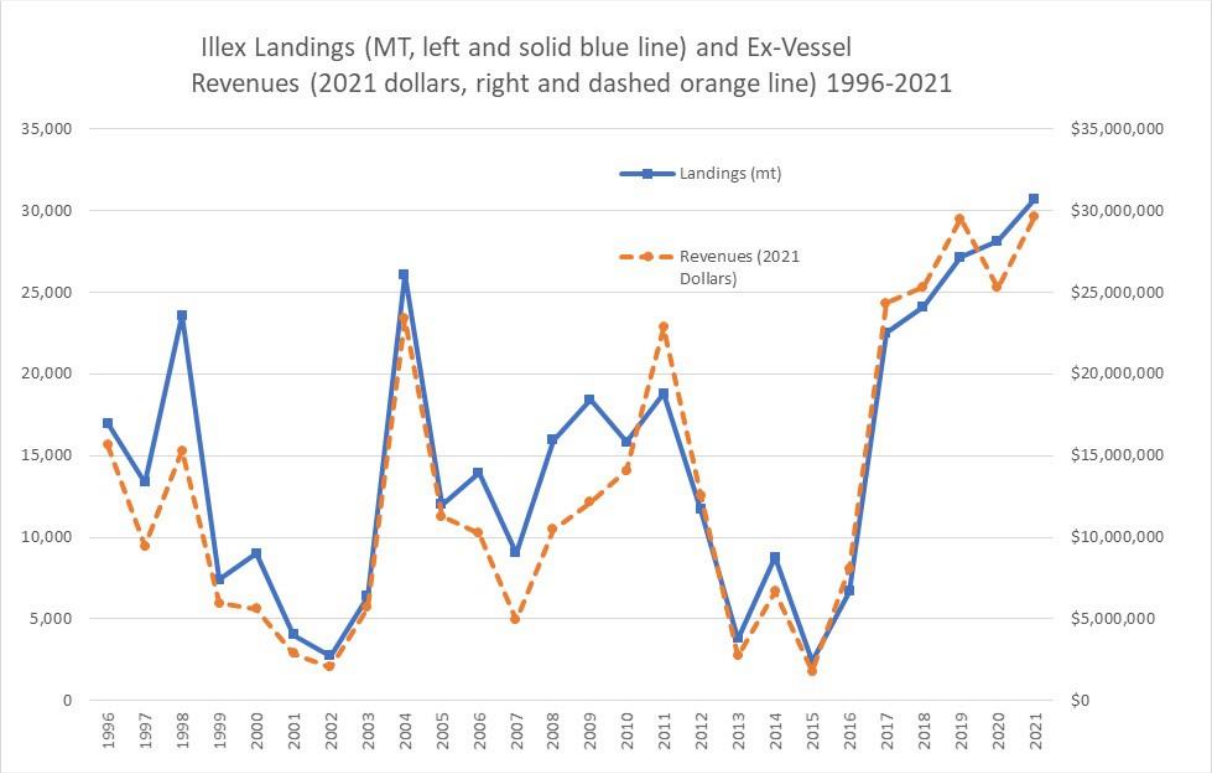

Figure 6. U.S. *Illex* Landings and Ex-Vessel Values 1996-2021. Source: NMFS unpublished dealer data.

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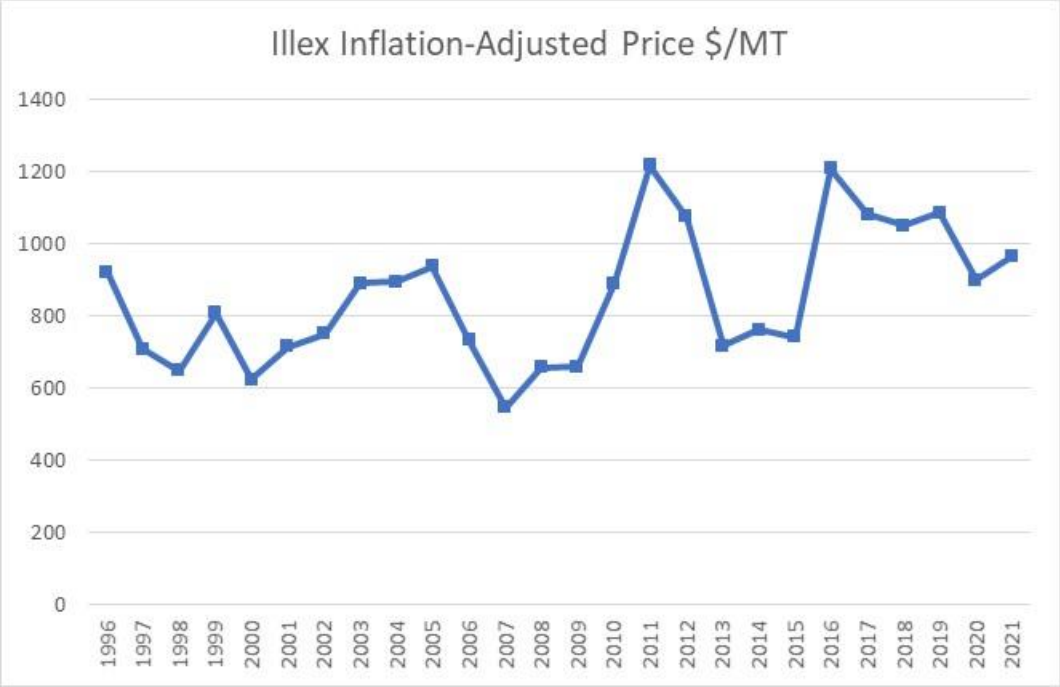

Figure 7. Ex-Vessel *Illex* Prices 1996-2021 Adjusted to 2021 Dollars Source: NMFS unpublished dealer data.

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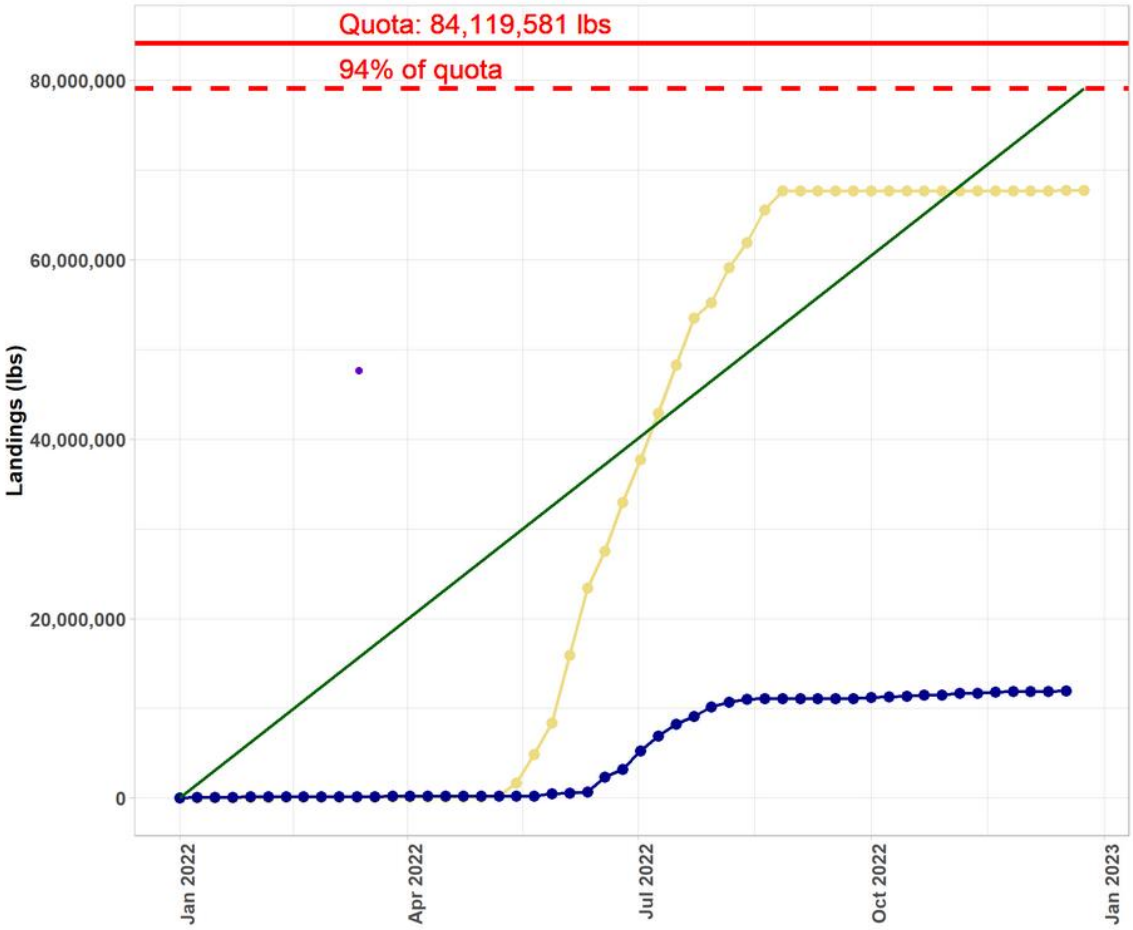

Figure 8. U.S. Preliminary *Illex* landings; 2022 in dark blue, 2021 in yellow-orange. Source: https://www.fisheries.noaa.gov/new-england-mid-atlantic/commercial-fishing/quota-monitoring-greater-atlantic-region (Preliminary 2022 landings totaled 5,410 MT or 11.9 million pounds.)

Table 7. Commercial *Illex* landings (live weight) by gear in 2021. Source: NMFS unpublished dealer data.

GEAR	Metric_Tons
Otter Trawl	29,383
Midwater Trawl	1,063
UNKNOWN	266
Other	3
Total	30,714

Table 8. Commercial *Illex* landings by statistical area in 2021. Source: NMFS unpublished VTR data.

NEMAREA	MT
622	17,988
526	3,714
537	2,852
616	1,710
626	1,504
623	920
632	543
636	269
621	193
627	134
Other	265
Total	30,091

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Table 9. Vessel participation over time in the *Illex* Fishery based on annual landings (pounds)

YEAR	Vessels 500,000+	Vessels 100,000 - 500,000	Vessels 50,000 - 100,000	Vessels 10,000 - 50,000	Total
1982	7	7	0	10	24
1983	1	8	7	11	27
1984	4	15	4	6	29
1985	2	6	4	3	15
1986	8	6	4	3	21
1987	7	10	2	1	20
1988	3	3	1	2	9
1989	8	5	1	3	17
1990	12	3	0	1	16
1991	12	1	1	0	14
1992	16	1	0	1	18
1993	19	3	1	3	26
1994	21	7	5	8	41
1995	24	5	2	7	38
1996	24	5	6	4	39
1997	13	9	2	0	24
1998	25	4	1	3	33
1999	6	9	2	10	27
2000	7	7	0	2	16
2001	3	4	1	2	10
2002	2	3	1	1	7
2003	5	6	1	2	14
2004	23	5	2	0	30
2005	10	10	2	2	24
2006	9	8	1	2	20
2007	8	2	1	0	11
2008	12	5	0	0	17
2009	10	3	1	1	15
2010	13	5	0	4	22
2011	17	4	2	0	23
2012	8	3	2	2	15
2013	5	4	3	5	17
2014	5	3	2	2	12
2015	3	0	1	1	5
2016	4	3	3	2	12
2017	14	6	0	0	20
2018	19	7	0	5	31
2019	26	6	0	3	35
2020	25	4	2	1	32
2021	23	8	0	2	33

6.3 Habitat, Including Essential Fish Habitat (EFH)

Pursuant to the MSA / EFH Provisions (50 CFR Part 600.815 (a)(1)), an FMP must describe EFH by life history stage for each of the managed species in the plan. This information was updated via Amendment 11 to the MSB FMP. EFH for the four species managed under this FMP is described using fundamental information on habitat requirements by life history stage that is summarized in a series of EFH source documents produced by NMFS and available at: http://www.nefsc.noaa.gov/nefsc/habitat/efh/. The updated EFH designations (text and maps) are available at https://www.habitat.noaa.gov/apps/efhmapper/. In general, EFH for the MSB species is the water column itself, and the species have temperature and prey preferences/needs that determine the habitat suitability of any particular area/depth, thus fishing activity has minimal impacts. Longfin squid also use hard bottom, submerged vegetation, other natural or artificial structure, and sand or mud to attach/anchor eggs, but there are no known preferences for different types of substrates or indications that fishing activity may negatively impact longfin squid egg EFH (which is separate from impacting the eggs themselves).

There are other lifestages of federally-managed species that have designated EFH that may be susceptible to adverse impacts from the bottom trawls predominantly used in MSB fisheries, depending on the geographic distribution of their essential habitats in relation to the footprint of MSB bottom trawl fishing activity, described in the following table (see Stevenson et al 2004):

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Table 10. EFH descriptions for species vulnerable to trawl gear

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Acadian redfish	Juveniles	Gulf of Maine and the continental slope north of 37°38'N	50-200 in Gulf of Maine, to 600 on slope	Sub-tidal coastal and offshore rocky reef substrates with associated structure-forming epifauna (e.g., sponges, corals) , and soft sediments with cerianthid anemones
Acadian redfish	Adults	Gulf of Maine and the continental slope north of 37°38'N	140-300 in Gulf of Maine, to 600 on slope	Offshore benthic habitats on finer grained sediments and on variable deposits of gravel, silt, clay, and boulders
American plaice	Juveniles	Gulf of Maine and bays and estuaries from Passamaquoddy Bay to Saco Bay, Maine and from Massachusetts Bay to Cape Cod Bay, Massachusetts Bay	40-180	Sub-tidal benthic habitats on mud and sand, also found on gravel and sandy substrates bordering bedrock
American plaice	Adults	Gulf of Maine, Georges Bank and bays and estuaries from Passamaquoddy Bay to Saco Bay, Maine and from Massachusetts Bay to Cape Cod Bay, Massachusetts Bay	40-300	Sub-tidal benthic habitats on mud and sand, also gravel and sandy substrates bordering bedrock
Atlantic cod	Juveniles	Gulf of Maine, Georges Bank, and Southern New England, including nearshore waters from eastern Maine to Rhode Island and the following estuaries: Passamaquoddy Bay to Saco Bay; Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	Mean high water-120	Structurally-complex intertidal and sub-tidal habitats, including eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulder) with and without attached macroalgae and emergent epifauna
Atlantic cod	Adults	Gulf of Maine, Georges Bank, Southern New England, and the Mid-Atlantic to Delaware Bay, including the following estuaries: Passamaquoddy Bay to Saco Bay; Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	30-160	Structurally complex sub-tidal hard bottom habitats with gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae, also sandy substrates and along deeper slopes of ledges
Atlantic halibut	Juveniles & Adults	Gulf of Maine, Georges Bank, and continental slope south of Georges Bank	60-140 and 400-700 on slope	Benthic habitats on sand, gravel, or clay substrates

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Atlantic herring	Eggs	Coastal Gulf of Maine, Georges Bank, and Southern New England	5-90	Sub-tidal benthic habitats on coarse sand, pebbles, cobbles, and boulders and/or macroalgae
Atlantic sea scallop	Eggs	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Inshore and offshore benthic habitats (see adults)
Atlantic sea scallop	Larvae	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Massachusetts Bay, and Cape Cod Bay	No information	Inshore and offshore pelagic and benthic habitats: pelagic larvae ("spat"), settle on variety of hard surfaces, including shells, pebbles, and gravel and to macroalgae and other benthic organisms such as hydroids
Atlantic sea scallop	Juveniles	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Benthic habitats initially attached to shells, gravel, and small rocks (pebble, cobble), later free-swimming juveniles found in same habitats as adults
Atlantic sea scallop	Adults	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Benthic habitats with sand and gravel substrates
Atlantic surfclams	Juveniles and adults	Continental shelf from southwestern Gulf of Maine to Cape Hatteras, North Carolina	Surf zone to about 61, abundance low >38	In substrate to depth of 3 ft
Atlantic wolffish	Eggs	U.S. waters north of 41˚N latitude and east of 71˚W longitude	<100	Sub-tidal benthic habitats under rocks and boulders in nests
Atlantic wolffish	Juveniles	U.S. waters north of 41˚N latitude and east of 71˚W longitude	70-184	Sub-tidal benthic habitats
Atlantic wolffish	Adults	U.S. waters north of 41˚N latitude and east of 71˚W longitude	<173	A wide variety of sub-tidal sand and gravel substrates once they leave rocky spawning habitats, but not on muddy bottom

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Barndoor skate	Juveniles and adults	Primarily on Georges Bank and in Southern New England and on the continental slope	40-400 on shelf and to 750 on slope	Sub-tidal benthic habitats on mud, sand, and gravel substrates
Black sea bass	Juveniles and adults	Continental shelf and estuarine waters from the southwestern Gulf of Maine and Cape Hatteras, North Carolina	Inshore in summer and spring	Benthic habitats with rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, also offshore clam beds and shell patches in winter
Chub Mackerel	Eggs	Pelagic waters throughout the exclusive economic zone (EEZ) from North Carolina to Texas, including intertidal and subtidal areas, at temperatures of 15-25 °C		
	Larvae	Pelagic waters throughout the EEZ from North Carolina to Texas, including intertidal and subtidal areas, at temperatures of 15-30 °C		
	Juveniles and Adults	Pelagic waters throughout the EEZ from Maine to Texas, including intertidal and subtidal areas, at temperatures of 15-30 °C		
Clearnose skate	Juveniles	Inner continental shelf from New Jersey to the St. Johns River in Florida and certain bays and certain estuaries including Raritan Bay, inland New Jersey bays, Chesapeake Bay, and Delaware Bays	0-30	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
Clearnose skate	Adults	Inner continental shelf from New Jersey to the St. Johns River in Florida and certain bays and certain estuaries including Raritan Bay, inland New Jersey bays, Chesapeake Bay, and Delaware Bays	0-40	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
Deep-sea red crab	Eggs	Outer continental shelf and slope throughout the region, including two seamounts	320-640	Benthic habitats attached to female crabs
Deep-sea red crab	Juveniles	Outer continental shelf and slope throughout the region, including two seamounts	320-1300 on slope and to 2000 on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments
Deep-sea red crab	Adults	Outer continental shelf and slope throughout the region, including two seamounts	320-900 on slope and up to 2000 on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Golden tilefish	Juveniles and adults	Outer continental shelf and slope from U.S.-Canada boundary to the Virginia-North Carolina boundary	100-300	Burrows in semi-lithified clay substrate, may also utilize rocks, boulders, scour depressions beneath boulders, and exposed rock ledges as shelter
Haddock	Juveniles	Inshore and offshore waters in the Gulf of Maine, on Georges Bank, and on the continental shelf in the Mid-Atlantic region	40-140 and as shallow as 20 in coastal Gulf of Maine	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel
Haddock	Adults	Offshore waters in the Gulf of Maine, on Georges Bank, and on the continental shelf in Southern New England	50-160	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel and adjacent to boulders and cobbles along the margins of rocky reefs
Little skate	Juveniles	Coastal waters in the Gulf of Maine, Georges Bank, and the continental shelf in the Mid-Atlantic region as far south as Delaware Bay, including certain bays and estuaries in the Gulf of Maine	Mean high water-80	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud
Little skate	Adults	Coastal waters in the Gulf of Maine, Georges Bank, and the continental shelf in the Mid-Atlantic region as far south as Delaware Bay, including certain bays and estuaries in the Gulf of Maine	Mean high water-100	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud
Longfin inshore squid	Eggs	Inshore and offshore waters from Georges Bank southward to Cape Hatteras	Generally <50	Bottom habitats attached to variety of hard bottom types, macroalgae, sand, and mud
Monkfish	Juveniles	Gulf of Maine, outer continental shelf in the Mid-Atlantic, and the continental slope	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Sub-tidal benthic habitats on a variety of habitats, including hard sand, pebbles, gravel, broken shells, and soft mud, also seek shelter among rocks with attached algae
Monkfish	Adults	Gulf of Maine, outer continental shelf in the Mid-Atlantic, and the continental slope	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine,	Sub-tidal benthic habitats on hard sand, pebbles, gravel, broken shells, and soft mud, but seem to

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

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

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Summer flounder	Juveniles	Continental shelf and estuaries from Cape Cod, Massachusetts, to Cape Canaveral, Florida	To maximum 152	Benthic habitats, including inshore estuaries, salt marsh creeks, seagrass beds, mudflats, and open bay areas
Summer flounder	Adults	Continental shelf from Cape Cod, Massachusetts, to Cape Canaveral, Florida, including shallow coastal and estuarine waters during warmer months	To maximum 152 in colder months	Benthic habitats
Spiny dogfish	Juveniles	Primarily the outer continental shelf and slope between Cape Hatteras and Georges Bank and in the Gulf of Maine	Deep water	Pelagic and epibenthic habitats
Spiny dogfish	Female sub-adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Male sub-adults	Primarily in the Gulf of Maine and on the outer continental shelf from Georges Bank to Cape Hatteras	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Female adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Male adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
Thorny skate	Juveniles	Offshore Gulf of Maine, some coastal bays in the Gulf of Maine, and on the continental slope from Georges Bank to North Carolina	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 om slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
Thorny skate	Adults	Offshore Gulf of Maine and on the continental slope from Georges Bank to North Carolina	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 om slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
White hake	Juveniles	Gulf of Maine, Georges Bank, and Southern New England, including bays and estuaries in the Gulf of Maine	Mean high water - 300	Intertidal and sub-tidal estuarine and marine habitats on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats
White hake	Adults	Gulf of Maine, including coastal bays and estuaries, and the outer continental shelf and slope	100-400 offshore Gulf of Maine, >25 inshore Gulf of	Sub-tidal benthic habitats on fine-grained, muddy substrates and in mixed soft and rocky habitats

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
			Maine, to 900 on slope	
Windowpane flounder	Juveniles	Estuarine, coastal, and continental shelf waters from the Gulf of Maine to northern Florida, including bays and estuaries from Maine to Maryland	Mean high water - 60	Intertidal and sub-tidal benthic habitats on mud and sand substrates
Windowpane flounder	Adults	Estuarine, coastal, and continental shelf waters from the Gulf of Maine to Cape Hatteras, North Carolina, including bays and estuaries from Maine to Maryland	Mean high water - 70	Intertidal and sub-tidal benthic habitats on mud and sand substrates
Winter flounder	Eggs	Eastern Maine to Absecon Inlet, New Jersey (39° 22´N) and Georges Bank	0-5 south of Cape Cod, 0-70 Gulf of Maine and Georges Bank	Sub-tidal estuarine and coastal benthic habitats on mud, muddy sand, sand, gravel, submerged aquatic vegetation, and macroalgae
Winter flounder	Juveniles	Coastal Gulf of Maine, Georges Bank, and continental shelf in Southern New England and Mid-Atlantic to Absecon Inlet, New Jersey, including bays and estuaries from eastern Maine to northern New Jersey	Mean high water - 60	Intertidal and sub-tidal benthic habitats on a variety of bottom types, such as mud, sand, rocky substrates with attached macro algae, tidal wetlands, and eelgrass; young-of-the-year juveniles on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks
Winter flounder	Adults	Coastal Gulf of Maine, Georges Bank, and continental shelf in Southern New England and Mid-Atlantic to Absecon Inlet, New Jersey, including bays and estuaries from eastern Maine to northern New Jersey	Mean high water - 70	Intertidal and sub-tidal benthic habitats on muddy and sandy substrates, and on hard bottom on offshore banks; for spawning adults, also see eggs
Winter skate	Juveniles	Coastal waters from eastern Maine to Delaware Bay, including certain bays and estuaries from eastern Maine to Chincoteague Bay, Virginia, and on Georges Bank and the continental shelf in Southern New England and the Mid-Atlantic	0-90	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud
Winter skate	Adults	Coastal waters from eastern Maine to Delaware Bay, including certain bays and estuaries in Maine and New Hampshire, and on Georges Bank and the continental shelf in	0-80	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
		Southern New England and the Mid-Atlantic		
Witch flounder	Juveniles	Gulf of Maine and outer continental shelf and slope	50-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
Witch flounder	Adults	Gulf of Maine and outer continental shelf and slope	35-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
Yellowtail flounder	Juveniles	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	20-80	Sub-tidal benthic habitats on sand and muddy sand
Yellowtail flounder	Adults	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	25-90	Sub-tidal benthic habitats on sand and sand with mud, shell hash, gravel, and rocks

Fishery Impact Considerations

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

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

Illex are mostly caught with mobile bottom-tending gear that does contact the bottom. Industry contacts report that MSB effort is generally over sand/mud bottoms that will not damage nets and that "hangs" or areas with structure have been mapped over the years and are avoided. Amendment 9 included an analysis of the adverse impacts of the MSB fisheries on EFH (per section 303(a)(7) of the MSA). In Amendment 9 the MAFMC determined that bottom trawls used in MSB fisheries do have the potential to adversely affect EFH for some federally-managed fisheries in the region and closed portions of two offshore canyons (Lydonia and Oceanographer) to squid trawling. Subsequent closures were implemented in these and two other canyons (Veatch and Norfolk) to protect tilefish EFH by prohibiting all bottom trawling activity. The

MAFMC adopted protections for deep-sea corals on the outer continental shelf and slope via Amendment 16 to the MSB FMP.

While some non-preferred alternatives could lead to increased effort, analyses in the 2021 *Illex* RTA showed that effort tends to be geographically concentrated in a given year in productive areas, meaning that increased effort in the range considered in this action is unlikely to result in substantially different habitat impacts, especially given the existing protections for sensitive habitats described above.

6.4 Protected Species

Section 6.4.1 Protected Species Present in the Area

Numerous protected species occur in the affected environment of the MSB FMP (Table 10), and have the potential to be impacted by the proposed action (i.e., there have been observed/documented interactions in the fisheries or with gear types similar to those used in the *Illex* fishery (i.e., bottom and mid-water trawls). While protected species interactions appear relatively rare in the *Illex* fishery compared to other fisheries according to the 2021 NMFS Biological Opinion and 2022 List of Fisheries, the gear types used in the *Illex* fishery have the potential for interactions. Relevant protected 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.

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

Table 11. Species Protected Under the ESA and/or MMPA that may occur in the Affected Environment of the MSB fisheries. Marine mammal species italicized and in bold are considered MMPA strategic stocks.[1]

Species	Status	Potentially impacted by this action?
Cetaceans		
North Atlantic right whale (Eubalaena glacialis)	***Endangered***	***No***
Humpback whale, West Indies DPS (*Megaptera novaeangliae)*	Protected (MMPA)	No
Fin whale (Balaenoptera physalus)	***Endangered***	***No***
Sei whale (Balaenoptera borealis)	***Endangered***	***No***
Blue whale (Balaenoptera musculus)	***Endangered***	***No***
Sperm whale (Physeter macrocephalus	***Endangered***	***No***
Minke whale (*Balaenoptera acutorostrata*)	Protected (MMPA)	***No***
Pilot whale (Globicephala spp.)[2]	Protected (MMPA)	Yes
Pygmy sperm whale (*Kogia breviceps*)	Protected (MMPA)	No
Dwarf sperm whale (*Kogia sima*)	Protected (MMPA)	No
Risso's dolphin (*Grampus griseus*)	Protected (MMPA)	Yes
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Protected (MMPA)	Yes
Short Beaked Common dolphin (*Delphinus delphis*)	Protected (MMPA)	Yes
Atlantic Spotted dolphin (*Stenella frontalis*)	Protected (MMPA)	No
Striped dolphin (*Stenella coeruleoalba*)	Protected (MMPA)	No
Bottlenose dolphin (Tursiops truncatus)[3]	***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
Giant manta ray (*Manta birostris)*	Threatened	Yes
Oceanic whitetip shark (*Carcharhinus longimanus*)	Threatened	No
Atlantic salmon (*Salmo salar*)	Endangered	Yes
Atlantic sturgeon: *(Acipenser oxyrinchus) Gulf of Maine DPS*	Threatened	Yes
Atlantic sturgeon: NY Bight, Ches. Bay, Carolina, and South Atlantic DPSs	Endangered	Yes
Cusk (*Brosme brosme)*	Candidate	Yes
Pinnipeds		
Harbor seal (*Phoca vitulina*), Gray seal (Halichoerus grypus), Harp seal (Phoca groenlandicus), Hooded seal (Cystophora cristata)	Protected (MMPA)	Yes
Critical Habitat		
North Atlantic Right Whale	ESA Designated	No
Northwest Atlantic DPS of Loggerhead Sea Turtle	ESA Designated	No

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

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

[3] Includes the Western N. Atlantic Offshore, Northern Migratory Coastal, and Southern Migratory Coastal Stocks of Bottlenose Dolphins. See NMFS Marine Mammal Stock Assessment Reports (SARs) for the Atlantic Region.

Section 6.4.2 Species and Critical Habitat Not Likely to be Impacted 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 MMPA protected species or any designated critical habitat (Table 10). 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 based on the most recent 10 years of observer, stranding, and/or marine mammal serious injury and mortality reports, there have been no observed or documented interactions between the species and the primary gear type (i.e., bottom and mid-water trawls) used to prosecute the *Illex* fishery (Greater Atlantic Region (GAR)[5] Marine Animal Incident Database, unpublished data; NMFS Marine Mammal Stock Assessment Reports (SARs) for the Atlantic Region; NMFS NEFSC observer/sea sampling database, unpublished data; NMFS NEFSC marine mammal (small cetacean, pinniped, baleen whale) serious injury and mortality Reference Documents or Technical Memoranda; MMPA List of Fisheries (LOF); NMFS 2021a).[6] In the case of critical habitat, this determination has been made because the action will not affect the essential physical and biological features of critical habitat identified in Table 10 and therefore, will not result in the destruction or adverse modification of any species critical habitat (NMFS 2021a).

Section 6.4.3 Species Potentially Impacted by the Proposed Action

Error! Reference source not found. provides a list of protected species of sea turtles, marine mammals, and fish present in the affected environment of the MSB fisheries, and that may also be impacted by the operation of these fisheries; that is, have the potential to become entangled or bycaught in the fishing gear used to prosecute these fisheries. To aid in the identification of MMPA protected species potentially impacted by the action, NMFS Marine Mammal SARs for the Atlantic Region, MMPA List of Fisheries (LOF), NMFS (2021b), NMFS NEFSC observer/sea sampling database (unpublished data), and NMFS NEFSC marine mammal (small cetacean, pinniped, baleen whale) serious injury and mortality Reference Documents or Technical Memoranda were referenced.

To help identify ESA listed species potentially impacted by the action, we queried the NMFS NEFSC observer/sea sampling (2010-2019), Sea Turtle Disentanglement Network (2010-2019), and the GAR Marine Animal Incident (2010-2019) databases for interactions, as well as reviewed the May 27, 2021, Biological Opinion (Opinion)[7] issued by NMFS. The 2021 Opinion

[5] The Greater Atlantic Region (GAR) encompasses large marine ecosystem of the Northwest Atlantic from Maine to Cape Hatteras, North Carolina (e.g., the Gulf of Maine, Mid-Atlantic).

[6] For marine mammals protected under the MMPA, the most recent 10 years of observer, stranding, and/or marine mammal serious injury and mortality reports are from 2010-2019. For ESA listed species, information on observer or documented interactions with fishing gear is from 2010-2019.

[7] NMFS' May 27, 2021, Biological Opinion on the 10 FMPs is found at: https://www.fisheries.noaa.gov/resource/document/biological-opinion-10-fishery-management-plans

considered the effects of the NMFS' authorization of ten FMPs,[8] including the MSB FMP on ESA-listed species and designated critical habitat. The Opinion determined that the authorization of ten FMPs may adversely affect, but is not likely to jeopardize, the continued existence of North Atlantic right, fin, sei, or sperm whales; the Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, leatherback, Kemp's ridley, or North Atlantic DPS of green sea turtles; any of the five DPSs of Atlantic sturgeon; GOM DPS Atlantic salmon; or giant manta rays. The Opinion also concluded that the proposed action is not likely to adversely affect designated critical habitat for North Atlantic right whales, the Northwest Atlantic Ocean DPS of loggerhead sea turtles, U.S. DPS of smalltooth sawfish, Johnson's seagrass, or elkhorn and staghorn corals. An Incidental Take Statement (ITS) was issued in the Opinion. The ITS includes reasonable and prudent measures and their implementing terms and conditions, which NMFS determined are necessary or appropriate to minimize impacts of the incidental take in the fisheries assessed in this Opinion.

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

6.4.3.1 Sea Turtles

Below is a brief summary of the status and trends, as well as the occurrence and distribution of sea turtles in the affected environment of the MSB fisheries. Additional background information on the range-wide status of affected sea turtles species, as well as a description and life history of each of these species, can be found in a number of published documents, including NMFS (2021a); sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b; Conant et al. 2009; NMFS and USFWS 2013), and recovery plans for the loggerhead (Northwest Atlantic DPS) sea turtle (NMFS and USFWS 2008), leatherback sea turtle (NMFS and USFWS 1992, 1998a, 2020), Kemp's ridley sea turtle (NMFS et al. 2011), and green sea turtle (NMFS and USFWS 1991, 1998b).

Status and Trends

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

[8] The ten FMPs considered in the May 27, 2021, Biological Opinion include the: (1) American Lobster; (2) Atlantic Bluefish; (3) Atlantic Deep-Sea Red Crab; (4) Mackerel/Squid/Butterfish; (5) Monkfish; (6) Northeast Multispecies; (7) Northeast Skate Complex; (8) Spiny Dogfish; (9) Summer Flounder/Scup/Black Sea Bass; and (10) Jonah Crab FMPs.

sea turtles (Table 10). Although stock assessments and similar reviews have been completed for sea turtles none have been able to develop a reliable estimate of absolute population size. As a result, nest counts are used to 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, Florida index nesting beaches comprise most of the nesting in the DPS (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). 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 (NMFS 2021a).

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). In 2019, there were 11,090 nests, a 37.61% decrease from 2018 and a 54.89% decrease from 2017, which had the highest number (24,587) of nests; the reason for this recent decline is uncertain (see NMFS 2021a). Given this and continued anthropogenic threats to the species, according to NMFS (2021a), the species resilience to future perturbation is low.

The North Atlantic DPS of green sea turtle, overall, 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). While anthropogenic threats to this species continue, taking into consideration the best available information on the species, NMFS (2021a), concluded that the North Atlantic DPS appears to be somewhat resilient to future perturbations.

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). The leatherback status review in 2020 concluded that leatherbacks are exhibiting an overall decreasing trend in annual nesting activity (NMFS and USFWS, 2020). Given continued anthropogenic threats to the species, according to NMFS (2021a), the species' resilience to additional perturbation both within the Northwest Atlantic and worldwide is low.

Occurrence and Distribution

Hard-shelled sea turtles - In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, MA, although their presence varies with the seasons due to changes in water temperature (Braun-McNeill et al. 2008; Braun & Epperly 1996; Epperly et al. 1995a,b; Mitchell et al. 2003; Shoop & Kenney 1992; TEWG 2009; Blumenthal et al. 2006; Braun-McNeill & Epperly 2002; Griffin et al. 2013; Hawkes et al. 2006; Hawkes et al. 2011; Mansfield et al. 2009; McClellan & Read 2007; Mitchell et al. 2003; Morreale & Standora 2005). As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States and also move up the Atlantic Coast (Braun-McNeill & Epperly 2002; Epperly et al. 1995a,b,c; Griffin et al. 2013; Morreale &

Standora 2005), occurring in Virginia foraging areas as early as late April and on the most northern foraging grounds in the GOM in June (Shoop & Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the GOM by September, but some remain in Mid-Atlantic and Northeast areas until late fall (i.e., November). By December, sea turtles have migrated south to waters offshore of North Carolina, particularly south of Cape Hatteras, and further south, although it should be noted that hard-shelled sea turtles can occur year-round in waters off Cape Hatteras and south (Epperly et al. 1995b; Griffin et al. 2013; Hawkes et al. 2011; Shoop & Kenney 1992).

Leatherback sea turtles - Leatherbacks, a pelagic species, are known to use coastal waters of the U.S. continental shelf and to have a greater tolerance for colder water than hard-shelled sea turtles (James *et al.* 2005; Eckert *et al.* 2006; Murphy *et al.* 2006; NMFS and USFWS 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., GOM) later in the year (i.e., similar time frame as hard-shelled sea turtles), with most leaving the Northwest Atlantic shelves by mid-November (James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014).

6.4.3.2 Marine Mammals

6.4.3.2.1 Small Cetaceans

Status and Trends

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 10). Review of the most recent stock assessment (Hayes et al. 2022) 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 the abundance estimates (Hayes et al 2022). 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. 2021). 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. 2021).

Occurrence and Distribution

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 NMFS Marine Mammal SARs for the Atlantic Region). Within this range, however, there are seasonal shifts in species distribution and abundance. For additional information on small cetacean occurrence and distribution in the Northwest Atlantic, refer to NMFS Marine Mammal SARs for the Atlantic Region.

6.4.3.2.2 Pinnipeds

Status and Trends

Harbor, gray, harp and hooded seals are identified as having the potential to be impacted by the proposed action (Table 10). Based on Hayes et al. (2019) and Hayes et al. (2022), the status of the:

- Western North Atlantic harbor seal and hooded seal, relative to Optimum Sustainable Population (OSP), in the U.S. Atlantic EEZ is unknown;
- gray seal population relative to OSP in U.S. Atlantic EEZ waters is unknown, but the stock's abundance appears to be increasing in Canadian and U.S. waters; and,
- harp seal stock, relative to OSP, in the U.S. Atlantic EEZ is unknown, but the stock's abundance appears to have stabilized.

Occurrence and Distribution

Harbor, gray, harp, and hooded seals are found in the nearshore, coastal waters of the Northwest Atlantic Ocean. Depending on species, they may be present year round or seasonally in some portion of the affected environment of the MSB fisheries. For additional information on pinniped occurrence and distribution in the Northwest Atlantic, refer to NMFS Marine Mammal SARs for the Atlantic Region.

6.4.3.3 Atlantic sturgeon

Status and Trends

As provided in Table 10, Atlantic sturgeon (all five DPSs) have the potential to be impacted by the proposed action. Population trends for Atlantic sturgeon are difficult to discern; however, the most recent stock assessment report concludes that Atlantic sturgeon, at both coastwide and DPS level, are depleted relative to historical levels (ASSRT 2007; ASMFC 2017; NMFS 2021a).

Occurrence and Distribution

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 (Altenritter et al. 2017; ASMFC 2017b; ASSRT 2007; Breece et al. 2016, 2018; Dovel and Berggren 1983; Dadswell et al. 1984; Dadswell 2006; Dunton et al. 2010, 2015; Erickson et al. 2011; Hilton et al. 2016; Ingram et al. 2019; Kynard et al. 2000; Laney et al. 2007; Novak et al. 2017; O'Leary et al. 2014; Rothermel et al. 2020; Stein et al. 2004a; Waldman et al. 2013; Wippelhauser et al. 2017; Wirgin et al. 2012, 2015a,b).

Based on fishery-independent and dependent surveys, as well as data collected from genetic, tracking, and/or tagging studies in the marine environment, Atlantic sturgeon appear to primarily occur inshore of the 50 meter depth contour; however, Atlantic sturgeon are not restricted to these depths, as excursions into deeper continental shelf waters have been documented (Altenritter et al. 2017; Breece et al. 2016; 2018; Collins and Smith 1997; Dunton et al. 2010; Erickson et al. 2011; Ingram et al. 2019; Novak et al. 2017; Rothermel et al. 2020; Stein et al. 2004a,b; Wippelhauser et al. 2017). Data from fishery-independent and dependent surveys, as well as data collected from genetic, tracking, and/or tagging studies also indicate that Atlantic sturgeon make seasonal coastal movements from marine waters to river estuaries in the spring and from river estuaries to marine waters in the fall; 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 (Altenritter et al. 2017; Dunton et al. 2010; Erickson et al. 2011; Ingram et al. 2019; Novak et al. 2017; Rothermel et al. 2020; Wipplehauser 2012; Wippelhauser et al. 2017).

For additional information on the biology and range wide distribution of each DPS of Atlantic sturgeon refer to: 77 FR 5880 and 77 FR 5914, the Atlantic Sturgeon Status Review Team's (ASSRT) 2007 status review of Atlantic sturgeon (ASSRT 2007); the ASMFC 2017 Atlantic Sturgeon Benchmark Stock Assessment and Peer Review Report (ASMFC 2017), and NMFS (2021a).

6.4.3.4 Atlantic salmon

Status and Trends

As provided in Table 10, Atlantic salmon (GOM DPS) have the potential to be impacted by the proposed action. There is no population growth rate available for GOM DPS Atlantic salmon; however, the consensus is that the DPS exhibits a continuing declining trend (NOAA 2016; USFWS and NMFS 2018; NMFS 2021a).

Occurrence and Distribution

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 (NMFS and USFWS 2005, 2016; Fay et al. 2006). 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; USASAC 2013; Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004, 2005; Reddin 1985; Reddin and Short 1991; Reddin and Friedland 1993; Sheehan et al. 2012; NMFS and USFWS 2005, 2016; Fay et al. 2006). For additional information on the on the biology and range wide distribution of the GOM DPS of Atlantic salmon, refer to NMFS and USFWS (2005, 2016); Fay et al. (2006); and NMFS (2021a).

6.4.3.5 Giant Manta Ray

Status and Trends

As provided in Table 10, giant manta rays have the potential to be impacted by the proposed action. While there is considerable uncertainty regarding the giant manta ray's current abundance throughout its range, the best available information indicates that in areas where the species is not subject to fishing, populations may be stable (NMFS 2021a). However, in regions where giant manta rays are (or were) actively targeted or caught as bycatch populations appear to be decreasing (Miller and Klimovich 2017).

Occurrence and Distribution

Based on the giant manta ray's distribution, the species may occur in coastal, nearshore, and pelagic waters off the U.S. east coast (Miller and Klimovich 2017). Along the U.S. East Coast, giant manta rays are usually found in water temperatures between 19 and 22°C (Miller and Klimovich 2017) and have been observed as far north as New Jersey. Given that the species is rarely identified in the fisheries data in the Atlantic, it may be assumed that populations within the Atlantic are small and sparsely distributed (Miller and Klimovich 2017).

Section 6.4.4 Gear Interactions and Protected Species

Protected species are at risk of interacting (i.e., bycaught or entangled) 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 (NMFS Marine Mammal SARs for the Atlantic Region; NMFS NEFSC observer/sea sampling database, 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, the most recent 10 years of

observer, stranding, and/or marine mammal serious injury and mortality reports are from 2010-2019[9]. For ESA listed species, the most recent 10 years of data on observed or documented interactions is available from 2010-2019[10]. Available information on gear interactions with a given species (or species group) is provided in the sections below. The sections to follow are not a comprehensive review of all fishing gear types known to interact with a given species; emphasis is only being placed on the primary gear types used to prosecute the *Illex* fishery (bottom and mid-water trawls).

6.4.4.2 Commercial Fisheries Interactions

6.4.4. 1 Sea Turtles

Bottom Trawl Gear:

Bottom trawl gear poses an injury and mortality risk to sea turtles (Sasso and Epperly 2006; NMFS Observer Program, unpublished data). Since 1989, the date of our earliest observer records for federally managed fisheries, sea turtle interactions with trawl gear have been observed in the GOM, Georges Bank, and/or the Mid-Atlantic; however, most of the observed interactions have been observed south of the GOM (Murray 2008; Murray 2015; Murray 2020; NMFS NEFSC observer/sea sampling database, unpublished data; NMFS 2021a; Warden 2011a,b). As few sea turtle interactions have been observed in the GOM, 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 (2015) estimated that from 2009-2013, the total average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic was 231 (CV=0.13, 95% CI=182-298); this equates to approximately 33 adult equivalents (Murray 2015). Most recently, Murray (2020) provided information on sea turtle interaction rates from 2014-2018 (the most recent five-year period that has been statistically analyzed for trawls). 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,

[9] GAR 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; Hayes et al. 2021; Hayes et al. 2022; Cole and Henry 2013; Henry et al. 2016; Henry et al. 2017; Henry et al. 2019; Henry et al. 2020; Henry et al. 2021; Henry et al. 2022.

[10] ASMFC 2017; Kocik et al. 2014; NMFS 2021a; GAR Marine Animal Incident Database, unpublished data; NMFS Marine Mammal SARs for the Atlantic Region; NMFS NEFSC protected species serious injury and mortality Reference Documents or Technical Memoranda; NMFS NEFSC observer/sea sampling database, unpublished data; GAR Sea Turtle and Disentanglement Network, unpublished data; NMFS Sea Turtle Stranding and Salvage Network, unpublished data.

during July to October in waters less than 50 meters deep. Within each stratum, interaction rates for non-loggerhead species were lower than rates for loggerheads (Murray 2020).

Based on Murray (2020)[11], from 2014-2018, 571 loggerhead (CV=0.29, 95% CI=318-997), 46 Kemp's ridley (CV=0.45, 95% CI=10-88), 20 leatherback (CV=0.72, 95% CI=0-50), and 16 green (CV=0.73, 95% CI=0-44) sea turtle interactions were estimated to have occurred in bottom trawl gear in the Mid-Atlantic region over the five-year period. On Georges Bank, 12 loggerheads (CV=0.70, 95% CI=0-31) and 6 leatherback (CV=1.0, 95% CI=0-20) interactions were estimated to have occurred from 2014-2018. An estimated 272 loggerhead, 23 Kemp's ridley, 13 leatherback, and 8 green sea turtle interactions resulted in mortality over this period (Murray 2020).

Mid-Water Trawl Gear

NEFOP and ASM observer data from 1989 to 2015 show five leatherback sea turtle interactions with mid-water trawl gear; the primary species landed during these interactions was tuna (NEFSC observer/sea sampling database, unpublished data). These takes were in the early 1990s in an experimental HMS fishery that no longer operates. Review of observer data over the last 30 years (i.e., between 1989 and 2019) shows that there have been no observed takes in other mid-water trawl fisheries (e.g., MSB fisheries) operating in the GAR (NMFS NEFSC observer/sea sampling database, unpublished data). Based on this and the best available information, sea turtle interactions in mid-water trawl gear in the GAR are expected to be rare.

6.4.4. 2 Atlantic Sturgeon

Bottom Trawl Gear:

Since 1989, Atlantic sturgeon interactions (i.e., bycatch) with bottom trawl gear have frequently been observed in the GAR, with most sturgeon observed captured falling within the 100 to 200 cm total length range; however, both larger and small individuals have been observed (ASMFC 2007; ASMFC 2017; Miller and Shepard 2011; NMFS NEFSC observer/sea sampling database, unpublished data; NMFS 2021a; Stein et al. 2004). For otter trawl fisheries, the highest incidence of Atlantic sturgeon bycatch have been associated with depths less than 30 meters (ASMFC 2007). More recently, over all gears and observer programs that have encountered Atlantic sturgeon, the distribution of haul depths on observed hauls that caught Atlantic sturgeon was significantly different from those that did not encounter Atlantic surgeon, with Atlantic sturgeon

[11] Murray (2020) estimated interaction rates for each sea turtle species with stratified ratio estimators. This method differs from previous approaches (Murray 2008; Murray 2015; Warden 2011a,b), where rates were estimated using generalized additive models (GAMs). Ratio estimator results may be similar to those using GAM or generalized linear models (GLM) if ratio estimators are stratified based on the same explanatory variables in a GAM or GLM model (Murray 2007, Murray and Orphanides 2013, Orphanides 2010).

encountered primarily at depths less than 20 meters (ASMFC 2017).

Review of NMFS (2021a), as well as the most recent 10 years of NMFS observer data (i.e., 2010-2019; NMFS NEFSC observer/sea sampling database, unpublished data) show that there have been observed interactions between Atlantic sturgeon and bottom trawl gear in the GAR. 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). 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. The total bycatch of Atlantic sturgeon from bottom otter trawls ranged between 624-1,518 fish over the 2000-2015 time series. Focusing on the most recent five-year period of data provided in the stock assessment report,[12] the estimated average annual bycatch during 2011-2015 of Atlantic sturgeon in bottom otter trawl gear is 777.4 individuals.

Mid-Water Trawl Gear

Review of ASM and NEFOP observer data over the last 30 years (i.e., between 1989 and 2019) shows that there have been no observed takes in mid-water trawl fisheries (e.g., MSB fisheries) operating in the GAR (NMFS NEFSC observer/sea sampling database, unpublished data). Based on this information, we anticipate that interactions between this gear type and Atlantic sturgeon to be unlikely and therefore, is not expected to be source of injury or mortality to this species.

6.4.4.3 Atlantic Salmon

Bottom Trawl Gear:

Atlantic salmon are at risk of interacting with bottom trawl (NEFSC observer/sea sampling database, unpublished data; Kocik *et al*. 2014; NMFS 2021a). Northeast Fisheries Observer Program (NEFOP) data from 1989-2019 show records of incidental bycatch of Atlantic salmon in seven of the 31 years, with a total of 15 individuals caught, nearly half of which (seven) occurred in 1992 (NMFS NEFSC observer/sea sampling database, unpublished data).[13] Of the observed incidentally caught Atlantic salmon, ten were listed as "discarded," which is assumed to be a live discard (Kocik, pers comm.; February 11, 2013). Out of the 15 salmon bycaught, four were observed in bottom trawl gear (with the remainder observed in gillnet gear). Given the

[12] 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.

[13] There is no information available on the genetics of these bycaught Atlantic salmon, so it is not known how many of them were part of the GOM DPS. It is likely that some of these salmon, particularly those caught south of Cape Cod, may have originated from the stocking program in the Connecticut River. Those Atlantic salmon caught north of Cape Cod and/or in the Gulf of Maine are more likely to be from the GOM DPS.

very low number of observed Atlantic salmon interactions in bottom trawl gear, interactions with this gear type is believed to be rare in the GAR.

Mid-Water Trawl Gear

Review of ASM and NEFOP observer data over the last 30 years (i.e., between 1989 and 2019) shows that there have been no observed takes in mid-water trawl fisheries (e.g., MSB fisheries) operating in the GAR (NMFS NEFSC observer/sea sampling database, unpublished data). Based on this information, we anticipate that interactions between this gear type and Atlantic salmon to be unlikely and therefore, is not expected to be source of injury or mortality to this species.

6.4.4. 4 Giant Manta Ray

Bottom Trawl Gear

Giant manta rays are potentially susceptible to capture by bottom trawl gear based on records of their capture in fisheries using these gear types (NMFS NEFSC observer/sea sampling database, unpublished data; NMFS 2021a). Review of the most recent 10 years of NEFOP data showed that between 2010-2019, two (unidentified) giant manta rays were observed in bottom trawl gear (NMFS NEFSC observer/sea sampling database, unpublished data). All of the giant manta ray interactions in trawl gear recorded in the NEFOP database indicate the animals were encountered and released alive.

Mid-Water Trawl Gear

NEFOP and ASM observer data since 1989 shows eight observed interactions between giant manta rays and mid-water trawl gear in the early 1990s; the interactions were likely associated with an experimental HMS fishery that no longer operates (NMFS NEFSC observer/sea sampling database, unpublished data). Review of observer data over the last 30 years (i.e., between 1989 and 2019) shows that there have been no observed takes in other mid-water trawl fisheries (e.g., MSB fisheries) operating in the GAR (NMFS NEFSC observer/sea sampling database, unpublished data). Based on this and the best available information, giant manta ray interactions in mid-water trawl gear in the GAR are expected to be rare.

6.4.4.2.5 Marine Mammals

Depending on species, marine mammals have been observed seriously injured or killed in bottom trawl and/or pot/trap gear. Pursuant to the MMPA, NMFS publishes a List of Fisheries (LOF) annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injuries and/or mortalities of marine mammals in each fishery (i.e., Category I=frequent; Category II=occasional; Category III=remote likelihood or no known interactions). In the Northwest Atlantic, the 2022 LOF (87 FR 23122, April 19, 2022) categorizes mid-water trawl (Northeast or Mid-Atlantic) and bottom trawl fisheries (Northeast or Mid-Atlantic) as Category II fisheries.

Small Cetaceans and Pinnipeds

Small cetaceans and pinnipeds are at risk of interacting with mid-water trawl and/or bottom trawl gear.[14] Reviewing marine mammal stock assessment and serious injury reports that cover the most recent 10 years data (i.e., 2010-2019), as well as the MMPA LOF's covering this time frame (i.e., issued between 2017 and 2022), Table 11 provides a list of species that have been observed (incidentally) seriously injured and/or killed by MMPA LOF Category II (occasional interactions) mid-water and/or bottom trawl fisheries that operate in the affected environment of the MSB FMP.

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

[14] For additional information on small cetacean and pinniped interactions, see: NMFS NEFSC marine mammal serious injury and mortality Reference Documents or Technical Memoranda; NMFS Marine Mammal SARs for the Atlantic Region; MMPA LOF.

Table 12. Small cetacean and pinniped species observed seriously injured and/or killed by Category II Mid-Water or Bottom Trawl Fisheries in the affected environment of the MSB FMP.

Fishery	Category	Species Observed or Reported Injured/Killed
Mid-Atlantic Mid-Water Trawl-Including Pair Trawl	II	Bottlenose dolphin (offshore)
		Atlantic white sided dolphin
		Risso's dolphin
		Harbor seal, Gray Seal
Northeast Mid-Water Trawl-Including Pair Trawl	II	Long-finned pilot whales
		Short-beaked common dolphin
		Harbor seal, Gray Seal
Northeast Bottom Trawl	II	Harp seal, Harbor Seal, Gray Seal
		Long-finned pilot whales
		Short-beaked common dolphin
		Atlantic 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 2017-2022 LOFs		

7.0 WHAT ARE THE IMPACTS (Biological and Human Community) FROM THE ALTERNATIVES CONSIDERED IN THIS DOCUMENT? .[15]

Landings of the other species in the FMP (butterfish, longfin squid, Atl. mackerel, and chub mackerel) are monitored and controlled separately and should be negligibly affected by this action (https://www.fisheries.noaa.gov/new-england-mid-atlantic/commercial-fishing/quota-monitoring-greater-atlantic-region). These other FMP species are also not discarded in sufficient amounts by the *Illex* fishery to be substantially impacted by this action (see Non-Target data and discussion in Section 6.1 above). Because catch of the other FMP species will thus be negligibly affected by this action, they are not discussed further. Recent specifications actions and supporting documents for those other FMP species can be consulted for more information (https://www.mafmc.org/msb). Related to this action and its alternatives (see Section 5 for details), the key determinant of biological impacts on *Illex* is how much *Illex* is caught, and how that catch impacts stock status. The 2021 *Illex* RTA continued to note that discards are a small portion of catch, so the primary effect from fishing on *Illex* stems from landings.

For habitat and non-target species impacts, the key determinant is the amount and character of the related effort, and the impact of that effort on the non-target's stock status and the quality/quantity of habitat. The availability of the target species can drive effort as much as any quota change, and as effort changes so would impacts on habitat, protected resources, and non-target species. Since limits on catch do cap effort however, measures that limit catch to varying degrees are a factor related to effort. For protected resources (i.e., ESA-listed, and MMPA protected), the key determinant is the status of the species, and the amount and character of effort. Even under reduced effort scenarios, some level of negative impacts are expected to ESA-listed species and non-listed MMPA protected species whose potential biological removal (PBR) levels have been exceeded (as any take can negatively impact the species recovery and/or sustainability). For MMPA protected species (non-ESA listed) with PBR levels that have not been exceeded, alternatives not expected to change fishing behavior or effort relative to no action may have positive impacts by maintaining takes below the PBR level and approaching the zero mortality rate goal. The table below summarizes the guidelines used for each VEC to determine the magnitude and direction of the impacts described in this section.

Because the *Illex* fishery was limited by its quota from 2017-2021, it is reasonable to expect that quota changes could affect future effort and landings. However, *Illex* abundance and availability are variable, so the potential quotas may not actually be limiting in any given year, as would have been the case in 2022.

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

Table 13. General definitions for impacts and qualifiers relative to resource condition (i.e., baselines)

General Definitions				
VEC	**Resource Condition**	**Impact of Action**		
		Positive (+)	Negative (-)	No Impact (0)
Target and non-target Species	Overfished status defined by the MSA	Alternatives that maintain or are projected to result in a stock status above an overfished condition*	Alternatives that maintain or are projected to result in a stock status below an overfished condition*	Alternatives that do not impact stock / populations
ESA-listed protected species (endangered or threatened)	Populations at risk of extinction (endangered) or endangerment (threatened)	Alternatives that contain specific measures to ensure no interactions with protected species (i.e., no take)	Alternatives that result in interactions/take of listed species, including actions that reduce interactions	Alternatives that do not impact ESA listed species
MMPA protected species (not also ESA listed)	Stock health may vary but populations remain impacted	Alternatives that maintain takes below PBR and approaching the Zero Mortality Rate Goal	Alternatives that result in interactions with/take of marine mammals that could result in takes above PBR	Alternatives that do not impact MMPA protected species
Physical environment / habitat / EFH	Many habitats degraded from historical effort	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), as in slight positive or slight negative	To a lesser degree / minor		
	Moderate (M) positive or negative	To an average degree (i.e., more than "slight", but not "high")		
	High (H), as in high positive or high negative	To a substantial degree (not significant unless stated)		
	Significant (in the case of an EIS)	Affecting the resource condition to a great degree, see 40 CFR 1508.27.		
	Likely	Some degree of uncertainty associated with the impact		

*Actions that will substantially increase or decrease stock size, but do not change a stock status may have different impacts depending on the particular action and stock. Meaningful differences between alternatives may be illustrated by using another resource attribute aside from the MSA status, but this must be justified within the impact analysis.

7.1 Biological Impacts on the Managed Resource - *Illex*

Baseline condition: The 2021 *Illex* Research Track Assessment (RTA) was not able to develop a basis for stock status determination. The 2019 stock status designation resulting from the 2021 RTA was "Unknown" with respect to both overfished and overfishing, due to the lack of an accepted method of estimating F and B and the lack of appropriate Biological Reference Points for this subannual species. The RTA Review Panel agreed with the RTA WG Report that indications from the various assessment approaches were that the stock was lightly fished in 2019. However, their report stated that the term "lightly fished" should be interpreted with caution because it has no specific definition relating to sustainable exploitation.

This action would primarily affect the *Illex* fishery, which is predominantly a commercial fishery. As discussed above, the availability of the targeted species, market conditions, and input costs (especially fuel and labor) may drive effort (and catch and revenues) as much as any regulations, though quotas were limiting from 2017-2021 (Figure 5). Given the lack of a defined formal stock status, in determining impacts to target species this analysis is also considering factors that affect the health and sustainability of the stock including relative escapement, mortality rates, overfishing risk, and general population size based on available information. Analyses described above in Section 6.1 suggest that recent catches are unlikely to have caused overfishing and that the preferred alternative is likely to continue to avoid overfishing, even though there is no formal overfishing definition.

7.1.1 ALTERNATIVE 1: NO ACTION, STATUS QUO, AND PREFERRED ALTERNATIVE

Alternative 1, which maintains the current catch level with an ABC of 40,000 MT, should restrict *Illex* squid catch at or below the SSC-recommended ABC, thus maintaining the baseline condition in an approximately similar fashion (SSC recommendations are designed by the MAFMC's risk policy to avoid overfishing and thus avoid development of an overfished condition – see discussion in Section 6.1 above). As such, Alternative 1 should have a slightly positive, if unquantifiable, impact on the *Illex* stock by maintaining the current condition.

Given the relative catch constraints, impacts from Alternative 1 would be slightly more positive than Alternative 3 (given 3's higher potential catches) but slightly less positive than Alternative 2 (given 2's lower potential catch). The relative impacts among alternatives are slight given the relative escapement that should occur under the different alternatives and eventual catches. While the analyses used by the SSC indicated that in some years with lower biomasses (e.g. 1999, 2001, and 2013), catches up to 60,000 MT would have a higher probability of having less than 50% escapement of the stock from the fishery, actual catch in those years was less than 10,000 MT (and well below the quota at the time) (see Figure 5). With catches apparently likely to be well below any of the Alternatives in the lowest abundance years (when the stock may be susceptible to overfishing), differential impacts among the alternatives on *Illex* are likely to be slight. In other words, when abundance is low catches have been low (lower than the quota), reducing the relative mortality compared to if the quota was caught in a low abundance year (Rago 2022, MAFMC SSC 2022a). When abundance is high, then the quota becomes a limit on relative mortality. So while catches (and effort) may be lower versus Alternative 3 and higher versus Alternative 2, the differential effects on the sustainability of the *Illex* stock are likely to be

slight among all alternatives because of how the fishery historically performs when abundance is high or low.

7.1.2 ALTERNATIVE 2: 50% LOWER RANGE

Alternative 2, which reduces from the current ABC (40,000 MT) to an ABC of 20,000 MT, should restrict *Illex* squid catch below the SSC-recommended ABC, thus maintaining the baseline condition in an approximately similar fashion (SSC recommendations are designed by the MAFMC's risk policy to avoid overfishing and thus avoid development of an overfished condition). As such, Alternative 2 should have a slightly positive, if unquantifiable, impact on the *Illex* stock by maintaining the current condition.

Given the lower potential catch, impacts from Alternative 2 would be slightly more positive than Alternative 1 or Alternative 3. An effort reduction under Alternative 2, if it occurs, is likely to be in the form of an earlier closure of the *Illex* fishery. However, the relative impacts among alternatives are slight given the relative escapement that should occur under the different alternatives and resulting catches. While the analyses used by the SSC indicated that in some years with lower biomasses (e.g. 1999, 2001, and 2013), catches up to 60,000 MT would have a higher probability of having less than 50% escapement of the stock from the fishery, actual catch in those years was less than 10,000 MT (and well below the quota at the time). With catches apparently likely to be well below any of the Alternatives in the lowest abundance years (when the stock may be susceptible to overfishing), differential impacts among the alternatives on *Illex* are likely to be slight. In other words, when abundance is low catches have been low (lower than the quota), reducing the relative mortality compared to if the quota was caught in a low abundance year (Rago 2022, MAFMC SSC 2022a). When abundance is high, then the quota becomes a limit on relative mortality. So while catches (and effort) may be lower under Alternative 2 compared to the other alternatives, the differential effects on the sustainability of the *Illex* stock are likely to be slight among all alternatives because of how the fishery historically performs when abundance is high or low.

7.1.3 ALTERNATIVE 3: 50% HIGHER RANGE

SSC recommendations are designed by the MAFMC's risk policy to avoid overfishing and thus avoid development of an overfished condition. Alternative 3, which increases from the current ABC to 60,000 MT, may not restrict *Illex* squid catch[16] below the SSC-recommended ABC (which is designed to have a low chance of overfishing). As such, alternative 3 could have a slight negative to slight positive impact on the *Illex* stock, depending on annual variations in the stock and the fishery. In general, based on past biological trends and the ways in which fishery effort typically responds to changes in abundance, even the higher ABC under Alternative 3 could still continue to maintain the stock in a similar sustainable condition and therefore have a slight positive impact. In higher abundance years, effort would still not be expected to change substantially, and even catches of the full ABC would be unlikely to negatively impact the stock. And in lower abundance years, it's unlikely the fishery would even achieve the entire quota or catch enough to cause negative impacts. However, in particularly low abundance years, if the fishery were to actually catch the full 60,000MT allowed under this alternative there could be

[16] And effort but catch, not effort, affects the target stock.

some increased risk of the stock experiencing overfishing, resulting in the slight negative end of the impact range.. It's not possible to know if overfishing might just temporarily suppress future landings or cause longer-term reductions in productivity. As such, this alternative is not preferred at this time.

Given the higher potential catch, impacts from Alternative 3 would be slightly more negative than Alternative 1 or Alternative 2. The relative impacts among alternatives are slight given the relative escapement that should occur under the different alternatives and resulting catches. While the analyses used by the SSC indicated that in some years with lower biomasses (e.g. 1999, 2001, and 2013), catches up to 60,000 MT would have a higher probability of having less than 50% escapement of the stock from the fishery, actual catch in those years was less than 10,000 MT (and well below the quota at the time). With catches apparently likely to be well below any of the Alternatives in the lowest abundance years (when the stock may be susceptible to overfishing), differential impacts among the alternatives on *Illex* are likely to be slight. In other words, when abundance is low catches have been low (lower than the quota), reducing the relative mortality compared to if the quota was caught in a low abundance year (Rago 2022, MAFMC SSC 2022a). When abundance is high, then the quota becomes a limit on relative mortality. So while catches (and effort) may be higher under Alternative 3 compared to the other alternatives, the differential effects on the sustainability of the *Illex* stock are likely to be slight among all alternatives because of how the fishery historically performs when abundance is high or low.

7.2 Habitat Impacts

Impacts on the habitat for the managed species (7.2.1) and other species (7.2.2) are addressed separately. The word "habitat" encompasses essential fish habitat (EFH) for the purposes of this analysis. The MAFMC has already minimized to the extent practicable impacts to habitat from the MSB fisheries through closure of several canyon areas in MSB Amendment 9 (http://www.mafmc.org/fmp/history/smb-hist.htm) and Tilefish Amendment 1 (http://www.mafmc.org/fmp/history/tilefish.htm), and protections for Deep Sea Corals via Amendment 16 (http://www.mafmc.org/fmp/history/smb-hist.htm). As a baseline, many habitats in the area of operation of the MSB fisheries are degraded from historical fishing effort (both MSB and other) and from non-fishing activities (Stevenson et al. 2004).

7.2.1 Impacts on Managed Species Habitat

Illex fishing takes place mostly with bottom otter trawling and some mid-water trawling. Habitat for the managed species (MSB) generally consists of the water column, which is not significantly impacted by fishing activity. The exception to the habitat location being the water column is longfin squid eggs, which are attached to sand, mud, or bottom structure (manmade or natural). However, as determined in Amendment 9, there is no indication that squid eggs are preferentially attached to substrates that are vulnerable to disturbance from bottom trawling, so no impacts on habitat for longfin squid eggs are expected from any increase or decrease in fishing effort by bottom trawls. Trawling won't impact the water column itself and there is no information to suggest that *Illex* trawling impacts on substrate will degrade it for purposes of longfin squid egg laying or survival. This means that bottom trawl effort is unlikely to further impact MSB species' habitat regardless of intensity.

7.2.2 Impacts on Other Federally Managed Species Habitat (see Table 9)

7.2.2.1 ALTERNATIVE 1: NO ACTION, STATUS QUO, AND PREFERRED ALTERNATIVE

As described in section 6.3 above, the bottom trawling used in this fishery can adversely impact some habitat types. However, since the MAFMC has considered habitat impacts in the past and has already restricted MSB fishing to protect sensitive habitats (e.g. Tilefish habitat canyon closures and coral protections), the impact of maintaining the current specifications via Alternative 1 is best characterized as overall slight negative, similar to past years, because effort is not expected to change under this alternative and therefore habitat disturbance and impacts are expected to continue similar to past years. The *Illex* fishery also takes place in a relatively small spatial footprint each year. Given the relative catch constraints (and therefore effort constraints), impacts would be slightly more negative than Alternative 2 and slightly less negative than Alternative 3. Impacts differences are slight because the existing measures that protect areas of sensitive habitats would remain, and also because analyses done in the 2021 *Illex* RTA showed that *Illex* effort tends to be geographically concentrated in a given year in productive areas, meaning that increased effort is unlikely to result in substantially different geographic distribution of habitat impacts.

7.2.2.2 ALTERNATIVE 2: 50% LOWER RANGE

As described in section 6.3 above, the bottom trawling used in this fishery can adversely impact some habitat types. However, since the MAFMC has considered habitat impacts in the past and has already restricted MSB fishing to protect sensitive habitats (e.g. Tilefish habitat canyon closures and coral protections), the impact of reducing potential catch to that in this alternative would likely maintain the overall slight negative impact, similar to past years. Given the relative catch constraints (and therefore effort constraints), impacts would be slightly less negative than Alternative 1 and slightly less negative than Alternative 3. Impacts differences are slight because the existing measures that protect areas of sensitive habitats would remain, and also because analyses done in the 2021 *Illex* RTA showed that *Illex* effort tends to be geographically concentrated in a given year in productive areas, meaning that decreased effort is unlikely to result in substantially different geographic distribution of habitat impacts. However, some level of habitat disturbance and impacts would still be expected to continue similar to past years.

7.2.2.3 ALTERNATIVE 3: 50% HIGHER RANGE

As described in section 6.3 above, the bottom trawling used in this fishery can adversely impact some habitat types. However, since the MAFMC has considered habitat impacts in the past and has already restricted MSB fishing to protect sensitive habitats (e.g. Tilefish habitat canyon closures and coral protections), the impact of increasing potential catch to that in this alternative would likely maintain the overall slight negative impact, similar to past years. The *Illex* fishery also takes place in a relatively small spatial footprint each year. Given the relative catch constraints (and therefore effort constraints), impacts would be slightly more negative than Alternative 1 and slightly more negative than Alternative 2. Impacts differences are slight because the existing measures that protect areas of sensitive habitats would remain, and also because analyses done in the 2021 *Illex* RTA showed that *Illex* effort tends to be geographically

concentrated in a given year in productive areas, meaning that increased effort is unlikely to result in substantially different geographic distribution of habitat impacts. So, even if some additional effort were realized, habitat disturbance and impacts would still be expected to continue similar to past years.

7.3 Protected Resources Impacts

The impacts of the alternatives on protected species take into account impacts to ESA-listed species, as well as impacts to MMPA protected species in good condition (i.e., marine mammal stocks whose PBR level have not been exceeded) or poor condition (i.e., marine mammal stocks that have exceeded or are near exceeding their PBR level). For ESA-listed species, any action that results in interactions or take is expected to have negative impacts, including actions that reduce interactions. Actions expected to result in positive impacts on ESA-listed species include only those that contain specific measures to ensure no interactions (i.e., no take). By definition, all ESA-listed species are in poor condition and any take can negatively impact that species' recovery (impacts are negligible for species without interactions and not repeated for every alternative – the focus here is on species where there are interactions as described in Section 6.4). The stock conditions for marine mammals not listed under the ESA varies by species; however, all are in need of protection. For marine mammal stocks that have their PBR level reached or exceeded, negative impacts would be expected from alternatives that result in the potential for interactions between fisheries and those stocks. For species that are at more sustainable levels (i.e., PBR levels have not been exceeded), alternatives not expected to change fishing behavior or effort may have positive impacts by maintaining takes below the PBR level and approaching the zero mortality rate goal.

In addition to taking into account the resource condition of ESA-listed and/or MMPA protected species, factors associated with the risk of an interaction between gear and protected species are also considered in assessing impacts of the alternatives proposed. Specifically, 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.

7.3.1 ALTERNATIVE 1: NO ACTION, STATUS QUO, AND PREFERRED ALTERNATIVE

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

Aside from several stocks of bottlenose dolphin, the PBR level has not been exceeded for any of the non-ESA listed marine mammal species in the affected environment (section 6.4).

Taking into consideration the above information, and the fact that there are non- ESA listed marine mammal stocks/species whose populations may or may not be at optimum sustainable levels, impacts of no action, i.e. maintaining the current specifications, on non-ESA listed species of marine mammals are likely to range from slight negative to slight positive. As noted above, there are some bottlenose dolphin stocks 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, are at risk. As a result, any potential for an interaction is a detriment to the species/stocks ability to recover from this condition. As provided above, 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. The No Action Alternative 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, gear tow duration, and the overlap between protected species and fishing gear (i.e., bottom trawl or mid-water trawl), in space and time, is not expected to change relative to current conditions. Given this information, and the information provided in section 6.4.3, the No Action Alternative is likely to result in slight 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 slight positive impacts to these non-ESA listed marine mammal species/stocks. Should future fishery management actions maintain similar operating condition as they have over the past several years, it is expected that these slight positive impacts would remain. Given this, and the fact that the potential risk of interacting with gear types used in the fishery varies between non-ESA listed marine mammal species in good condition (see section 6.4), the impacts of no action on these non-ESA listed species of marine mammals in good condition are expected to be negligible to slight 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, the No Action Alternative is expected to have slight negative to slight positive impacts on non-ESA listed species of marine mammals.

No-action: ESA Listed Species Impacts

The *Illex* fishery is prosecuted with mostly bottom and some mid-water trawl gear. As provided in section 6.4, reviewing the most recent 10 years (2010-2019) of observer data, Sea Turtle Disentanglement Network and GAR Marine Animal Incident database, and NMFS (2021a), interactions between mid-water trawl gear and ESA-listed species of whales, sea turtles, Atlantic sturgeon, and Atlantic salmon have not been observed or documented; only giant manta rays have been observed/documented in this gear type. In terms of bottom trawl gear, interactions with ESA-listed species of sea turtles, Atlantic sturgeon, Atlantic salmon and giant manta rays have been observed/documented in this gear type.

Based on this information, the *Illex* fishery is likely to result in some level some level of negative impacts to ESA listed species. Taking into consideration fishing behavior/effort under the No Action, as well the fact that interaction risks with protected species are strongly associated with amount, time, and location of gear in the water (with vulnerability of an interaction increasing with increases in of any or all of these factors), we determined the level of negative impacts to ESA listed species to be slight. Below, we provide support for this determination.

Under the No Action, the amount of trawl gear, tow times, and area fished are not expected change significantly from current operating conditions. As interactions risks with protected species are strongly associated with amount, time, and location of gear in the water, continuation of "status quo" fishing behavior/effort is not expected to change any of these operating conditions. Based on this, and the fact that the potential risk of interacting with gear types used in fishery varies between ESA listed species (e.g., listed species of large whales have never been documented/observed in bottom or mid-water trawl gear; 6.4) the impacts of the No Action Alternatives on ESA listed species is expected to be negligible to slight negative.

Compared to Alternative 2's lower catch limits and potential constraint on fishing, Alternative 1 (also no action and status quo), would have slightly more negative and/or less positive impacts on protected resources. The impact is slight because overall regional bottom trawl effort, the gear predominantly used for *Illex*, would not differ much[17] regardless of the selected alternative.

Compared to Alternative 3's higher catch limits and potential constraint on fishing, Alternative 1 (also no action and status quo), would have slightly less negative and/or more positive impacts on protected resources. The impact is slight because overall regional bottom trawl effort, the gear predominantly used for *Illex*, would not differ much [16] regardless of the selected alternative.

7.3.2 ALTERNATIVE 2: 50% LOWER RANGE

Catches could potentially be 50% lower under Alternative 2 compared to the current specifications (i.e. no action), which could translate to about 50% less effort in the *Illex* fishery. This effort reduction, if it occurs, is likely to be in the form of an earlier closure of the *Illex* fishery, resulting in fewer trips but not a change in the operational practices of the fishery (location, tow times, etc.).

As described above, interaction risks with protected species (ESA-listed and/or MMPA protected) are 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. There is no information to suggest that decreased *Illex* quota would lead to effort that would be substantially different in character from the status quo, but if allowed catch is lower and *Illex* are available, there could be a general scaling down of effort. If *Illex* are available, such effort may consist of some fewer vessels participating in the fishery (which already varies substantially from year to year), and some vessels decreasing the days they participate in the fishery, but the types of vessels and gear, as well as gear tow duration, are not expected to substantially differ from previous years. Also, since the fishery is limited access, any permit which would participate

[17] For July 2020 through June 2021 (most recent SBRM data available), there were 14,308 bottom trawl trips reported just on federal VTRs (there are additional state vessel trawl trips), the predominant gear type used in the *Illex* fishery. In 2021, trips averaging 162.7 MT accounted for half of the 2021 *Illex* landings, so 20,000 MT more or less of landings might result in about 123 more or fewer directed trips, which is less than a 1% change in just total bottom trawl trips reporting VTRs (there were over 70,000 total trips reported on VTRs across all gear types in the 2020-2021 SBRM period and other state waters trips as well). At even a 40,000 MT difference the trip difference might only be 246 trips, less than a 2% difference in annual trips for the relevant gear type (bottom trawl). There is also no information to suggest that *Illex* trawling would have unique effects compared to other types of trawling in the region.

substantially has also previously participated in the fishery (further maintaining the similar character of any resulting effort) . The year to year changes in availability and market conditions in the MSB and other alternative fishery opportunities that drive effort (quotas are often not fully utilized in all MSB fisheries) preclude further speculation as to exactly what might change year to year due to a catch limit change in terms of vessel participation, gear used, and tow times.

Given the above information, effort under Alternative 2 will be less than or equal to status quo conditions, which is also Alternative 1. If effort does decrease (e.g., fewer trips, fewer vessels), the risk of an interaction between fishing gear and protected species also has the potential to decrease. Although this may provide some benefit to protected species, as interactions can still occur under a reduced effort scenario, some level of negative impacts is still expected to those protected species in poor condition (i.e., ESA listed; MMPA protected with PBR levels exceeded). Based on this, impacts of Alternative 2 on protected species are expected to range from slight negative to moderate positive, with slight negative to negligible impacts expected for ESA-listed species and non-ESA listed marine mammal species whose PBR levels have been exceeded, and slight to low moderate positive impacts for non-ESA listed marine mammal species whose PBR levels have not been exceeded (as the change could slightly further reduce removals below PBR).

Compared to Alternative 1 or Alternative's 3's higher catch limits and potential constraints on fishing, Alternative 2 would have slightly less negative and/or more positive impacts on protected resources. The impact differences are slight because overall regional bottom trawl effort, the gear predominantly used for *Illex*, would not differ much [16] regardless of the selected alternative.

7.3.3 ALTERNATIVE 3: 50% HIGHER RANGE

Catches could potentially be 50% higher under Alternative 3 compared to the current specifications (i.e. no action), which could translate to about 50% more effort for *Illex*. This effort increase, if it occurs, is likely to be in the form of a later closure of the *Illex* fishery, resulting in more trips but not a change in the operational practices of the fishery (location, tow times, etc.).

As described above, interaction risks with protected species (ESA-listed and/or MMPA protected) are 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 listed species in the same area and time as the gear, with risk of an interaction increasing with increases in of any of these factors. There is no information to suggest that increased *Illex* quota would lead to effort that would be substantially different in character from the status quo, but if allowed catch is higher and *Illex* are available, there could be a general scaling up of effort. If *Illex* are available, such effort may consist of some more vessels participating in the fishery (which already varies substantially from year to year), and some vessels increasing the days they participate in the fishery, but the types of vessels and the types of gears, as well as tow duration, are not expected to substantially differ from previous years. Also, since the fishery is limited access, any permit which would participate substantially has also previously participated in the fishery (further maintaining the similar character of any resulting effort). The year to year changes in availability and market conditions

in the MSB and other alternative fishery opportunities that drive effort (quotas are often not fully utilized in all MSB fisheries) preclude speculation as to exactly what might change year to year due to a catch limit change in terms of vessel participation, gear used, and tow times.

Given the above information, effort under Alternative 3 may be greater than or equal to status quo conditions. If effort does increase (e.g., more trips, more vessels), the risk of an interaction between fishing gear and protected species also has the potential to increase. Based on this, impacts of Alternative 3 on protected species are expected to range from low moderate negative to slight positive. Specifically, low moderate negative to negligible impacts are expected for ESA-listed species and non-ESA listed marine mammal species whose PBR levels have been exceeded. For non-ESA listed marine mammal species in good condition (i.e., current PBR levels have not been exceeded), slight negative to slight positive impacts are expected (the slight negative impacts are reflective for the possible slight increase in effort, which may result in takes no longer being maintaining below the species PBR level and approaching the zero mortality rate goal) [16].

Compared to Alternative 1 or Alternative's 2's lower catch limits and potentially lower effort, Alternative 3 would have slightly more negative and/or less positive impacts on protected resources. The impact differences are slight because overall regional bottom trawl effort, the gear predominantly used for *Illex*, would not differ much[16] regardless of the selected alternative.

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7.4 Socioeconomic Impacts

This action would primarily affect the *Illex* fishery, which is predominantly a commercial fishery. As discussed above, the availability of the targeted species, market conditions, and input costs (especially fuel and labor) may drive effort (and catch and revenues) as much as any regulations.

Illex Fishery Baseline Condition for Socioeconomic Impacts:

Where possible, effects on ex-vessel revenues are described. Although ex-vessel revenues are a useful indicator of relative importance for various fisheries, we note that the true economic importance of these fisheries comes from the overall economic activity, jobs, and community vitality that are supported by the ex-vessel revenues. In fact, when related impact multipliers are considered, the actual economic impact can be several times larger (Jacobsen 2014, Dyck and Sumaila 2010). This concept applies to each alternative, and is not repeated for each alternative. The socioeconomic contributions of *Illex* have been relatively high in recent years. Due to the year-to-year variation in catch and effort in the fishery, it is difficult to fully quantify human community impacts but the current fishery supports a number of vessels, as described in Section 6.2, and provides a variety of jobs related directly to fishing and also in associated support services. 33 vessels landed over 10,000 pounds of *Illex* in 2021, with total *Illex* landings valued at $29.7 million. From 2019-2021 *Illex* ex-vessel revenues varied from $25.3-$29.7 million, averaging $28.2 million. Given these contributions to the socioeconomics of fishing communities, the recent impacts are best summarized as moderate positive. While $25.3-$29.7 million annually is a small ex-vessel amount compared to some fisheries like scallops, it is larger than a number of other MAFMC-managed species ex-vessel values (e.g. golden tilefish, blueline tilefish, scup, butterfish, bluefish, mackerel, chub mackerel, and spiny dogfish). Especially considering the multiplier effects within communities from support services, a moderate impact qualifier appears reasonable.

7.4.1 ALTERNATIVE 1: NO ACTION, STATUS QUO, AND PREFERRED ALTERNATIVE (40,000 MT ABC, 38,192 MT QUOTA)

Alternative 1, which maintains the current catch level, should maintain the current condition whereby relevant communities benefit from sustainable *Illex* fishing in a similar fashion as described above, so similar moderate positive impacts would be expected to continue, like recent years (so not a change from recent years). Production in the fishery can vary substantially year to year, but Alternative 1 would maintain the same quota restrictions as currently exist. At 2021 prices, this could yield $36.9 million in ex-vessel revenues. Impacts would be more positive than the lower quota in Alternative 2. Short term impacts for Alternative 1 would be less positive than the higher quota in Alternative 3, but it has not been determined that those higher quotas are sustainable, so long run impacts may be slightly higher with Alternative 1 compared to Alternative 3 if Alternative 3 caused overfishing and reduced long term yield for an extended period of time (see discussion in 7.1.3).

7.4.2 ALTERNATIVE 2: 50% LOWER RANGE (20,000 MT ABC, 19,096 MT QUOTA)

Because the *Illex* fishery was limited by its quota from 2017-2021, it is reasonable to expect that quota changes could affect future effort and landings. However, *Illex* abundance and availability are variable, so the potential quotas may not actually be limiting in any given year, as would have been the case in 2022. Alternative 2 would result in a quota 50% lower than the current 2022 quota, which is also Alternative 1. This could reduce potential *Illex* ex-vessel revenues to and by $18.4 million at 2021 average prices. While relevant communities would still benefit moderately positive from this diminished activity, impacts would be moderately negative compared to Alternative 1 given our understanding that the catches at the current ABC are sustainable while still providing for more potential opportunity than Alternative 2. Short term impacts would also be moderately negative compared to Alternative 3 due to lower revenues and potentially earlier closures under Alternative 2, but long term impacts may be slightly more positive than Alternative 3 if Alternative 3 caused overfishing and reduced long term yield for an extended period of time (see discussion in 7.1.3).

7.4.3 ALTERNATIVE 3: 50% HIGHER RANGE (60,000 MT ABC, 57,288 MT QUOTA)

Alternative 3 would result in a quota 50% higher than the current 2022 quota, which is also Alternative 1. If *Illex* are available to the fishery, this could increase potential short term *Illex* ex-vessel revenues by about $18.4 million at 2021 average prices compared to Alternative 1, up to $55.3 million (effort would expand similarly). This is also three times higher than Alternative 2. Overall, this could provide slight to moderately positive short-term impacts based on the additional opportunity and potential revenue increases, and positive impacts relative to Alternatives 1 and 2. However, long term impacts may be slightly negative compared if this quota induced overfishing (as discussed in Section 7.1 impacts on the *Illex* stock could be slightly negative under Alternative 3, so long term socioeconomic impacts could also be slightly negative compared to Alternatives 1 and 2 if long-term sustainability is compromised). Catches at the level of Alternative 3 have not occurred, so it is not possible to quantify short and long term tradeoffs involved at this time – it's not possible to know if overfishing might just temporarily suppress future landings or cause longer-term reductions in productivity.

7.5 Non-Target Fish Species Impacts

Given the very low levels of incidental catch observed in the *Illex* fishery, negligible catch of and impacts on other fish species would be expected to continue under all alternatives (see Section 6.1 for details on expected minimal non-target catches). Illex availability is highly variable, and that availability as well as market conditions and input costs (especially fuel and labor) may drive effort as much as any regulations. Under No Action (Alternative 1), illex effort would be expected to continue similar to past years. As described in other VECs, the varying levels of

quota considered for the action alternatives are generally also expected to result in similar effort to past years, but could result in some corresponding effort increases or decreases. Particularly in years of high *Illex* abundance, Alternative 2's lower quota could potentially result in restricting the number of trips or overall effort, and the higher ABC under Alternative 3 would have the potential for some increased effort (see sections 7.1 and 7.3 for additional discussions of potential for effort changes and likelihood of quotas being limiting).

However, with non-target interactions so low, the *Illex* fishery is not likely to have contributed to the current positive or negative status of any other species in a more than negligible fashion. Therefore, even if some minor changes to overall effort were realized under the various alternatives, differences in impacts among all three alternatives would still be negligible.

7.6 Cumulative Effects

7.6.1 Introduction

The purpose of the CEA is to consider the combined effects of many actions on the human environment over time that would be missed if each action were evaluated separately. It is not practical to analyze the cumulative effects of an action from every conceivable perspective. Rather, the focus on those effects that are truly meaningful. A cumulative effects assessment makes effect determinations based on a combination of: 1) impacts from past, present, and reasonably foreseeable future actions; 2) the baseline conditions 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 alternatives under consideration for this action.

7.6.1.1 Consideration of Valued Ecosystem Components (VECs)

The valued ecosystem components for the MAFMC-managed fisheries are generally the "place" where the impacts of management actions occur, and are identified in section 6.0.

- Managed resources
- Physical habitat
- Protected species
- Non-target species
- Human communities

The CEA identifies and characterizes the impacts on the VECs by the alternatives under consideration when analyzed in the context of other past, present, and reasonably foreseeable future actions.

7.6.1.2 Geographic Boundaries

The analysis of impacts focuses on actions related to the commercial harvest of *Illex*. The geographic scope of the analysis of impacts to fish species and habitat for this action is the range of the fisheries in the Western Atlantic Ocean, as described in the Affected Environment section of the document. For endangered and protected species the geographic range is the total range of each species. The geographic range for socioeconomic impacts is defined as those U.S. fishing communities bordering the range of the fisheries for *Illex* which occur primarily from Massachusetts to Virginia, although the management unit includes all the coastal states from Maine to Florida.

7.6.1.3 Temporal Boundaries

The temporal scope of this analysis is focused on actions that have taken place since 1976, when these fisheries began to be managed under the MSA. For endangered and other protected species, the context is largely focused since 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 this analysis does not extend beyond 2028 (5-years) because the issues facing these fisheries may change in ways that can't be effectively predicted beyond 2028. An assessment using this timeframe demonstrates the changes to resources and the human environment that have resulted through management under the MAFMC process and through U.S. prosecution of the fishery. The impacts discussed herein are focused on the cumulative effects of the proposed action (i.e., the preferred alternative) in combination with the relevant other past, present, and reasonably foreseeable future actions over these time scales.

7.6.2 Relevant Actions Other Than Those Proposed in this Document

This section summarizes the past, present, and reasonably foreseeable future actions and effects that are relevant for this cumulative effects assessment.

7.6.2.1 Fishery Management Actions

The historical management practices of the MAFMC have generally resulted in positive impacts on the health of the managed resources. Numerous actions have been taken to manage these commercial and recreational fisheries through FMP amendment and FMP framework adjustment actions. The annual (or multi-year) specifications process is intended to provide the opportunity for the MAFMC and NMFS to regularly assess the status of the fisheries and to make necessary adjustments to ensure that there is a reasonable expectation of meeting the objectives of each FMP and the targets associated with any rebuilding programs under the FMP.

The earliest management actions implemented under the MAFMC's FMPs involved the sequential phasing out of foreign fishing for these species in US waters and the development of domestic fisheries. All MAFMC-managed species are considered to be fully utilized by the US domestic fishery to the extent that sufficient availability will result in a full harvest of the various quotas. More recent actions have focused on stock rebuilding, reducing non-target catch and discards, reducing habitat impacts, and reducing protected species impacts. Limited access and/or catch shares have been established in most directed MAFMC-managed fisheries to control capacity. All MAFMC-managed fisheries have a variety of reporting and monitoring requirements to document catch and facilitate regulatory compliance with a focus on timely and reliable electronic reporting methods. Based on the 2007 MSA reauthorization and the MAFMC's ACL/AM Omnibus Amendment, the SSC now sets an upper limit (ABCs) on catches to avoid overfishing. There is also a Standardized Bycatch Reporting Methodology (SBRM) to evaluate discards and allocate observer coverage. A full list of MAFMC FMPs and their amendments is available at http://www.mafmc.org/fishery-management-plans.

Specific actions from this FMP (http://www.mafmc.org/msb/) which had substantial impacts on the fishery included: the implementation of a limited access program in Amendment 5 to control capacity in the squid and butterfish fisheries; revision of overfishing definitions in Amendment 6; modification of vessel upgrade rules in Amendment 7; and implementation of overfishing and rebuilding control rules and other measures in Amendment 8. Amendment 9 allowed multi-year specifications, extended the moratorium on entry into the *Illex* fishery without a sunset provision; adopted biological reference points recommended by the SARC 34 (2002) for longfin squid; designated EFH for longfin squid eggs, and prohibited bottom trawling by MSB-permitted vessels in Lydonia and Oceanographer Canyons to protect Tilefish EFH. Amendment 1 to the Tilefish FMP created closures in these canyons as well as Veatches and Norfolk canyons for bottom trawling generally. MSB Amendment 10's measures included increasing the longfin squid minimum mesh to 2 1/8 inches in Trimesters 1 and 3 and implementing a butterfish mortality cap in the longfin squid fishery. Amendment 11 implemented mackerel limited access, a recreational-commercial mackerel allocation, and EFH updates. Amendment 12 implemented a Standardized Bycatch Reporting Methodology that was vacated by court order and has been revisited through Amendment 15. Amendment 13 to the MSB FMP implemented Annual Catch Limit and Accountability Measures. Amendment 14 increased and improved reporting and monitoring (vessel, dealer, and observer) of the mackerel and longfin squid fisheries and implemented a catch cap for river herrings and shads in the mackerel fishery since 2014. Monitoring improvements include minimization of unobserved catch, observer facilitation and assistance, weekly vessel trip reporting, additional trip notification, and electronic vessel monitoring systems and reporting. Amendment 16 implemented protections for deep-water corals. Framework 9 followed-up on Amendment 14's measures to specifically improve observer operations by minimizing slippage (unobserved discards) and NMFS has implemented a new Standardized Bycatch Reporting Methodology in Amendment 15 to address observer assignment deficiencies identified in a previous lawsuit. Amendment 18 restricted the expansion of commercial fisheries for certain forage species, some of which are encountered in the MSB fisheries. Amendment 20 reduced latent directed longfin permits, created limited access incidental permits, and lowered Trimester 2 post-closure trip limit to 250 pounds to discourage directed longfin fishing after closures. Amendment 21 added chub mackerel as a managed species. Framework 9 followed-up on Amendment 14's measures to specifically improve observer operations by minimizing slippage (unobserved discards). Framework 12 allowed the

possession of 5,000 lb of Atlantic mackerel after 100 percent of the domestic annual harvest is caught instead of prohibiting the possession of Atlantic mackerel for the rest of the year to facilitate incidental catch in the Atlantic herring fishery. Framework 13 implemented the first iteration of mackerel rebuilding, which is currently being revised in another pending amendment. Framework 14 established a requirement for commercial vessels with federal permits for all species managed by the MAFMC and NEFMC to submit vessel trip reports electronically within 48 hours after entering port at the conclusion of a trip. Framework 15 revised the MAFMC's risk policy to reduce the probability of overfishing as stock size falls below the target biomass while allowing for increased risk and greater economic benefit under higher stock biomass conditions. Past annual specifications have also limited catches to avoid overfishing. The MAFMC is also planning on revising EFH for all species and considering the impacts of fishing on EFH during by 2025.

Recent actions at the NEFMC extend deep-water coral protections in the New England area and protect deep-water corals there against any future expansion of the MSB fisheries in the rest of the continental slope. The NEFMC's omnibus habitat amendment revised EFH and habitat area of particular concern designations for NEFMC-managed species; revised or created habitat management areas, including gear restrictions to protect vulnerable habitat from fishing gear impacts; and established dedicated habitat research areas. This action is expected to have overall positive impacts on habitat and EFH, with expected long-term positive implications for target and non-target species, while having mixed socioeconomic impacts on various user groups. Various actions at the NEFMC also set annual specifications to maintain or rebuild stocks at/to sustainable levels.

In addition to the managed resource FMPs, there are many other FMPs and associated fishery management actions for other species that impacted these VECs over the temporal scale described in Section 7.6.1.3. These include FMPs managed by the MAFMC, NEFMC, Atlantic States Marine Fisheries Commission, and to a lesser extent the South Atlantic Fishery Management Council. Omnibus amendments are also frequently developed to amend multiple FMPs at once. Actions associated with other FMPs and omnibus amendments have generally included (but are not limited to) measures to regulate fishing effort for other species, measures to protect habitat and forage species, and fishery monitoring and reporting requirements.

Fishery management actions within the next five years should generally maintain or restore the sustainability of the stocks and fisheries under management. An action affecting the monkfish and spiny dogfish fisheries should reduce sturgeon catch by 2025, but the degree of impacts is uncertain. Measures for fisheries using vertical lines should also reduce impacts on large whales over the next several years, but likewise the degree of impacts is currently uncertain.

As with all the managed resource FMP actions described above, other FMP actions have had positive long-term cumulative impacts on managed and non-target species because they constrain fishing effort and manage stocks at sustainable levels (or rebuild when necessary). As previously stated, constraining fishing effort can have negative short-term socioeconomic impacts and long-term positive impacts. These actions have typically had slight negative impacts on habitat, due to continued fishing operations preventing impacted habitats from recovering; however, some actions had long-term positive impacts through designating or protecting important habitats. FMP actions have also had a range of impacts on protected species, generally

slight negative to slight positive, depending on the species and interaction levels as detailed elsewhere in this document.

7.6.2.2 Non-Fishing Impacts

7.6.2.2.1 Other Human Activities

Non-fishing activities that occur in the marine nearshore and offshore environments and connected watersheds can cause the loss or degradation of habitat and/or affect the fish and protected species that utilize those areas. The impacts of most nearshore, human-induced, non-fishing activities tend to be localized in the areas where they occur, although effects on species could be felt throughout their populations since many marine organisms are highly mobile. For offshore projects, some impacts may be localized while others may have regional influence, especially for larger projects. The following discussion of impacts is based on past assessments of activities and assumes these activities will continue as projects are proposed. Examples of non-fishing activities include point source and non-point source pollution, shipping, dredging/deepening, wind energy development, oil and gas development, construction, and other activities. Specific examples include at-sea disposal areas, oil and mineral resource exploration, aquaculture, construction of offshore wind farms, and bulk transportation of petrochemicals. Episodic storm events and the restoration activities that follow can also cause impacts. The impacts from these 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 accretion of sediments, pollutants, habitat conversion, and shifting currents and thermoclines. 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 productivity 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. Non-fishing activities can cause target, non-target, and protected species to shift their distributions away from preferred areas, and may also lead to decreased reproductive ability and success (from current changes, spawning disruptions, and behavior changes), disrupted or modified food web interactions, and increased disease. While localized impacts may be more severe, the overall impact on the affected species and their habitats on a population level is unknown, but likely to have impacts that mostly range from no impact to slight negative, depending on the species and activity.

Non-fishing activities permitted by other Federal agencies (e.g. beach nourishment, offshore wind facilities) 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 making comments and recommendations on federal or state actions that may affect habitat for their managed species. Agencies need to respond to, but do not necessarily need to adopt these recommendations. Habitat conservation measures serve to potentially minimize the extent and magnitude of indirect negative impacts federally-permitted activities could have on resources under NMFS' jurisdiction. In addition to guidelines mandated by the MSA, NMFS evaluates non-fishing effects during the review processes 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 authorities. Non-fishing activities must also meet the mandates under the ESA, specifically Section 7(a)(2)[18], 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.

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

[18] "Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat."

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[19]. 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 essential life functions (e.g., migrating, breeding, communicating, resting, foraging)[20] (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

[19] See NMFS Ocean Noise Strategy Roadmap: https://cetsound.noaa.gov/Assets/cetsound/documents/Roadmap/ONS_Roadmap_Final_Complete.pdf
[20] See NMFS Ocean Noise Strategy Roadmap (footnote #2)

protected species[21] and ecological monitoring surveys. Disruption of such scientific surveys could increase scientific uncertainty in survey results and may 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.

Impacts of Offshore Wind Energy Development on Socioeconomic Resources

One offshore wind pilot project off Virginia installed two turbines in federal waters in 2020**.** Two more projects were approved in 2021. More than 20 leases have been issued for future wind energy development in federal waters from Massachusetts to North Carolina (see leasing map below – Figure 9). BOEM has a goal of deploying 30 gigawatts of wind energy production capacity in Federal waters by 2030. Currently, the majority of that proposed development is reasonably foreseeable along the Atlantic coast. 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 nearly all MAFMC-managed resources. Recent habitat modeling work by the NEFSC and presented as part of the 2020 Mid-Atlantic State of the Ecosystem Report found that summer flounder, butterfish, longfin squid, and spiny dogfish are highly likely to occupy wind lease areas throughout the region (NEFSC 2020). Habitat conditions for those species are projected to become more favorable over time within the lease areas, potentially leading to increased interactions and impacts over time. Fisheries for the managed resources have been active in many of the lease areas at present and are expected to be for the near future (section 6.0). The social and economic impacts of offshore wind energy on fisheries could be generally negative due to the substantial overlap of wind energy areas with productive fishing grounds for many MAFMC-managed fisheries. Impacts may vary by species and by year depending upon habitat overlap, species availability, and any area-based regulations that define the amount and type of fishing access with the lease area. 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.

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

BOEM's Supplemental Draft Environmental Impact Statement (SEIS) for the Vineyard Wind project, an 800 megawatt wind farm southeast of Martha's Vineyard, Massachusetts (BOEM 2020) evaluated the revenue exposure (defined as the dockside value of the fish caught within individual lease areas) of various Mid-Atlantic and New England commercial fisheries found within future wind energy lease areas. For most MAFMC-managed fisheries, less than 3 percent of the total revenue would be exposed to future offshore wind development (see table 3.11.-3, section B-78). The analysis noted that the Atlantic surfclam and ocean quahog fisheries represented the largest combined percent exposure and dollar value (BOEM 2020). The SEIS concluded that the impacts associated with future offshore wind activities in the geographic analysis area would result in major adverse impacts on commercial fisheries and moderate adverse impacts on for-hire recreational fishing due to the presence of structures.

It's also worth noting, that turbine structures could increase the presence of and fishing for structure affiliated MAFMC-managed species, such as black sea bass. Many recreational fishing trips in this region target a combination of species. For example, recreational trips which catch black sea bass often also catch tautog, scup, summer flounder, and Atlantic croaker (NEFSC 2017). For this reason, increased recreational fishing effort focusing on species such as black sea bass in wind farms could also lead to increased recreational catches of other species. This could lead to socioeconomic benefits in terms of increased for-hire fishing revenues and angler satisfaction in certain wind development 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 wind turbines, depending on the spacing and orientation of the array and weather conditions.[22] 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 both positive and negative for various managed resources. Fishing within wind farms could lead to increased catch rates, decreased steaming searching for concentrations of fish and different size availability (e.g., larger fish found within a wind farm) which would result in positive effects. However negative effects could occur due to the potential

[22] 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).

for reduced catch and associated revenue, user conflicts, gear damage/loss, and increased risk of allision or collision.

Impacts of Oil and Gas Development on Biological and Socioeconomic Resources

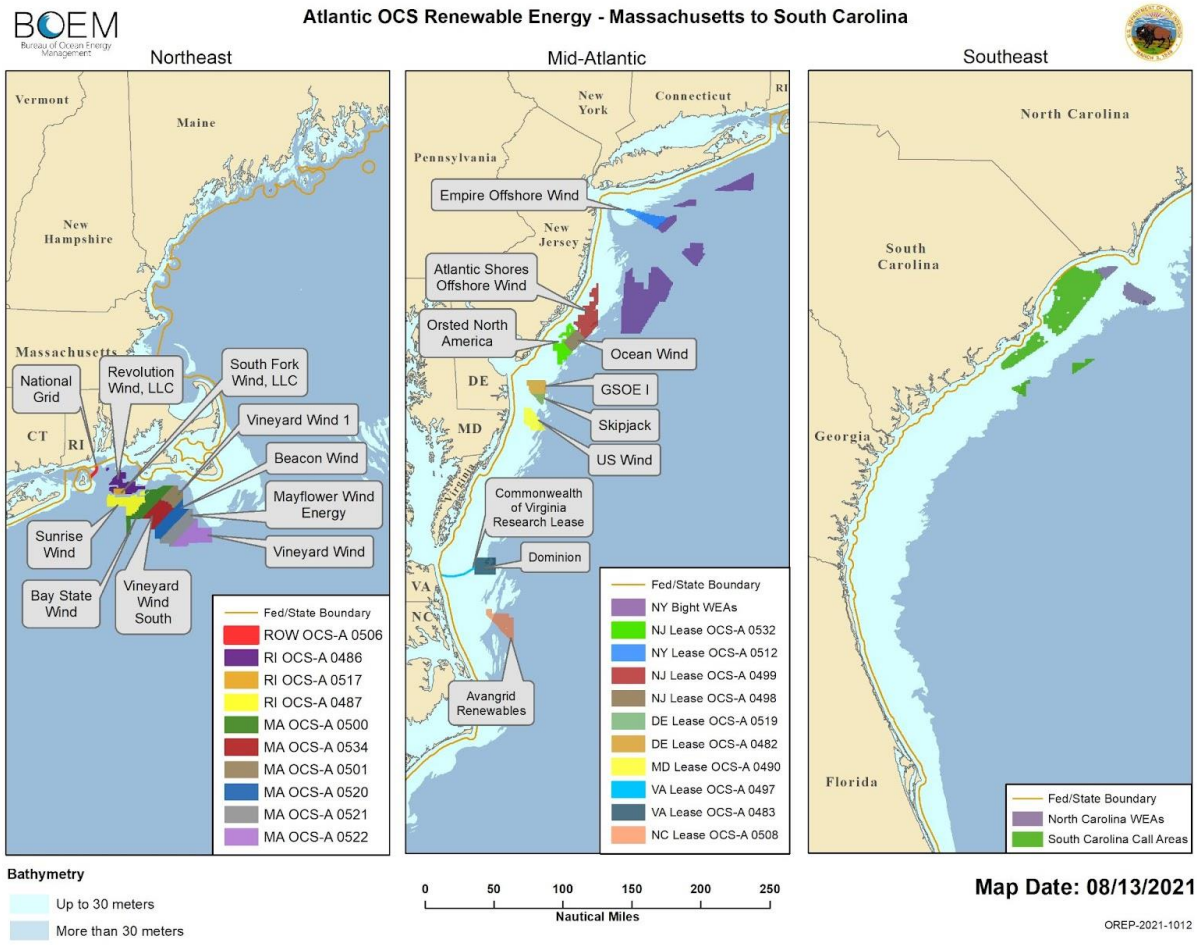
For oil and gas, this timeframe could include leasing and possible surveys, depending on the direction of BOEM's 5-year planning process in the North and Mid-Atlantic regions. (Note that there are fewer oil and gas development activities in the region than offshore wind; therefore, the non-fishing impacts 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. 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.

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.

Figure 9: BOEM approved renewable energy lease areas in federal waters in the Atlantic Ocean off the Mid-Atlantic and New England

(source: BOEM Map Book of Outer Continental Shelf Renewable Energy Lease Areas, https://www.boem.gov/sites/default/files/renewable-energy-program/Mapping-and-Data/Renewable_Energy_Leases_Map_Book_March_2019.pdf)



7.6.2.2.2 Global 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 MAFMC-managed species that range from negative to positive, depending on the adaptability of each MAFMC-managed species to the changing environment (Hare et al. 2016).

Based on this assessment, all MAFMC-managed species have a high or very high exposure to climate change (Figure 29). For MAFMC-managed species, ocean quahog was identified as being very highly sensitive to climate change, and three species (tilefish, Atlantic surfclam, and black sea bass) were highly sensitive to climate change. The remaining species had moderate or low sensitivity to a change in abundance and productivity due to climate change. A vast majority of MAFMC-managed species had a high or very high potential for changes in distribution (12 of 13 species managed at time of analysis); only golden tilefish had a low potential for a change in distribution. Overall, the impacts of climate change are expected to be negative for three MAFMC-managed species (Atlantic mackerel, Atlantic surfclam, and ocean quahog), whereas the impacts are expected to be positive for six species (black sea bass, scup, butterfish, longfin inshore squid, Northern shortfin squid (*Illex*), and bluefish; Figure 30). The effects of climate change are expected to be neutral for the remainder of MAFMC-managed species

Overall vulnerability results for additional Greater Atlantic species, including many non-target species identified in this action, are shown in Figure 29 (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.

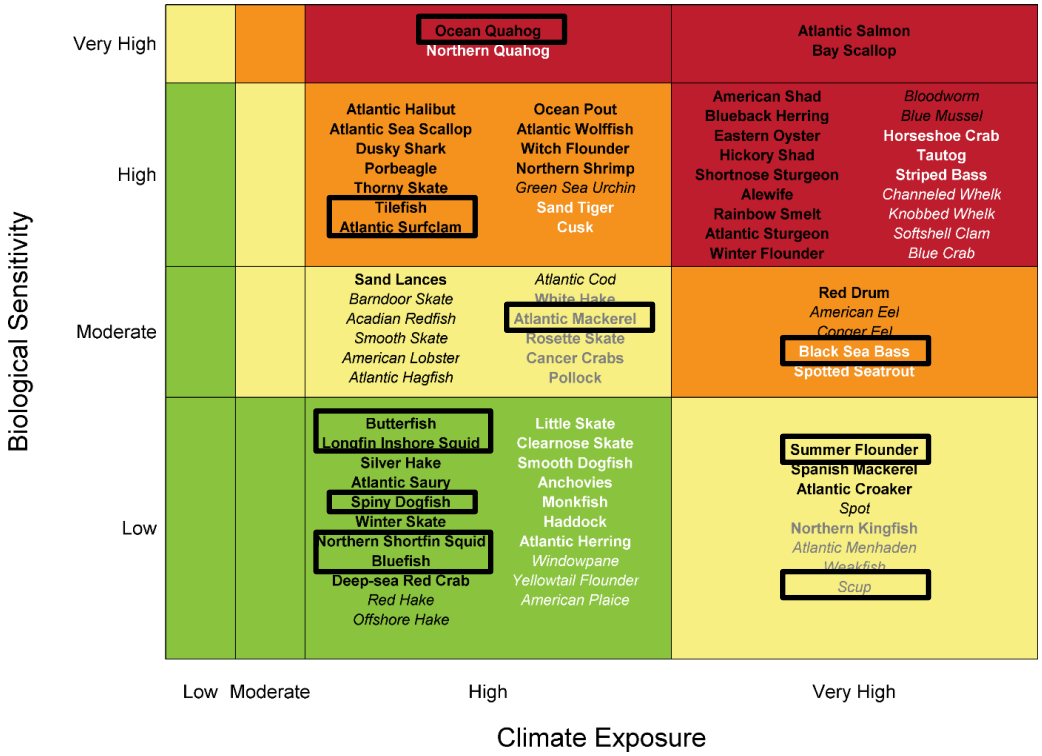


Figure 10: Overall climate vulnerability score for Greater Atlantic species, with MAFMC-managed species highlighted with black boxes.

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.

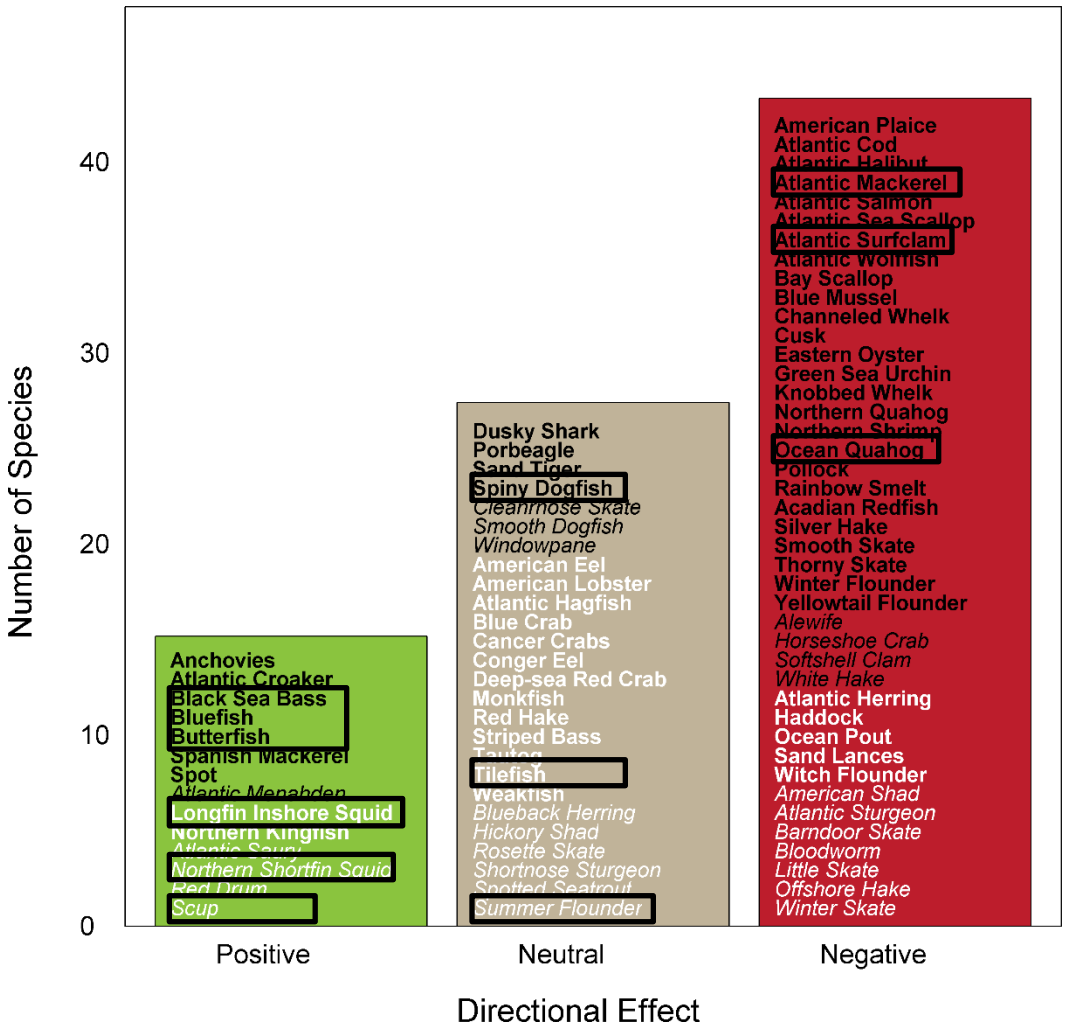


Figure 11: Directional effect of climate change for MAFMC-managed species.
MAFMC species in black boxes. Colors represent expected negative (red), neutral (tan), and positive (green) effects. Certainty in score is denoted by text font and text color: very high certainty (>95%, black, bold font), high 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.

7.6.3 Magnitude and Significance of Cumulative Effects

In determining the magnitude and significance of the cumulative impacts of the preferred alternatives, 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 discussed relative to the past, present, and reasonably foreseeable future actions of both fishing and non-fishing actions. Those past, present, and reasonably foreseeable future actions which may impact the VECs, and the direction of those potential impacts, are summarized in section 7.6.2. When an alternative has a positive impact on the VEC, for example, reduced fishing mortality on a managed species, it has a positive cumulative effect on the stock size of the species when combined with "other" actions that were also designed to increase stock size. In contrast, when an alternative has negative effects on a VEC, such as increased mortality, the cumulative effect on the VEC would be negative and tend to reduce the positive effects of the other actions. The resultant positive and negative cumulative effects are described below for each VEC. As seen above in section 7.6.2, non-fishing impacts on the VECs generally range from slight positive to slight negative.

7.6.3.1 Magnitude and Significance of Cumulative Effects on Managed Resources

Past fishery management actions taken through all MAFMC-managed resource FMPs and the annual specifications process such as catch limits and commercial quotas for the managed resource ensure that stocks are managed sustainably and that measures are consistent with the objectives of the FMP under the guidance of the MSA. While species have been designated as overfished, including mackerel recently in this FMP, rebuilding measures have been subsequently implemented. The impacts of annual specification of management measures are largely dependent 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., gear restricted areas, limited access, minimum mesh sizes etc.) are effective; however, these actions have generally had a positive cumulative effect on the managed resources. It is anticipated that any future management actions will have additional direct positive impacts and indirect positive effects on the target species through actions which reduce and monitor bycatch, protect habitat, and protect the ecosystem services on which the productivity of the target species depends.

As noted above, the preferred alternative is not expected to change the status of the target species, *Illex*. The preferred alternative is not expected to result in significantly increased levels of fishing effort or changes to the character of that effort relative to current conditions. Therefore, impacts of the fisheries on target species are not expected to change relative to current conditions under the preferred alternative (i.e., generally positive for target species). The proposed actions described in this document would positively reinforce the past and anticipated positive cumulative effects on all managed resources by achieving the objectives specified in the FMP.

When the effects of the preferred specifications are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), *the cumulative effects are expected to yield non-significant positive impacts on the MAFMC-managed resources.*

7.6.3.2 Magnitude and Significance of Cumulative Effects on Physical Environment

Past fishery management actions taken through the federal fisheries management process and the MSB fishery have had positive cumulative effects on habitat but fishery activities still likely have slight negative habitat impacts. Actions have constrained fishing effort both at a large scale and locally which may reduce impacts on habitat. As required under these FMP actions, EFH was designated for the managed stocks. It is anticipated that future management actions will result in additional direct or indirect positive effects on habitat through actions which protect EFH and protect ecosystem services on which these species' productivity depends. Many additional non-fishing activities, as described above in section 7.6.2, are concentrated near-shore and likely work either additively or synergistically to decrease habitat quality. The effects of these actions, combined with impacts resulting from years of commercial fishing activity, have negatively affected habitat. These impacts could be broad in scope. All the VECs are interrelated; therefore, the linkages among habitat quality, managed and non-target species productivity, and associated fishery yields should be considered. For habitat, there are direct and indirect negative effects from actions which may be localized or broad in scope; however, positive actions that have broad implications have been, and will likely continue to be, taken to improve the condition of habitat. Some actions, such as coastal population growth and climate change may impact habitat and ecosystem productivity; however, these actions are beyond the scope of NMFS and MAFMC management.

As noted above, the preferred alternative is not expected to result in substantially changed levels of fishing effort or changes to the character of that effort relative to current conditions. The preferred actions are thus expected to have no significant impact (direct or indirect) on habitat. Although the impacted areas have been fished for many years with many different gear types and therefore will not likely be further impacted by these measures, continued fishing effort will continue to impact habitats. Therefore, the impacts of the fishery on the physical environment are not expected to change relative to the current condition under the preferred alternatives (i.e., slight negative for physical environment).

Overall, the relevant past, present, and reasonably foreseeable future actions, including the proposed actions, *the cumulative effects are expected to yield non-significant impacts on habitat that are slight negative.*

7.6.3.3 Magnitude and Significance of Cumulative Effects on Protected Resources

Given their life history, large changes in protected species abundance over long time periods, and the multiple and wide-ranging fisheries management actions that have occurred, the cumulative impacts on protected species were evaluated over a long time frame (i.e., from the early 1970s when the MMPA and ESA were implemented through the present).

Taking into consideration the above information and information provided in section 6.4, past fishery management actions taken through the respective FMPs and annual specifications process have had slight indirect positive cumulative effects on protected species. The actions have constrained fishing effort both at a large scale and locally, and have implemented, pursuant to the ESA, MMPA, or MSA, gear modifications, requirements, and management areas. These measures and/or actions have served to reduce interactions between protected species and fishing gear. It is anticipated that future management actions, described in Section 7.6 will result in additional indirect positive effects on protected species. These impacts could be broad in scope.

The preferred alternative would not substantially modify current levels of fishing effort in terms of the overall amount of effort, timing, and location. They would generally allow existing fishing effort to continue. As described in section 7.3, the proposed action is expected to have slight negative to slight positive impacts on protected resources depending on the species.

When the direct and indirect effects of the proposed action alternatives are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), the cumulative effects are expected to yield non-significant impacts on protected resources that range from slight negative to slight positive.

7.6.3.4 Magnitude and Significance of Cumulative Effects on Non-Target Species

The combined impacts of past federal fishery management actions on non-target species have been mixed. Decreased effort and reduced catch of non-target species continue, though some stocks are in poor status and to some degree that status is worsened by bycatch, which can vary among directed fisheries. Therefore the effect to date of federal fishery management actions is overall slight negative. Current regulations continue to manage for sustainable stocks, thus controlling effort on direct and discard/bycatch species and accounting for all catch. Future actions are anticipated to continue rebuilding non-target species stocks if needed and limit the take of incidental/bycatch in MAFMC-managed fisheries, particularly through mitigation measures like sub-ACLs, AMs, spatial-temporal measures, and bycatch caps. Continued management of directed stocks will also control catch of non-target species. Therefore, cumulative impacts on non-target species (slight negative) are not expected to change relative to the current condition under the preferred alternative, especially given the minimal catch of non-target species in the *Illex* fishery. The proposed actions in this document would positively reinforce past and anticipated cumulative effects on non-target species by achieving the objectives specified in the FMP.

When the effects of the preferred alternatives are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), *the cumulative effects are expected to yield ongoing slight negative impacts to non-target species overall.*

7.6.3.5 Magnitude and Significance of Cumulative Effects on Human Communities

Past fishery management actions taken through the respective FMPs and annual specifications process such as catch limits and commercial quotas have had both positive and negative cumulative effects on human communities. They have benefitted domestic fisheries through sustainable fishery management and/or rebuilding, but can also reduce participation in fisheries. The impacts from annual specification of management measures are largely dependent on how effective those measures are in meeting their intended objectives and the extent to which mitigating measures such as seasons and trip/possession limits are effective.

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

The first cumulative human community effect of the FMP has been to guide the development of the domestic harvest and processing fishery infrastructure. Part of this fishery rationalization process included the development of limited access programs to control capitalization while maintaining harvest levels that are sustainable. In addition, by meeting the National Standards prescribed in the MSA, the MAFMC has strived to meet one of the primary objectives of the act - to achieve optimum yield in each fishery. The preferred alternative would maintain status quo quotas, and is unlikely to result in significant changes to levels of effort or the character of that effort relative to the status quo.

The indirectly affecting actions and activities described above have both positive and negative human community affects. For example agricultural pollution may negatively impact marine

resources negatively affecting human communities, but there are also benefits to human communities from the food and jobs created during agricultural operations. The same tradeoff will exist for each of the indirectly affecting activities, resulting on overall indirect negative impacts on human communities by reducing marine resource availability; however, this effect is not quantifiable. NMFS has several means under which it can review non-fishing actions of other Federal or state agencies prior to permitting or implementation of those projects. This serves to minimize the extent and magnitude of indirect negative impacts those actions could have on human communities.

It is anticipated that future management actions will result in positive effects for human communities due to sustainable management practices, although additional indirect negative effects on some human communities could occur if management actions result in reduced revenues, if temporarily. Overall, the past, present, and reasonably foreseeable future actions that are truly meaningful to human communities have had overall positive cumulative effects. Despite the potential for negative short-term effects on human communities due to reduced revenue, positive long-term effects are expected due to the long-term sustainability of the managed stocks.

By providing revenues and contributing to the overall functioning of and employment in coastal communities, MAFMC-managed fisheries have both direct and indirect positive social impacts. As previously described in this section, the preferred alternatives are unlikely to result in significant changes to levels of fishing effort or the character of that effort relative to current conditions.

Overall, the relevant past, present, and reasonably foreseeable future actions, including the proposed action, *the cumulative effects are expected to yield non-significant slight positive impacts.*

7.6.4 Proposed Action on all the VECs

The MAFMC's preferred alternative (i.e. the proposed actions) is described in section 5.0. The direct and indirect impacts of the proposed action on the VECs are described in sections 7.6.3.1 – 7.6.3.5. The magnitude and significance of the cumulative effects, including additive and synergistic effects of the proposed actions, as well as past, present, and future actions, have been taken into account (section 7.6.3).

When considered in conjunction with all other pressures placed on the fisheries by past, present, and reasonably foreseeable future actions, the preferred alternatives are not expected to result in any significant impacts, positive or negative. They should generally reinforce existing impacts.

The magnitudes and directions of impacts on each VEC from the proposed alternatives are summarized below and detailed in Sections 7.1-7.5 and the non-significant cumulative effects are described in Section 7.6. The proposed action is anticipated to generally maintain the current status of the VECs

Summary of Impacts

Target Species Impact Summary

The preferred alternative should maintain the sustainable status of the *Illex* resource, resulting in a slight positive impact.

Non-Target Species Impact Summary

Non-target interactions, and therefore impacts on these species, are negligible in the *Illex* fishery.

Habitat Impact Summary

Under the preferred alternative, fishing activity would generally continue in a manner similar to past effort, so impacts would be expected to continue to be slight negative.

Protected Resources Impact Summary

Under the preferred alternative, fishing activity would generally continue in a manner similar to past effort, so impacts would be expected to continue to be slight negative to slight positive depending on the protected species.

Human Communities Impact Summary

Under the preferred alternative, fishing activity would generally continue in a manner similar to past effort, so impacts would be expected to continue to be moderate positive.

Conclusion

The preferred alternatives are consistent with other management measures that have been implemented in the past for MAFMC-managed resources. These measures are part of a broader management scheme for all MAFMC-managed fisheries. This management scheme has helped to rebuild stocks and ensure long-term sustainability, while minimizing environmental impacts. The regulatory atmosphere within which federal fishery management operates requires that management actions be taken in a manner that will optimize the conditions of managed species, habitat, and human communities. Consistent with NEPA, the MSA requires that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment. Given this regulatory environment, and because fishery management actions must strive to create and maintain sustainable resources, impacts on all VECs from past, present and reasonably foreseeable future actions have generally been positive in trend and are expected to continue in that manner for the foreseeable future. This is not to say that some aspects of the VECs are not experiencing negative impacts, but rather that when considered as a whole and as a result of the management measures implemented in these fisheries, the overall long-term trend is positive, though there are no significant cumulative effects associated with the preferred alternatives based on the information and analyses presented in this document and in past FMP documents. Cumulatively, through 2023, it is anticipated that the preferred alternatives will result in non-significant impacts on all VECs, ranging from slight negative to moderate positive.

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

8.1 Magnuson-Stevens Fishery Conservation and Management Act

8.1.1 National Standards

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

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

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

The proposed measures should avoid overfishing and achieve optimum yield.

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

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

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

The FMP addresses management of *Illex* throughout the range of the species in U.S. waters.

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

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

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

There is no allocation proposed. The proposed actions are efficient in that they should facilitate full utilization of the relevant quotas.

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

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

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

As always, the MAFMC considered the costs and benefits associated with the management measures proposed in the action when developing this action. This action should not create any duplications related to managing the MSB resources and is taken to utilize updated information on these stocks.

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

The human community impacts of the action are described above in Section 7.5. No changes to quotas are proposed, which should enable ongoing participation by relevant communities.

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

There is minimal bycatch in the *Illex* fishery – see Section 6.1.

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

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

8.1.2 Other Required Provisions of the Magnuson-Stevens Act

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

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

The MSB FMP has evolved over time through 20+ Amendments and currently uses Acceptable Biological Catch recommendations from the MAFMC's SSC to sustainably manage the MSB fisheries. Under the umbrella of limiting catch to the Acceptable Biological Catch, a variety of other management and conservation measures have been developed to meet the goals of the FMP and remain consistent with the National Standards. The current measures are codified in the Code of Federal Regulations (50 C.F.R. § 648 Subpart B - https://www.ecfr.gov/current/title-

50/part-648) This action proposes measures that should continue to promote the long-term health and stability of the fisheries, consistent with the MSA.

(2) contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any

Every Amendment to the MSB FMP provides this information. This document updates this information as appropriate in Section 6.

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

Full assessment reports are available at: https://www.fisheries.noaa.gov/about/resource-evaluation-and-assessment-northeast or by contacting MAFMC staff. The preferred measures use the most recent assessments, which combine biological, fishery, and other data to estimate resource productivity. The SSC reviewed these materials when recommending the proposed ABC (see Section 5 and https://www.mafmc.org/ssc-meetings/2022/july-25-26 for details).

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

Based on past performance, if any MSB species are sufficiently abundant and available, the domestic fishery has the desire and ability to fully harvest the available quotas, and domestic processors can process the fish/squid.

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

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

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

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

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

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

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

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

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

Section 7.5 of this document provides an assessment of the likely effects on fishery participants and communities from the considered actions. No quota changes are proposed.

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

Previous actions have provided for automatic incorporation of new overfished/overfishing reference points once accepted through a peer-review process.

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

NMFS implemented an omnibus amendment to implement a standardized reporting methodology. For details see: https://www.federalregister.gov/documents/2017/01/19/2017-00405/standardized-bycatch-reporting-methodology.

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

There is minimal recreational fishing for *Illex*, and no relevant catch and release programs.

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

This document updates this information as appropriate in Section 6.

(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.

No reductions in harvest are proposed.

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

The annual specifications process addresses this requirement. Acceptable Biological Catch recommendations from the MAFMC's SSC are designed to avoid overfishing and form the upper bounds on catches. There are a variety of proactive and reactive accountability measures for these fisheries, fully described in the Code of Federal Regulations.

8.1.3 Discretionary Provisions of the Magnuson-Stevens Act

Section 303b of the MSA contains 14 additional discretionary provisions for FMPs. See https://www.fisheries.noaa.gov/topic/laws-policies#magnuson-stevens-act. Of import for this action, these discretionary provisions allow fishery closures and trip limits for when the quota is reached, though these are not being changed in this action.

8.1.4 Essential Fish Habitat Assessment

The measures under the preferred alternatives proposed in this action are not expected to result in substantial changes in effort that impact habitat, as described in Section 7. Therefore, the MAFMC concluded in section 7 of this document that the proposed measures will have no additional adverse impacts on EFH that are more than minimal or temporary. Thus no mitigation is necessary. The adverse impacts of bottom trawls used in MSB fisheries on other managed species (not MSB), which were determined to be more than minimal and not temporary in Amendment 9, were minimized to the extent practicable by the Lydonia and Oceanographer canyon closures to squid fishing. In addition, Amendment 1 to the Tilefish FMP closed those canyons plus Veatch's and Norfolk Canyons to all bottom trawling. Deepwater corals were also protected in Amendment 16. Therefore, the adverse habitat impacts of MSB fisheries "continue to be minimized." Amendment 11 revised the MSB EFH designations and EFH impacts will continue to be monitored and addressed as appropriate. A review of EFH designations and fishery impacts is planned for 2023.

8.2 Marine Mammal Protection Act

The various species of marine mammals occurring in the management unit of the MSB FMP that are afforded protection under the Marine Mammal Protection Act of 1972 (MMPA) are

described in Section 6.4. As provided in section 6.4, various MMPA protected species have the potential to interact with the gear types used in the FMP (i.e., mid-water and/or bottom trawl gear). None of the proposed measures are expected to significantly alter fishing methods or activities or result in substantially increased effort. The MAFMC has reviewed the impacts of the proposed measures on marine mammals and concluded that the management actions proposed are consistent with the provisions of the MMPA and would not alter existing measures to protect the species likely to occur in management units of the MSB fisheries. A final determination of consistency with the MMPA will be made by the agency when this action is approved. For further information on the potential marine mammal impacts of the fishery and the proposed management action, see Sections 6 and 7 of this Environmental Assessment.

8.3 Endangered Species Act

Pursuant to section 7 of the Endangered Species Act (ESA), NOAA's National Marine Fisheries Service (NMFS) issued a Biological Opinion (Opinion) on May 27, 2021, that considered the effects of the NMFS' authorization of ten FMPs, NMFS' North Atlantic Right Whale Conservation Framework, and the NEFMC's Omnibus Essential Fish Habitat Amendment 2, on ESA-listed species and designated critical habitat. The ten FMPs considered in the Opinion include the: (1) American Lobster; (2) Atlantic Bluefish; (3) Atlantic Deep-Sea Red Crab; (4) Mackerel/Squid/Butterfish; (5) Monkfish; (6) Northeast Multispecies; (7) Northeast Skate Complex; (8) Spiny Dogfish; (9) Summer Flounder/Scup/Black Sea Bass; and (10) Jonah Crab FMPs. The American Lobster and Jonah Crab FMPs are permitted and operated through implementing regulations compatible with the interstate fishery management plans (ISFMP) issued under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACA), the other eight FMPs are issued under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

The 2021 Opinion determined that the NMFS' authorization of ten FMPs, NMFS' North Atlantic Right Whale Conservation Framework, and the NEFMC's Omnibus Essential Fish Habitat Amendment 2: (1) may adversely affect, but is not likely to jeopardize, the continued existence of North Atlantic right, fin, sei, or sperm whales; the Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, leatherback, Kemp's ridley, or North Atlantic DPS of green sea turtles; any of the five DPSs of Atlantic sturgeon; Gulf of Maine DPS Atlantic salmon; or giant manta rays; and (2) is not likely to adversely affect designated critical habitat for North Atlantic right whales, the Northwest Atlantic Ocean DPS of loggerhead sea turtles, U.S. DPS of smalltooth sawfish, Johnson's seagrass, or elkhorn and staghorn corals. An Incidental Take Statement (ITS) was issued in the Opinion. The ITS includes reasonable and prudent measures and their implementing terms and conditions, which NMFS determined are necessary or appropriate to minimize impacts of the incidental take in the fisheries assessed in this Opinion.

NMFS has recently received information that the estimated incidental bycatch rate of Atlantic sturgeon in gillnet gear through 2021 may be higher than what was expected and authorized in the Opinion. NMFS is reviewing this information in order to fully understand the implications on Atlantic sturgeon and is considering if reinitiation of consultation is required. However, as provided in the analyses above, the proposed action does not entail making any changes to the MSB fishery that would cause an increase in interactions with or effects to ESA-listed species or their critical habitat. Further, gillnet gear is not used in the MSB fisheries. Given this, new or elevated interaction risks with listed species are not expected to occur under the proposed action, and therefore, we do not expect the proposed action to jeopardize the continued existence of any ESA-listed species or adversely modify their designated critical habitat.

Given the information provided above, it has been determined that the proposed action is within the scope of the MSB FMP considered in the 2021 Opinion and will not create impacts to ESA-listed species or critical habitat that go above and beyond those considered for the MSB FMP in the 2021 Opinion completed by NMFS.

8.4 Administrative Procedures Act

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

8.5 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act (PRA) is to control and, to the extent possible, minimize the paperwork burden for individuals, small businesses, nonprofit institutions, and other persons resulting from the collection of information by or for the Federal Government. No required paperwork or reporting changes should occur as a result of this action.

8.6 Coastal Zone Management Act

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

coastal policies of affected states and will make an appropriate determination as part of the rulemaking process.

8.7 Section 515 (Data Quality Act)

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

Utility

The information presented in this document should be helpful to the intended users (the affected public) by presenting a clear description of the purpose and need of the proposed action, the measures proposed, and the impacts of those measures. A discussion of the reasons for selecting the proposed action is included in Section 5 so that intended users may have a full understanding of the proposed action, its implications, and the MAFMC's rationale.

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

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

Integrity

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

Confidentiality of Statistics provisions of the MSA; and NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics.

Objectivity

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

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

Despite current data limitations, the conservation and management measures proposed for this action were selected based upon the best scientific information available. The analyses conducted in support of the proposed action were conducted using information from the most recent complete calendar years, generally through 2021 except as noted and explained. The data used in the analyses provide the best available information on the number of seafood dealers operating in the northeast, the number, amount, and value of fish purchases made by these dealers. Specialists (including professional members of plan development teams, technical teams, committees, and MAFMC staff) who worked with these data are familiar with the most current analytical techniques and with the available data and information relevant to these fisheries.

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

The review process used in preparation of this document will involve the responsible Council, the Northeast Fisheries Science Center, the Greater Atlantic Regional Fisheries Office, and

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

8.8 Regulatory Flexibility Analysis

Initial Regulatory Flexibility Analysis

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

For RFA purposes, a business primarily engaged in fishing 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.

The RFA emphasizes predicting significant adverse impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts, while still achieving the stated objective of the action. When an agency publishes a proposed rule, it must either, (1)"certify" that the action will not have a significant adverse impact on a substantial number of small entities, and support such a certification declaration with a "factual basis", demonstrating this outcome, or, (2) if such a certification cannot be supported by a factual basis, prepare and make available for public review an Initial Regulatory Flexibility Analysis (IRFA) that describes the impact of the proposed rule on small entities.

This document provides the factual basis supporting a certification that the proposed regulations will not have a "significant impact on a substantial number of small entities" and that an IRFA is not needed in this case. Certifying an action must include the following elements, and each element is subsequently elaborated upon below:

A. A statement of basis and purpose of the rule
B A description and estimate of the number of small entities to which the rule applies
C. Description and estimate of economic impacts on small entities, by entity size and industry
D. An explanation of the criteria used to evaluate whether the rule would impose significant economic impacts
E. An explanation of the criteria used to evaluate whether the rule would impose impacts on a substantial number of small entities
F. A description of, and an explanation of the basis for, assumptions used

A – Basis and purpose of the rule

The basis of the rules proposed in this action are the provisions of the MSA for federal fishery management to avoid overfishing by controlling catches while also achieving optimum yield. As discretionary provisions of FMPs the MSA also allows restriction of fishing when quotas are attained.

The purpose of this action is to set specifications for the 2023 *Illex* fishery. This action is needed to prevent overfishing and achieve optimum yield. Per the Magnuson-Stevens Fishery Conservation and Management Act (MSA), optimum yield is defined as the amount of fish that will provide the greatest overall benefit to the nation based on the stock's maximum sustainable yield as reduced by relevant economic, social, and/or ecological factors. A full description of all alternatives is provided in Section 5.

To assist with further evaluation of the measures proposed in this document, the following is a brief summary of the preferred alternative selected by the MAFMC for this action:

This action would set 2023 specifications for *Illex* squid. The specifications would be the same as 2022, with a 40,000 MT ABC and a quota of 38,192 MT. No other measures are proposed.

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

The measures proposed in this action apply to vessels that hold commercial limited access permits for *Illex*. No changes are proposed for the open access incidental permits. Some entities own multiple vessels with *Illex* permits. Staff queried ownership data provided by the Social Science Branch of NMFS' Northeast Fisheries Science Center to determine the numbers of relevant entities. The analysis found that in 2021, there were 69 limited access *Illex* permits/vessels. These 69 vessels were owned by 55 entities, 49 of which qualified as small businesses under SBA definitions (6 were classified as large entities).

C – Description and estimate of economic impacts on small entities

Because status-quo measures are proposed, no negative impacts are expected, especially since the proposed quotas would be higher than recent (2019-2021) catches.

D/E – An explanation of the criteria used to evaluate whether the rule would impose significant economic impacts/ An explanation of the criteria used to evaluate whether the rule would impose impacts on a substantial number of small entities

Because status-quo measures are proposed, no negative impacts are expected, especially since the proposed quotas would be higher than recent (2019-2021) catches.

F – A description of, and an explanation of the basis for, assumptions

Other than those described directly in the above analyses, the primary assumption utilized in the above analyses is that comparing upcoming fishery operation to how the fishery operated over 2019-2021 is appropriate. Using the most recent three years of fishery operation is standard practice for Regulatory Flexibility Analysis and there is no indication that such an approach is contraindicated in this case since doing so captures what the industry has recently experienced versus potential impacts going forward from implementation of the proposed specifications.

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

INTRODUCTION

Executive Order 12866 requires a Regulatory Impact Review (RIR) in order to enhance planning and coordination with respect to new and existing regulations. This Executive Order requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be "significant." Section 7 assesses the costs and benefits of the Proposed Action and found the impacts to be moderately positive. Because status-quo measures are proposed, no negative impacts are expected, especially since the proposed quotas would be higher than recent (2019-2021) catches. 33 vessels landed over 10,000 pounds of *Illex* in 2021, with total *Illex* landings valued at $29.7 million. From 2019-2021 *Illex* ex-vessel revenues varied from $25.3-$29.7 million, averaging $28.2 million. The analysis included in this RIR further demonstrates that this action is not a "significant regulatory action" because it will not affect in a material way the economy or a sector of the economy.

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

1* Have an annual effect on the economy of $100 million or more, or adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

2* Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

3* Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

4* Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

OBJECTIVES and PROBLEM STATEMENT

The goals and objectives of the MSB FMP are described above in Section 4. The purpose of this action is to set specifications for the 2023 *Illex* fishery. This action is needed to prevent overfishing and achieve optimum yield.

ANALYSIS OF ALTERNATIVES

Executive Order 12866 mandates that proposed measures be analyzed below in terms of: (1) changes in net benefits and costs to stakeholders, (2) changes to the distribution of benefits and costs within the industry, (3) changes in income and employment, (4) Cumulative effects of the regulation, and (5) changes in other social concerns. As described in Section 7, none of the preferred measures will substantially limit the *Illex* fishery compared to recent performance. These findings support a determination that this action is not significant for purposes of Executive Order 12866.

There should not be substantial distributional issues (all permit holders are impacted similarly), and impacts on income and employment should mirror the impacts on fishing revenues described above (i.e. should not be substantial especially in the long run). As described in Section 7, the MAFMC has concluded that no significant cumulative effects will result from the proposed specifications. There are no other expected social concerns.

DETERMINATION OF EXECUTIVE ORDER 12866 SIGNIFICANCE

Given the analysis in Section 7 and summary information above, the action overall should have moderately positive impacts on participants in the MSB fisheries that are well below the $100 million threshold for a significance determination given the overall ex-vessel value of the fishery in recent years. In addition, there should be no interactions with activities of other agencies and no impacts on entitlements, grants, user fees, or loan programs. The proposed action is also similar to actions taken previously that set specifications and as such does not raise novel legal or policy issues. As such, the Proposed Action is not considered significant as defined by Executive Order 12866.

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

This Executive Order established nine fundamental federalism principles for Federal agencies to follow when developing and implementing actions with federalism implications. The Executive Order also lists a series of policy making criteria to which Federal agencies must adhere when formulating and implementing policies that have federalism implications. However, no federalism issues or implications have been identified relative to the measures proposed measures. This action does not contain policies with federalism implications sufficient to warrant preparation of an assessment under Executive Order 13132. The affected states have been closely involved in the development of the proposed management measures through their representation on the MAFMC (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

8.11 Executive Order (E.O.) 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). NOAA guidance NAO 216-6A, Companion Manual, Section 10(A) requires the consideration of EO 12898 in NEPA documents. 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 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 MSB fisheries. 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 of the species relevant for this action.

9.0 LITERATURE CITED AND SELECTED BACKGROUND DOCUMENTS

Adams, Charles. 2018-2020 NEFSC Butterfish Data Updates – Available at https://www.mafmc.org/ssc.

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

Altenritter, M. N., G. B. Zydlewski, M. T. Kinnison, and G. S. Wippelhauser. 2017. Atlantic sturgeon use of the Penobscot River and marine movements within and beyond the Gulf of Maine. Marine and Coastal Fisheries 9:216-230.

Arai, Kohma, Castonguay, Martin, Secor, David. 2021. Multi-decadal trends in contingent mixing of Atlantic mackerel (Scomber scombrus) in the Northwest Atlantic from otolith stable isotopes. March 2021. Scientific Reports 11(1):6667

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

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

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

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

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

Atlantic States Marine Fisheries Commission (ASMFC). 2017. 2017 Atlantic sturgeon benchmark stock assessment and peer review report. October 18, 2017. 456 pp.

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

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

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

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

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

Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C.

Broderick, and B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. Endangered Species Research 2:51-61.

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

Breece, M. W., D. A. Fox, K. J. Dunton, M. G. Frisk, A. Jordaan, and M. J. Oliver. 2016. Dynamic seascapes predict the marine occurrence of an endangered species: Atlantic sturgeon Acipenser oxyrinchus oxyrinchus. Methods in Ecology and Evolution 7:725-733.

Breece, M. W., D. A. Fox, D. E. Haulsee, I. I. Wirgin, and M. J. Oliver. 2018. Satellite driven distribution models of endangered Atlantic sturgeon occurrence in the mid-Atlantic Bight. ICES Journal of Marine Science, 75:562-571.

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

Bolten, A.B., L.B. Crowder, M. G. Dodd, A.M. Lauritsen, J. A. Musick, B. A. Schroeder, and B. E. Witherington (2019). Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (Caretta caretta) Second Revision (2008); Assessment of Progress Toward Recovery. Issued December 2019; https://media.fisheries.noaa.gov/dam-migration/final_nw_atl_cc_recovery_team_progress_review_report_508.pdf.

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

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

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

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.

Campos, Aida, and Paulo Fonseca. 2003. “Selectivity of Diamond and Square Mesh Cod Ends for Horse Mackerel (Trachurus trachurus), European Hake (Merluccius Merluccius) and Axillary Seabream (Pagellus Acarne) in the Shallow Groundfish Assemblage off the South-West Coast of Portugal”. Scientia Marina 67 (2):249-60. https://doi.org/10.3989/scimar.2003.67n2249.

Casey J., Nicholson M.D. & Warnes S. (1992) Selectivity of square mesh codends of pelagic trawls for Atlantic mackerel (Scomber scombrus L.). Fisheries Research, 13, 267-279.

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

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

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

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

Clark, W. G. 1993. The effect of recruitment variability on the choice of a target level of spawning biomass per recruit. Pages 233–246 in G. Kruse, R. J. Marasco, C. Pautzke, and T. J. Quinn II, editors. Proceedings of the international symposium on management strategies for exploited fish populations. University of Alaska, Alaska Sea Grant College Program Report 93-02, Fairbanks.

Clark 2002. F35% Revisited Ten Years Later. North American Journal of Fisheries Management 22:251–257, 2002.

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

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

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

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

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

Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons topopulations 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.

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.

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

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

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

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

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

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

Dyck, A.J., Sumaila, U.R. Economic impact of ocean fish populations in the global fishery. J Bioecon 12, 227–243 (2010). https://doi.org/10.1007/s10818-010-9088-3.

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

Ecosystem Assessment Program (EAP). 2009. Ecosystem Assessment Report for the Northeast U.S. Continental Shelf Large Marine Ecosystem. U.S. Dept Commer, Northeast Fish Sci Cent

Ref Doc. 09-11; 61 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/crd/crd0911/crd0911.pdf.

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

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

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

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

Fay, C., M. Bartron, S. Craig, A. Hecht, J. Pruden, R. Saunders, T. Sheehan, and J. Trial. 2006. Status Review for Anadromous Atlantic Salmon (Salmo salar) in the United States. Report to the National Marine Fisheries Service and U.S. Fish and Wildlife Service. 294 pages.

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

Gabriel, W. L., Mace, P. M. (1999). A review of biological reference points in the context of the precautionary approach. In Proceedings of the 5th annual NMFS National Stock Assessment Workshop. NOAA Tech Memo. NMFS-F/SPO-40.

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

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

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

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

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

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

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

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

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.

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

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

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

Hendrickson, L. 2020-2018 NEFSC Longfin and Illex Data Updates – Available at https://www.mafmc.org/ssc.

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

Henry A.; M. Garron; D. Morin; A. Smith; A. Reid; W. Ledwell; T.V.N. Cole. 2022. Serious Injury and Mortality Determinations for Baleen Whale Stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2015-2019. US Dept Commer Northeast Fish Sci Cent Tech Memo 280. 65 p. Accessible at: https://doi.org/10.25923/nfr5-7r84

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.

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

Hilborn et al 2017. When does fishing forage species affect their predators? Fisheries Research. Volume 191, July 2017, Pages 211-221

Hilton, E. J., B. Kynard, M.T. Balazik, and C.B. Dillman. 2016. Review of the biology, fisheries, and conservation status of the Atlantic sturgeon, (Acipenser oxyrinchus oxyrinchus Mitchell, 1815). Journal of Applied Ichthyology 32:30-66.

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

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

Hutt and Silva 2019. Economic Contributions of Atlantic Highly Migratory Species Anglers and Tournaments, 2016. Available at https://repository.library.noaa.gov/

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.

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

Ingram, E. C., R. M. Cerrato, K. J. Dunton, and M. G. Frisk. 2019. Endangered Atlantic sturgeon in the New York Wind Energy Area: Implications of future development in an offshore wind energy site. Scientific Reports 9(1):1–13.

Jacobsen, Kelsey 2014. A global synthesis of the economic multiplier effects of marine sectors. Marine Policy. Marine Policy 44 (2014) 273–278

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

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

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

Jefferson, T.A., D. Fertl, J. Bolanos-Jimenez and A.N. Zerbini. 2009. Distribution of common dolphins (Delphinus spp.) in the western North Atlantic: a critical re-examination. Mar. Biol. 156:1109-1124.

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

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

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

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

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

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

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

Laney, R.W., J.E. Hightower, B.R. Versak, M.F. Mangold, W.W. Cole Jr., and S.E. Winslow 2007. Distribution, habitat use, and size of Atlantic sturgeon captured during cooperative winter tagging cruises, 1988–2006. Pages 167-182. In: J. Munro, D. Hatin, J. E. Hightower, K.

McKown, K. J. Sulak, A. W. Kahnle, and F. Caron, (editors), Anadromous sturgeons: Habitats, threats, and management. Am. Fish. Soc. Symp. 56, Bethesda, MD.

Legault and Brooks 2013. Can stock–recruitment points determine which spawning potential ratio is the best proxy for maximum sustainable yield reference points? ICES Journal of Marine Science, Volume 70, Issue 6, September 2013, Pages 1075–1080, https://doi.org/10.1093/icesjms/fst105

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

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

Lovell et al 2020. The Economic Contribution of Marine Angler Expenditures on Fishing Trips in the United States, 2017. NOAA Technical Memorandum NMFS-F/SPO-201. March 2020. Available at https://spo.nmfs.noaa.gov/sites/default/files/TM201.pdf.

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

Mace 1994. Relationships between Common Biological Reference Points Used as Thresholds and Targets of Fisheries Management Strategies. January 1994. Canadian Journal of Fisheries and Aquatic Sciences 51(1):110-122 DOI:10.1139/f94-013

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

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

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

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

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

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

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

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

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

MAFMC 2019. Framework 13 to MSB FMP - Mackerel Rebuilding. Available at https://www.mafmc.org/msb.

MAFMC 2021. MSB Specifications EA. Available at https://www.mafmc.org/supporting-documents.

MAFMC SSC 2021a. July 2021 Report of the MAFMC's SSC. Available at https://www.mafmc.org/ssc.

MAFMC SSC 2021b. September 2021 Report of the MAFMC's SSC. Available at https://www.mafmc.org/ssc.

MAFMC SSC 2022. March 2022 Report of the MAFMC's SSC. Available at https://www.mafmc.org/ssc.

MAFMC SSC 2022b. July 2022 Report of the MAFMC's SSC. Available at https://www.mafmc.org/ssc.

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

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

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

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

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.

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

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

Moura, A., Muniz, A.A., Mullis, E., Wilson, J.M., Viera, R.P., Almeida, A.A., Pinto, E., Brummer, G.J.A., Gaever, P.V., Gonçalves, J.M.S., and Correia, A.T. 2020. Population structure and dynamics of the Atlantic Mackerel (Scomber scombrus) in the North Atlantic inferred from otolith chemical and shape signatures . Fisheries Research 230: doi.org/10.1016/j.fishres.2020.105621.

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

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

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

NEFSC 2004. Northeast Fisheries Science Center. 2004. Report of the 38th Northeast Regional Stock

Assessment Workshop (38th SAW): advisory report. Northeast Fish. Sci. Cent. Ref. Doc. 04-04; 24 p. Available at: http://www.nefsc.noaa.gov/nefsc/publications/.

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

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

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

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

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

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

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

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

NEFSC 2020a. Butterfish Management Track Assessment. Available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/population-assessments/fishery-stock-assessments-new-england-and-mid-atlantic.

NEFSC 2020b. Longfin Squid Management Track Assessment. Available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/population-assessments/fishery-stock-assessments-new-england-and-mid-atlantic.

NEFSC 2020c. State of the Ecosystem Reports for the Northeast U.S. Shelf. Available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/ecosystems/state-ecosystem-reports-northeast-us-shelf.

NEFSC 2020d. 2020 Discard Estimation, Precision, and Sample Size Analyses for 14 Federally Managed Species Groups in the Waters off the Northeastern United States. By SE Wigley and C Tholke. Available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/northeast-fisheries-science-center-publications.

NEFSC 2021. Atlantic Mackerel Management Track Assessment. Available at https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php.

NEFSC 2022a. Mid-Atlantic Bight State of the Ecosystem Report. Available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/ecosystems/state-ecosystem-reports-northeast-us-shelf.

NEFSC 2022b. New England Shelf State of the Ecosystem Report. Available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/ecosystems/state-ecosystem-reports-northeast-us-shelf.

NEFSC 2022c. Illex Research Track Assessment. Available at https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php.

Network (WIDECAST). WIDECAST Technical Report No. 16. Godfrey, Illinois. 36 pp.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB). 2018. Northeast Fisheries Observer Program: Incidental Take

Reports. Omnibus data request + supplemental data for 2017 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html

NMFS (National Marine Fisheries Service). 2021a. Endangered Species Act Section 7 Consultation on the: (a) Authorization of the American Lobster, Atlantic Bluefish, Atlantic, Deep-Sea Red Crab, Mackerel/Squid/Butterfish, Monkfish, Northeast Multispecies, Northeast Skate Complex, Spiny Dogfish, Summer Flounder/Scup/Black Sea Bass, and Jonah Crab Fisheries and (b) Implementation of the New England Fishery Management Council's Omnibus Essential Fish Habitat Amendment 2. National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, Gloucester, Massachusetts; May 2021.

NMFS (National Marine Fisheries Service). 2021b. Final Environmental Impact Statement, Regulatory Impact Review, and Final Regulatory Flexibility Analysis for Amending the Atlantic Large Whale Take Reduction Plan: Risk Reduction Rule. Prepared by: NOAA's National Marine Fisheries Service and Industrial Economics, Incorporated; June 2021. https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/atlantic-large-whale-take-reduction-plan

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Novak, A. J., A. E. Carlson, C. R. Wheeler, G. S. Wippelhauser, and J. A. Sulikowsk. 2017. Critical foraging habitat of Atlantic sturgeon based on feeding habits, prey distribution, and movement patterns in the Saco River Estuary, Maine. Transactions of the American Fisheries Society 146:308-317

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

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

O'Leary, S.J., K. J. Dunton, T. L. King, M. G. Frisk, and D.D. Chapman. 2014. Genetic diversity and effective size of Atlantic sturgeon, Acipenser oxyrhinchus oxyrhinchus, river spawning

populations estimated from the microsatellite genotypes of marine-captured juveniles. Conserv Genet: DOI 10.1007/s10592-014-0609-9; ISSN 1566-0621

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

Pace, R. M., III, P. J. Corkeron, and S. D. Kraus. 2017. State–space mark–recapture estimates reveal a recent decline in abundance of North Atlantic right whales [online]. Ecology and Evolution 2017: 1-12. DOI: 10.1002/ece3.3406.

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

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

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

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

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

Pikitch et al 2012. The global contribution of forage fish to marine Fisheries and Ecosystems. Fish and Fisheries. First published: 05 September 2012 https://doi.org/10.1111/faf.12004

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

Rago, Paul. 2022. Evaluation of Alternative Catch Limits for *Illex* in 2022 Report to Mid-Atlantic Fishery Management Council Scientific and Statistical Committee. Available at https://www.mafmc.org/ssc-meetings/2022/march-15-16.

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

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

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

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

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

Rothermel E. R., M. T. Balazik, J. E. Best, M. W. Breece, D. A. Fox, B. I. Gahagan, D. E. Haulsee, A. L. Higgs, M. H. P. O'Brien, M. J. Oliver, I. A. Park, and D. H. Secor. 2020. Comparative migration ecology of striped bass and Atlantic sturgeon in the US Southern mid-Atlantic bight flyway. PLoS ONE 15(6): e0234442. https://doi.org/10.1371/journal.pone.0234442

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

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

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

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

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

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

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

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

Seminoff, J.A., C.D. Allen, G.H. Balazs, P.H. Dutton, T. Eguchi, H.L. Hass, S.A. Hargrove, M. Jensen, D.L. Klemm, A.M. Lauritsen, S.L. MacPherson, P. Opay, E.E. Possardt, S. Pultz, E. Seney, K.S. Van Houtan, and R.S. Waples. 2015. Status Review of the Green Turtle (Chelonia

mydas) Under the Endangered Species Act. NOAA Technical Memorandum: NOAA-TM-NMFS-SWFSC-539. NMFS Southwest Fisheries Science Center, March 2015.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2014a. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2013. NOAA Tech Memo NMFS- NE-228. 475 pp.

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

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

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

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

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

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

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

Wippelhauser, G. S., J. Sulikowsk, G. B. Zydlewski, M. A. Altenritter, M. Kieffer, M. T. Kinnison. 2017. Movements of Atlantic Sturgeon of the Gulf of Maine Inside and Outside of the Geographically Defined Distinct Population Segment Marine and Coastal Fisheries 9:93-107.

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

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

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

10.0 LIST OF AGENCIES AND PERSONS CONSULTED

In preparing this annual specifications analysis the MAFMC consulted with the NMFS, New England and South Atlantic Fishery Management Councils, Fish and Wildlife Service, Department of State, and the states of Maine through Florida through their membership on the Mid-Atlantic, New England and/or South Atlantic Fishery Management Councils. In addition, states that are members within the management unit were consulted through the Coastal Zone Management Program consistency process. Letters were sent to each of the following states within the management unit reviewing the consistency of the proposed action relative to states' Coastal Zone Management Programs: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia and Florida.

11.0 LIST OF PREPARERS AND POINT OF CONTACT

This environmental assessment was prepared by Jason Didden of MAFMC staff in coordination with a number of NMFS staff. Questions about this environmental assessment or additional copies may be obtained by contacting Jason Didden, Mid-Atlantic Fishery Management Council, 800 N. State Street Suite 201, Dover, DE 19901 (302-674-2331). This Environmental Assessment may also be accessed by visiting the MAFMC website at www.mafmc.org.

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