ENVIRONMENTAL ASSESSMENT, FINDING OF NO SIGNIFICANCE, AND REGULATORY IMPACT REVIEW FOR THE 2022 EMERGENCY FINAL RULE TO REDUCE RIGHT WHALE INTERACTIONS WITH LOBSTER AND JONAH CRAB TRAP/POT GEAR

March 31, 2022

Contents:

US DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

GREATER ATLANTIC REGIONAL FISHERIES OFFICE

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1 INTRODUCTION

In accordance with the National Environmental Policy Act (NEPA), this Environmental Assessment (EA) evaluates potential environmental impacts of an emergency rule implemented by NOAA's National Marine Fisheries Service (NMFS) under Section 118 of the Marine Mammal Protection Act (MMPA) to modify the regulations implementing the Atlantic Large Whale Take Reduction Plan (Plan). NMFS determined that this emergency closure of the waters between state and federal portions of the Massachusetts Restricted Area (MRA) in April is necessary to respond to immediate threats to valuable natural resources, as described in Section 11 of the NEPA Companion Manual (CM) to NAO 216-6A (Pentony 2022). Significant impacts are not anticipated as a result of this action because the emergency closure area is small relative to the entire MRA, minimal economic impacts are expected, and any indirect effects are likely beneficial for the environment. NMFS determined that this emergency action constitutes "a scenario with an immediate threat to human health or safety, or immediate threats to valuable natural resources" (CM Section 11), and that the activities necessary to respond to the emergency are not clearly covered by an existing Categorical Exclusion under NOAA Administrative Order 216-6A. Due to the urgent nature of this issue, the NEPA analysis may be completed after the emergency action is published for actions that are expected to have no significant impacts on the environment (NMFS 2019).

1.1 Background

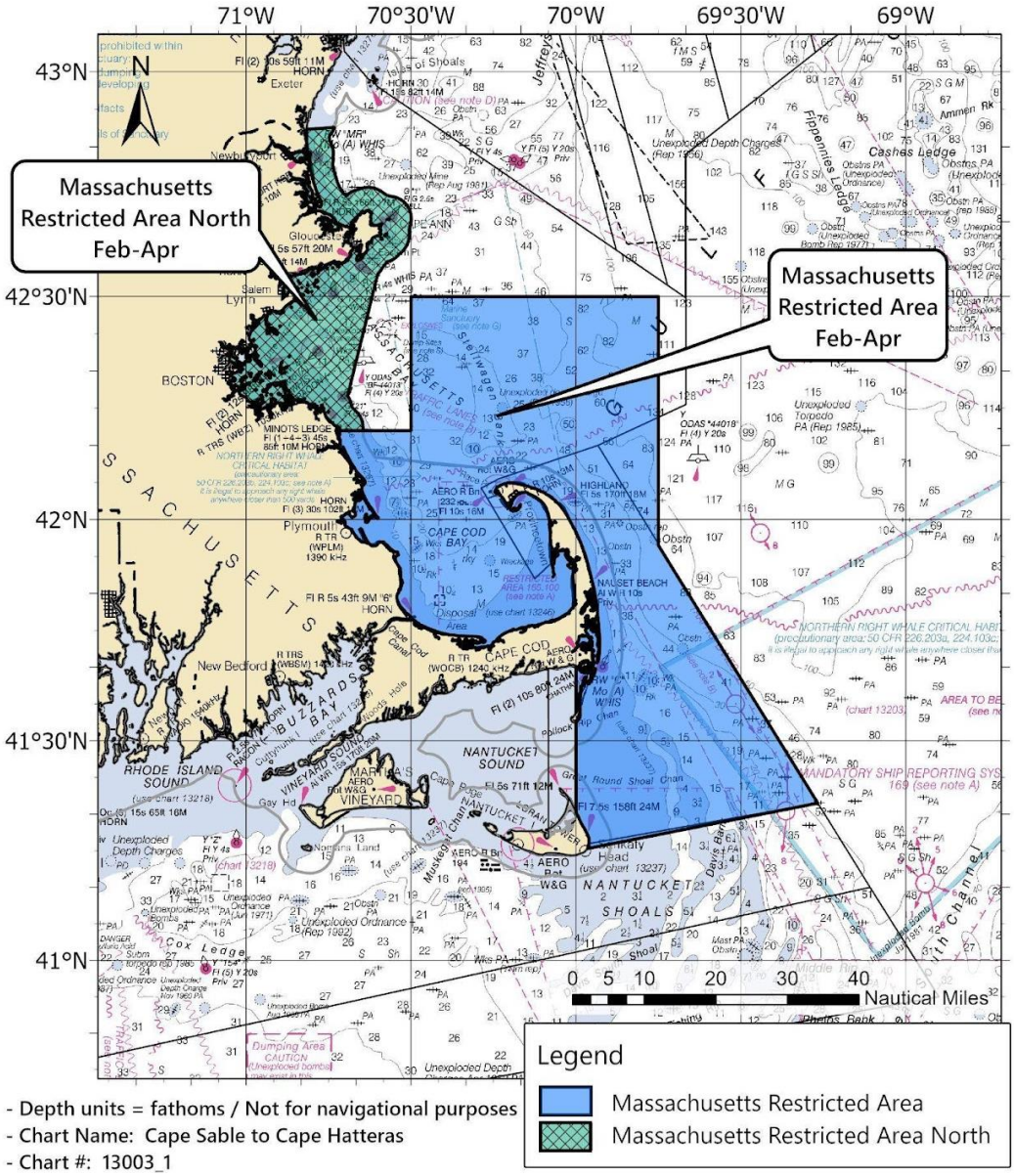
The Plan was developed pursuant to section 118(f) of the MMPA to reduce the level of mortality and serious injury of large whales as a result of trap/pot and gillnet commercial fishing gear. After the 1994 amendments to the MMPA, NMFS created the Atlantic Large Whale Take Reduction Team (Team) in 1996 and developed the first Atlantic Large Whale Take Reduction Plan (Plan), which published its implementing regulations on July 22, 1997 (62 FR 39157). The Team consists of stakeholders representing state and federal government agencies, fishing industry, conservation organizations, and researchers. For a more detailed management history of the Plan and management of fishery interactions, please see the Final Environmental Impact Statement (FEIS) accompanying the 2021 amendment to the Plan (NMFS 2021d).

In 2017, new research confirmed that the North Atlantic right whale (*Eubalaena glacialis*; hereafter referred to as right whale) population had been in decline since 2010 as a result of low calving rates and increased human-caused mortality, much of which is unobserved (Pace et al. 2017). Seventeen right whale mortalities were documented in 2017, causing NMFS to declare an Unusual Mortality Event, which has continued through 2022 (NMFS 2021a). The evidence of a declining population exacerbated by high mortality caused NMFS to convene subgroups of the Team in early 2018 to investigate the feasibility of risk reduction measures. A full team meeting was held in April 2019 to develop recommendations for Phase 1 modifications of the Plan with a focus on the American lobster and Jonah crab trap/pot fishery in the Northeast Region Trap/Pot Management Area (Northeast Region). The Northeast American lobster and Jonah crab fishery makes up approximately 93 percent of fixed gear buoy lines in the right whale range within U.S. waters. The Plan was modified in 2021 based on the near-consensus risk reduction framework provided by the Team in 2019. NMFS published an FEIS on July 2, 2021 (86 FR 35288) with a 30-day comment period. The Record of Decision was signed on August 30, 2021 and the Final

Rule was published on September 17, 2021 (86 FR 51970). This rule was estimated to reduce the risk of right whale mortality or serious injury by about 60 percent through reductions in the number and strength of trap/pot buoy lines fished in the Northeast Region.

New population information published since the 2019 Team meeting and recent 2021 Final Rule suggest that a greater amount of risk reduction is needed to reduce mortality and serious injury of right whales in U.S. commercial fisheries below their potential biological removal level (PBR), as required by the MMPA. PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, which may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. The most recent Draft 2021 Stock Assessment Report (SAR) published an estimate of right whale population size in 2019 of 368 whales (± 11) with a strong male bias (NMFS 2021b, Pace et al. 2017, Pace 2021). Preliminary 2020 and 2021 data suggest the decline has continued and that fewer than 350 individuals remain (Pettis et al. 2022). Though the population estimate in the 2021 Draft SAR is not final and still undergoing final peer review, it relies upon the same peer-reviewed population models used in Pace et al. (2017) and Pace (2021), and is not expected to change significantly in the final publication. In a webinar on November 2, 2021, NMFS presented this new information and a new estimate of the minimum risk reduction needed to ensure that U.S. commercial fisheries are not causing morality or serious injury to right whales above the stock's PBR Level, the take reduction mandate to the Team established under the MMPA. NMFS estimates an increase from the minimum of 60 percent risk reduction previously identified based on observed entanglement incidents, to at least a 90 percent risk reduction based on total estimated mortality (observed and unobserved). Following a rulemaking effort that culminated in regulations published on September 17, 2021, NMFS has initiated a second rulemaking effort to implement Phase 2 modifications to the Plan. Meetings with the Team on Phase 2 modifications began in January 2021. On August 11, 2021, NMFS started scoping to support development of regulations, publishing a Notice of Intent to prepare an Environmental Impact Statement to analyze measures that would further reduce risk in all fisheries covered under the Plan coast-wide. While that effort is ongoing, a single mortality or serious injury of a North Atlantic right whale in a U.S. fishery would exceed PBR. Observations in 2021 and new information submitted to NMFS in 2022 demonstrate the need for rapid measures to prevent an entanglement in an area of anticipated acute risk of entanglement in April 2022, while long-term measures are developed to address risk in this area and the entire U.S. Atlantic.

Figure 1.1: The Massachusetts Restricted Area North (hatched area in green) of the original closure area (solid blue) was closed by Massachusetts State in Spring of 2021 and mirrored in the Atlantic Large Whale Take Reduction Plan in Fall of 2021. Federal and state waters within the Massachusetts Restricted Area are seasonally closed to the use of vertical buoy lines from February 1 through April 30. Massachusetts State regulations prohibit trap/pot fishing in any waters under the jurisdiction of the Commonwealth from February 1 through May 15 (322 CMR 12.04(2)).



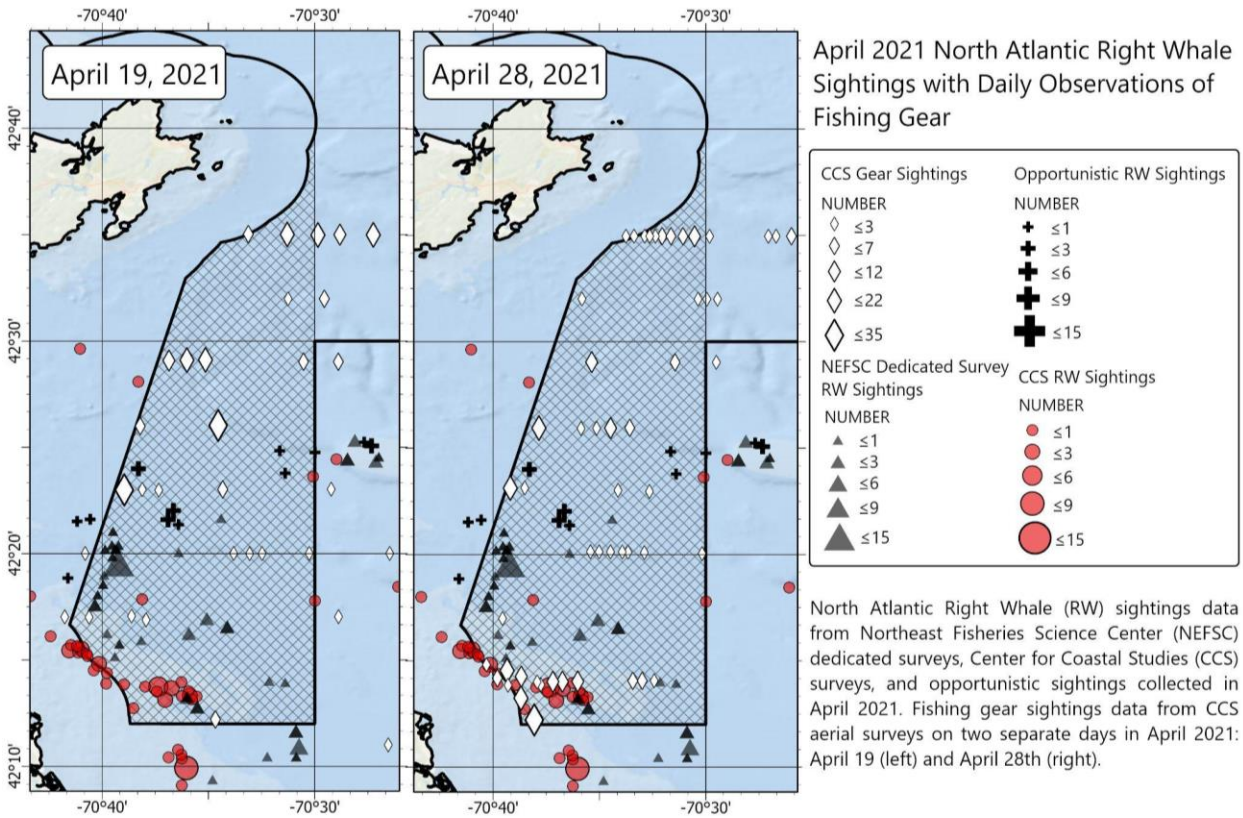
One measure included in the 2021 Final Rule (86 FR 51970, September 17, 2021) has left a critical gap in protection where recent right whale distribution information identifies an area of high overlap between right whales and buoy lines, creating an acute risk of entanglement. The 2021 expansion of the geographic extent of the MRA to include Massachusetts state waters north to the New Hampshire border (MRA North; Figure 1.1) mirrors the Massachusetts 2021 modification of the state water closure (322 CMR 12.04(2)). However, rulemaking to incorporate the State's expansion did not close the gap between the previous MRA Massachusetts Restricted Area and the expanded restricted area. As a result, outside of the boundary of MRA, approximately 200 square miles (518 square kilometers) of federal waters remain open to the lobster and Jonah crab trap/pot fishery between state and federal closures, creating a wedge where right whales and fishing gear overlap. The Center for Coastal Studies (CCS) aerial surveys, aerial and shipboard surveys conducted by the Northeast Fisheries Science Center, and reported opportunistic sightings in April 2021 show an increase in right whales within

unrestricted federal waters surrounded on three sides by the expanded Massachusetts Restricted Area (MRA; Figure 1.2). The CCS survey data also indicates that trap/pot gear is concentrated in this wedge during April. Fishermen that use this area in April are likely to be using the remaining open waters to fish trap/pot gear and also could be staging their gear in preparation for the opening of the federal waters portion of the MRA on May 1.

The September 2021 Final Rule implemented a maximum breaking strength of 1,700 pounds (771 kilograms) in buoy lines for trap/pot fisheries as a precautionary measure to allow whales to break free and reduce the likelihood of serious injury should a right whale become entangled in a buoy line. However, weak insertion requirements do not become effective until May 1, 2022. Given the dense concentration of high-strength buoy lines in an area with persistent right whale presence, this wedge area presents an imminent entanglement threat as whales move in and out of their feeding grounds.

In a letter to Michael Pentony, regional administrator of NMFS's Greater Atlantic Region (GAR), dated January 7, 2022, the Massachusetts Division of Marine Fisheries provided 2020 and 2021 right whale and fishing gear survey data and identified their serious concerns regarding emerging entanglement risks to right whales in the waters adjacent to the expanded MRA. These concerns were echoed by two Team members representing environmental organizations in a letter to GAR dated January 5, 2022 (see Appendix 1.1). The Team was invited to discuss this high risk entanglement area during an informational webinar on January 18, 2022. During this meeting, academic and environmental organizations as well as the Marine Mammal Commission representative on the Team expressed support for expedited rulemaking to restrict the use of lobster and Jonah crab trap/pot buoy lines in this open area. Massachusetts fishermen, including the Massachusetts Lobstermen's Association, which has been instrumental in informing whale protective measures and developing weak insertions to reduce impacts of the Northeast lobster and Jonah crab fishery on right whales, did not support expansion of the MRA to include these waters.

Figure 1.2: The hatched area is closed by Alternative 2 (Preferred) in this emergency rule. Sightings of right whales during April 2021 (red, gray, and black) and gear observed (white) on two different days are overlaid. Red circles show right whale sightings from the Center for Coastal Studies (CCS) aerial surveys, gray triangles show sightings by the Northeast Fisheries Science Center's (NEFSC) dedicated aerial and shipboard surveys, and black crosses are opportunistic sightings collected by NEFSC. Fishing gear observed by CCS on April 19, 2021 and April 28, 2021, two days that were selected as representative snapshots of fishing gear present in survey areas, are represented by white diamonds. Surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA. These maps are used for qualitative not quantitative comparison, and differ from Decision Support Tool data.



1.2 Purpose and Need

The purpose of the emergency rule is to reduce the acute risk of right whale entanglement in lobster and Jonah crab trap/pot fisheries in waters adjacent to the existing MRA during April 2022. Recent survey data demonstrates the likelihood of high overlap between right whales and buoy lines in this area. There is an urgent need to prevent the take of right whales in U.S. commercial fisheries because even one take that causes serious injury or mortality exceeds PBR for this population. Implementing an emergency closure to fishing with buoy lines in this area will address a critical gap in restrictions. This emergency closure in 2022 will reduce entanglement risk where there is a particularly high chance of entanglement that was not addressed in the Plan's recent modifications while long term measures are being developed.

Need	**Purposes**
To prevent any right whale mortality and serious injury in U.S. commercial fisheries	Reduce the acute risk of entanglement in lobster and Jonah crab trap/pot fisheries in a high risk area adjacent to the MRA

1.2.1 Scope of the Analysis

The scope of this analysis is limited to three alternatives modifying the Plan to create an emergency restricted area to supplement the existing MRA during the month of April. This analysis only affects a small portion of federal waters within Lobster Management Area 1 (LMA 1) in the Northeast portion of the waters covered under the Plan (see the remaining waters within LMA 1 outside of the MRA seasonal closure shown in Figure 1.1).

2 SUMMARY OF MANAGEMENT ALTERNATIVES

The Alternatives were selected based on surveys conducted by the Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) that observed North Atlantic right whales (right whales) and/or fixed fishing gear adjacent to the Massachusetts Restricted Area (MRA) seasonal closure in April 2021 and modeling conducted using the Decision Support Tool (described further in Section 4.1).

2.1 Alternative 1: No Action (Status Quo)

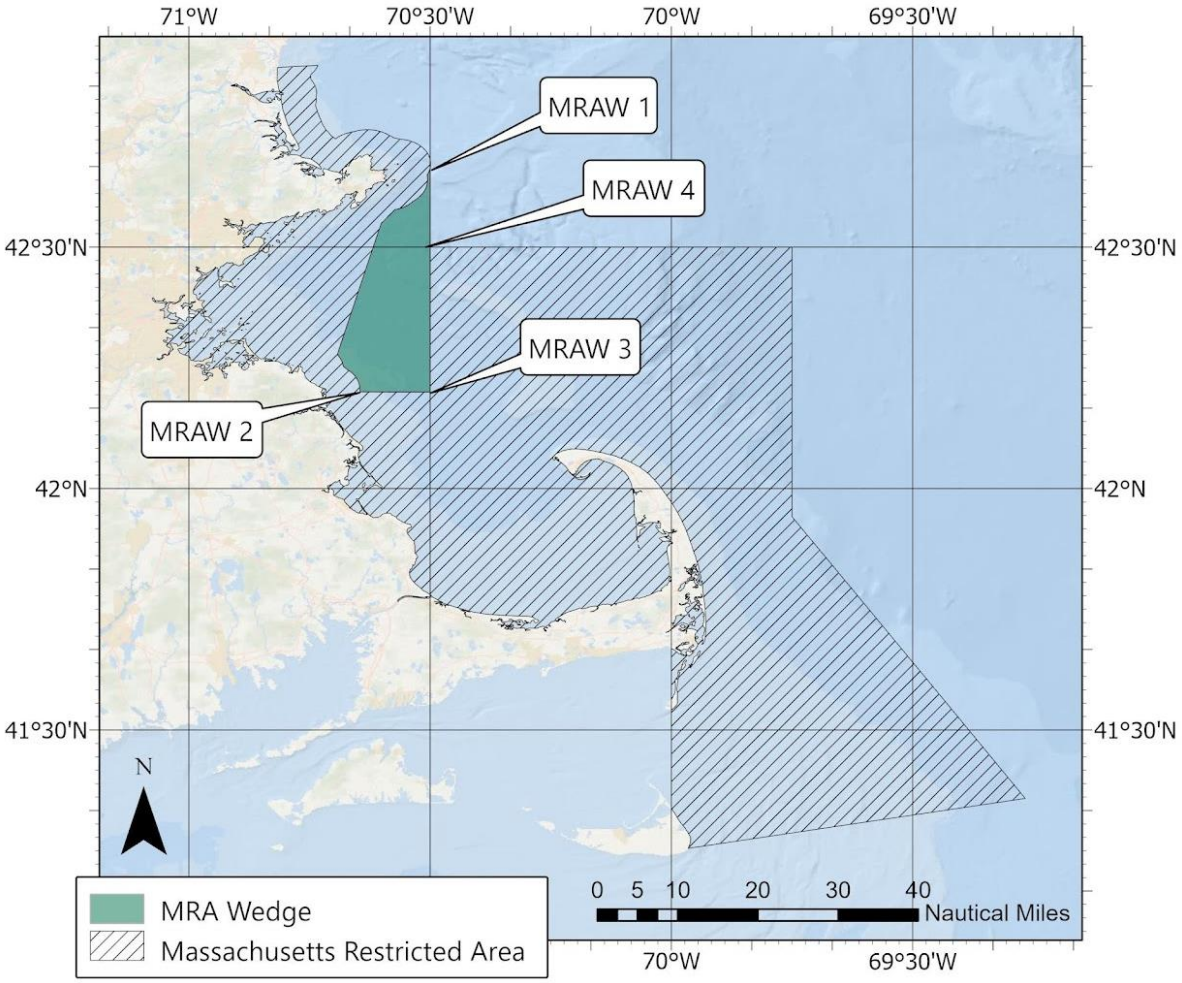
Alternative 1, "No Action," leaves the current Plan intact with no regulatory changes proposed. This includes the restricted areas implemented by the Final Rule on September 17, 2021 (86 FR 51970) that went into effect October 18, 2021. Under the Final Rule, requirements for minimum traps per trawl and weak inserts throughout the buoy line go into effect May 1, 2022, and, thus, these regulations are not included in the status quo Alternative. The status quo Alternative includes:

- Minimum traps per trawl requirements based within Lobster Management Area 1 (LMA 1):
    - Massachusetts state waters – 2 or no minimum
    - LMA 1 (3-12 miles) – 10
    - LMA 1 (12+ miles) – 20
- Modifications to existing restricted areas from seasonal fishing closures to seasonal closures to fishing with persistent buoy lines. The use of ropeless gear, where buoy lines are stored on the bottom until retrieval, is allowed with an Exempted Fishing Permit.
- Expanded geographic extent of the MRA to include MRA North (i.e. Massachusetts state waters north to the New Hampshire border).

2.2 Alternative 2: Preferred

Alternative 2, the Preferred Alternative, implements a new emergency closure that restricts the use of persistent lobster and Jonah crab trap/pot gear buoy lines from April 1, 2022 through April 30, 2022. The closure area is approximately 200 square miles (518 square kilometers) and begins in federal waters east of Cape Ann, is bounded landward by Massachusetts state waters, follows east along the 42°12′N latitude line until it intersects with the MRA at the 70°30′ W longitude line, and runs north along that line until it intersects the state water boundary (MRA Wedge; Figure 2.1). Authorizations for fishing without buoy lines using ropeless gear in the MRA Wedge during this time must be obtained through an Exempted Fishing Permit.

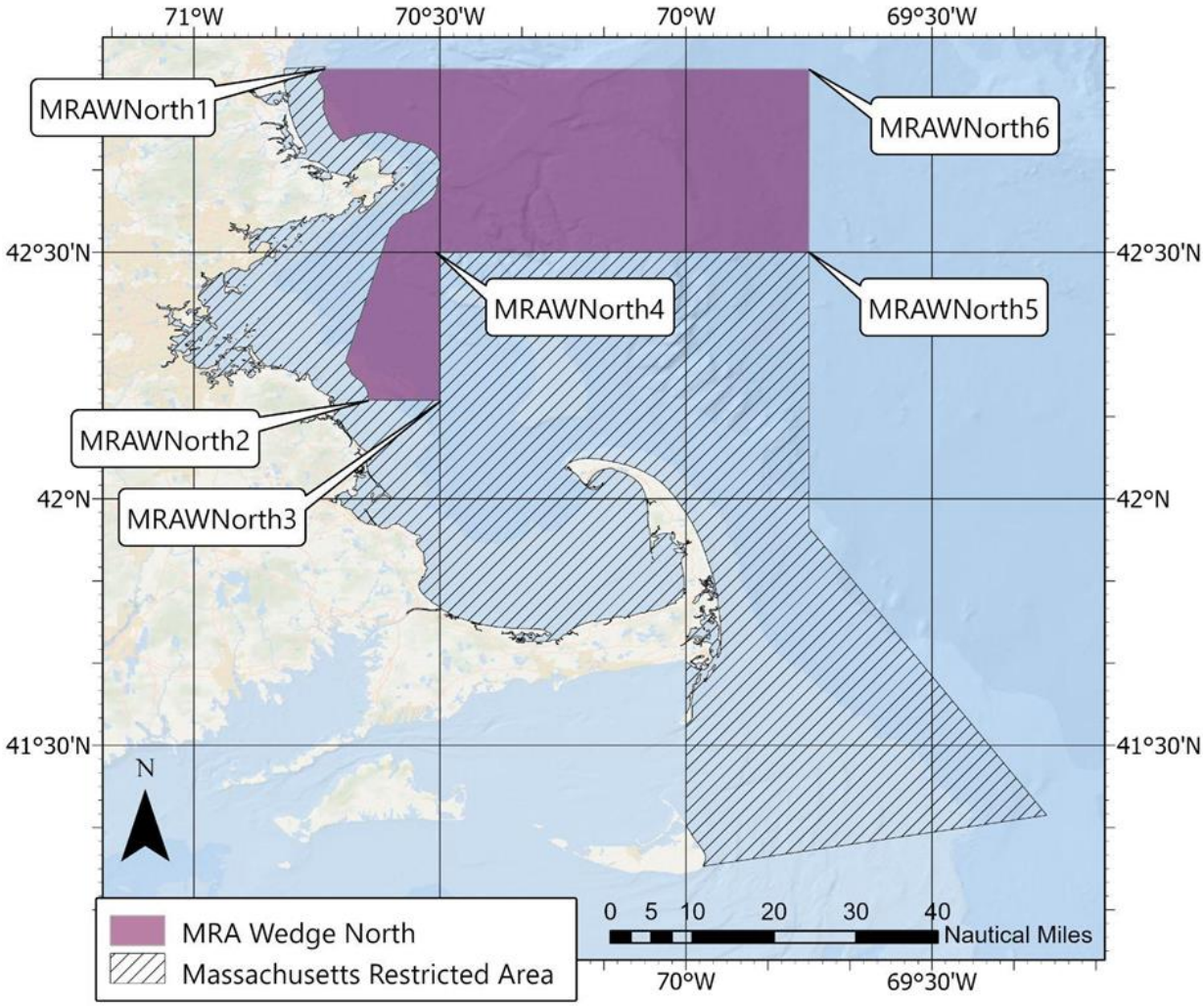
Figure 2.1: The shaded area green area, MRA Wedge, is closed by this emergency rule in Alternative 2 (Preferred Alternative). The existing MRA is the hatched area. MRA Wedge would remain closed to trap/pot fishing with buoy lines from April 1, 2022 through April 30, 2022.



2.3 Alternative 3: Non-Preferred

Alternative 3, the Non-Preferred Alternative implements an emergency closure that restricts the use of persistent lobster and Jonah crab trap/pot gear buoy lines from April 1, 2022 through April 30, 2022. The closed area is approximately 1,300 square miles (3,367 square kilometers) and extends the northern LMA 1 MRA boundaries up to the New Hampshire border at 42°52.58′ N (MRA Wedge North; Figure 2.2). Authorizations for fishing without buoy lines using ropeless gear in the MRA Wedge North during this time must be obtained through an Exempted Fishing Permit.

Figure 2.2: The shade purple area, MRA Wedge North to New Hampshire, is closed by this emergency rule in Alternative 3 (Non-Preferred Alternative). The existing MRA is the hatched area. MRA Wedge North would remain closed to trap/pot fishing with buoy lines from April 1, 2022 through April 30, 2022.



3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This chapter describes the valued ecosystem components (VECs) that may be affected by the Preferred, Non-Preferred, and No Action Alternatives within the Massachusetts portion of Lobster Management Area 1 (MA LMA 1; action area). The proposed action is not expected to have significant impacts on the biological aspects of the fisheries and therefore fish/lobster biology is not included in this analysis.

The three major VECs potentially affected by the proposed action are as follows:

- **Protected Species:** Section 3.1 provides information on species listed under the Endangered Species Act of 1973 and/or protected by the Marine Mammal Protection Act of 1972 that may be affected by elements of the proposed action.
- **Habitat**: Section 3.2 provides information on marine habitats, with a focus on Essential Fish Habitat. This includes the physical environment and benthic organisms that provide important ecological functions.

- **Human Community**: Section 3.3 describes the fisheries as well as the social and economic environment most likely to be impacted by the Alternatives under consideration.

3.1 Protected Species

The following discussion examines the potential impacts of management actions on protected species. Table 3.1 shows the protected species that were considered and identifies which of those may be impacted by the proposed action. NMFS identified five species of Atlantic large whales that are likely to be directly impacted by the implementation of an emergency restricted area (Subsection 3.1.1). Subsection 3.1.1 is further organized by species for information on stock status, distribution, and current threats for North Atlantic right whales (*Eubalaena glacialis*), Gulf of Maine humpback whales (*Megaptera novaeangliae*), fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), and common minke whales (*Balaenoptera acutorostrata*). Subsection 3.1.2 provides information on the protected species not likely to be impacted by the proposed action. For more in-depth details on biology, distribution, and documented mortality or serious injury incidents for protected species in the Atlantic Ocean, including Canadian serious mortality or serious injury incidents, please refer to Section 4.1 of the 2021 FEIS Volume 1 (NMFS 2021d).

Information regarding marine mammal distribution, abundance, potential biological removal levels (PBR), and sources of mortality and serious injury can be found in the most recent marine mammal Stock Assessment Reports (SARs). NOAA Fisheries prepares marine mammal SARs annually, as directed by the Marine Mammal Protection Act (MMPA). The Draft 2021 SAR was published on October 25, 2021 (86 FR 58887) and open for public comment until January 24, 2022. The information is considered preliminary; however the Draft 2021 SAR has been reviewed by the Atlantic Scientific Review Group and is not expected to change significantly in the final publication. Information provided in this Environmental Assessment is from the Draft 2021 SAR, unless indicated otherwise.[1]

Table 3.1: The species and critical habitat that were considered, their current status, and which ones are likely to be impacted by the proposed regulations. Status refers to species status under the Endangered Species Act (ESA), and Protected indicates the species that are protected under the Marine Mammal Protection Act (MMPA). Critical habitat for the North Atlantic right whale is protected under the ESA.

Potential Effect	Category	Species	Status
Potentially Impacted	**Marine Mammals**	North Atlantic Right Whale	Endangered
		Gulf of Maine Humpback Whale	Protected (MMPA)
		Fin Whale	Endangered

[1] NMFS determined that the Gulf of Maine stock of humpback whales was not strategic for the 2019 Stock Assessment Report (SAR; Hayes et al. 2020), but was strategic for the 2020 SAR because human-caused mortality exceeds PBR. The humpback whale chapter has not been updated since 2019, thus values on population abundance, stock status, and PBR are from the 2019 SAR.

		Sei Whale	Endangered
		Minke Whale	Protected (MMPA)
Not Likely to Be Impacted	**Fish**	Giant Manta Ray	Threatened
		Oceanic Whitetip Shark	Threatened
		Atlantic Salmon	Endangered
		Shortnose Sturgeon	Endangered
		Atlantic Sturgeon	New York, Chesapeake Bay, Carolina, and South Atlantic DPSs - endangered, Gulf of Maine DPS as threatened
	Marine Mammals	Sperm Whale	Endangered
		Bryde's Whale	Protected (MMPA)
		Harbor Porpoise	Protected (MMPA)
		Blue Whale	Endangered
		WNA Coastal Bottlenose Dolphin	Protected (MMPA)
		Atlantic White-Sided Dolphin	Protected (MMPA)
		Risso's Dolphin	Protected (MMPA)
		Spotted Dolphin	Protected (MMPA)
		Striped Dolphin	Protected (MMPA)
		Pilot Whale	Protected (MMPA)
		Offshore Bottlenose Dolphin	Protected (MMPA)
		Common Dolphin	Protected (MMPA)
	Seals	Harbor Seal	Protected (MMPA)
		Gray Seal	Protected (MMPA)
		Harp Seal	Protected (MMPA)
	Sea Turtles	Loggerhead Sea Turtle (Northwest Atlantic Ocean DPS)	Threatened
		Leatherback Sea Turtle	Endangered
		Kemp's Ridley Sea Turtle	Endangered

	Green Sea Turtle (North Atlantic DPS)	Threatened
	Hawksbill Sea Turtle	Endangered
	Olive Ridley Sea Turtle	Threatened
Critical Habitat	North Atlantic Right Whale	ESA

3.1.1 Protected Species: Atlantic Large Whales

The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. Section 118 of the MMPA specifies that NMFS develop and implement Take Reduction Plans to assist in the recovery or prevent the depletion of strategic marine mammal stocks[2] that interact with Category I and Category II fisheries, which are fisheries with frequent (Category I) or occasional (Category II) serious injuries and mortalities of marine mammals. All marine mammals are protected by the MMPA.

Five Atlantic large whales may be present in the affected environment throughout the month of April and have the potential to be impacted by the emergency rule: North Atlantic right whales (right whales), Gulf of Maine humpback whales (humpback whales), fin whales, sei whales, and common minke whales (minke whales). These large whales are also known to interact with Category I and II fisheries in the Northwest Atlantic Ocean and are susceptible to entanglement in trap/pot fishing gear. Fin, sei, and right whales are also listed as endangered under the ESA and considered strategic stocks under the MMPA. Although not currently identified as strategic stocks, humpback and minke whales are protected under the MMPA.

North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is a baleen whale found in temperate and subpolar latitudes in the North Atlantic Ocean. Historic right whale populations were severely depleted by commercial whaling, and despite protections from commercial harvest, the population remains low. Today, they are mainly found in the western North Atlantic (Kraus and Rolland 2007, Monsarrat et al. 2016). For information on right whale distribution outside of the U.S. Exclusive Economic Zone (EEZ), please refer to Subsection 4.1.1.1 of Chapter 4 in the 2021 FEIS (NMFS 2021d). Although some individuals are occasionally sighted in the Gulf of Mexico, the current geographic range of right whales within the U.S. EEZ is primarily along the East Coast of North America, from Florida, Georgia, and South Carolina in the south, where calving occurs, through the mid-Atlantic to the coastal waters of Massachusetts to the Gulf of Maine (Morano et al. 2012, NMFS 2013, Wikgren et al. 2014, Oedekoven et al. 2015, Davis et

[2] A strategic stock is defined under the MMPA as a marine mammal stock for which the level of direct human-caused mortality exceeds the potential biological removal level; which, 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; or that is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA.

al. 2017, Krzystan et al. 2018). Other than right whales that aggregate in small numbers on the calving grounds in the winter, aggregations are most frequently observed in New England, particularly in Cape Cod Bay and the Gulf of Maine (Wikgren et al. 2014, Davis et al. 2017, Mayo et al. 2018) as well as in Canadian waters, such as the Bay of Fundy, Scotian Shelf, and Gulf of Saint Lawrence (Davies et al. 2019, Plourde et al. 2019) where there are sufficient zooplankton patches to support aggregations.

Right whales feed on zooplankton, primarily on copepods, particularly *Calanus finmarchicus*, where they occur in high abundance (Watkins and Schevill 1976, Wishner et al. 1988, Mayo and Marx 1990, Wishner et al. 1995, Woodley and Gaskin 1996, Kenney 2001, Baumgartner et al. 2003, Baumgartner and Mate 2003). In the spring, right whale foraging commonly occurs in Cape Cod Bay (Mayo and Marx 1990), where high densities of *C. finmarchicus* occur. Right whale critical habitat of approximately 29,763 square nautical miles (55,121 kilometers) was designated in 2016 (January 27, 2016, 81 FR 4837; 50 CFR 226).

Shifting *C. finmarchicus* distribution and abundance coincides with changes in spatial distribution and calving rates in right whales (Sorochan et al. 2018). Right whales need to consume large quantities of prey to meet their basic energy requirements and to support population reproduction, migrations, and lactation (Klanjscek et al. 2007, Williams et al. 2013, Meyer-Gutbrod et al. 2015, Irvine et al. 2017). Climate change has already shifted *C. finmarchicus* abundance and phenology in the Gulf of Maine (Record et al. 2019a,b) and model projections suggest resource limitation will likely worsen in the future (Grieve et al. 2017). As prey density and quality shift (namely, reductions in copepod size and nutritional density, while expanding into the northern end of their range), whales need to spend more time foraging and finding areas that have higher quality aggregations of prey. Shifting seasonal patterns and distribution of *C. finmarchicus* throughout the Gulf of Maine (Record et al. 2019a,b), make it more challenging to predict aggregations of both right whales and their prey. High abundance of prey species farther north suggests longer travel between calving grounds and feeding grounds, and could contribute further to nutritional stress. Low prey availability also leads to longer interval periods between births (Meyer-Gutbrod and Greene 2018). Lactating females, in particular, appear to be experiencing energy deficits, which could contribute to low reproductive output (Fortune et al. 2013). For more information on distribution of prey and right whale feeding behavior, refer to Subsection 4.1.1.1 of Chapter 4 and Subsection 8.3.37 of Chapter 8 in the 2021 FEIS (NMFS 2021d).

The right whale is listed as endangered under the ESA. NMFS believes that the right whale is well below the optimum sustainable population level (NMFS 2021b). The Draft 2021 Stock Assessment Report (SAR) published by NMFS (2021b) estimates a minimum population size of 364, and a best estimate of population size to be 368 individuals (Table 3.2). Potential Biological Removal (PBR) for the North Atlantic right whale population was 0.8 whales per year in the most recently published 2020 SAR (Hayes et al. 2021) and is expected to go down to 0.7 (NMFS 2021b). Preliminary 2020 and 2021 data suggest the decline has continued and that fewer than 350 individuals remain (Pettis et al. 2022). The preliminary estimated annual total mortality and serious injury value for right whales in the U.S. and Canada between 2014 and 2018 is 27.4 (Pace 2021, NMFS 2021b). The annual average of observed total human-caused mortality and serious injury from 2015 to 2019 is 7.7, including 5.7 observed incidental mortalities and serious

injuries attributed to fishery interactions and 2.0 observed vessel collisions (NMFS 2021b; Table 3.2), well above PBR. The observed incidental fishery interaction count does not include fishery related serious injuries that were prevented by disentanglement, which is an annual average of 1.6 from 2015 to 2019 (NMFS 2021b). Though this population estimate is not final and still undergoing final peer review, it relies upon the same peer-reviewed population models used in Pace et al. (2017) and Pace (2021) and is not expected to change significantly in the final publication. The right whale population is experiencing an Unusual Mortality Event that began in 2017 due to vessel strikes and entanglement in fishing gear (NMFS 2021b, Daoust et al. 2018, Bourque et al. 2020). 63 percent of mortalities and serious injuries were attributed to entanglements documented between 2010 and 2019 (see Chapter 2 of 2021 FEIS, NMFS 2021d). Anthropogenic mortality has limited the recovery of the right whale (Corkeron et al. 2018). While vessel strikes declined after vessel speed regulations were implemented (78 FR 73726; Conn and Silber 2013), both entanglement in fishing gear and vessel strikes remain a significant threat (Kraus et al. 2016, Sharp et al. 2019) and appear to be worsening (Hayes et al. 2018b).

Human-caused mortality heavily influences population demographics (Corkeron et al. 2018). Findings based on the use of a state-space model to estimate abundance of right whales (Pace et al. 2017, Pace 2021) show a strong a male survival bias (Pace et al. 2017, Pace 2021). Female right whales may be predisposed to human-caused mortalities because of the increased time spent at the surface in calving grounds and deeper maximum dive depths, which increase their risk for vessel strikes and entanglement in fishing gear, respectively (Dombroski et al. 2021).

Based on the best available information, the greatest entanglement risks to large whales are posed by trap/pot and gillnet fisheries (Angliss and Demaster 1998, Cassoff et al. 2011, Knowlton and Kraus 2001, Hartley et al. 2003, Johnson et al. 2005, Whittingham et al. 2005, Knowlton et al. 2012, Hamilton and Kraus 2019, Sharp et al. 2019, Pace 2021). Specifically, while foraging or transiting, large whales are at risk of becoming entangled in buoy lines and groundlines of trap/pot and gillnet, as well as the net panels of gillnet gear that rise into the water column (Baumgartner et al. 2017, Cassoff et al. 2011, Hamilton and Kraus 2019, Johnson et al. 2005, Knowlton and Kraus 2001, Knowlton et al. 2012, Hayes et al. 2021). Large whale interactions (entanglements) with these features of trap/pot and/or sink gillnet gear often result in the mortality of or serious injury to the whale (Angliss and Demaster 1998, Cassoff et al. 2011, Henry et al. 2016, Henry et al. 2021, Knowlton and Kraus 2001, Knowlton et al. 2012, Moore and Van der Hoop 2012, Sharp et al. 2019, van der Hoop et al. 2016, van der Hoop et al. 2017). Many entanglements, including mortality or serious injury events, go unobserved, and the gear type, fishery, and/or country of origin for reported entanglement events are often not traceable (Henry et al. 2016, Henry et al. 2021). The rates of large whale entanglement, and thus, rates of mortality and serious injury due to entanglement, are likely underestimated (Hamilton et al. 2019, Henry et al. 2016, Henry et al. 2021, Knowlton et al. 2012, Pace et al. 2017, Robbins 2009). Population models estimate that up to 64 percent of right whale mortalities and serious injuries are unobserved (Pace 2021). Additionally, there are mortalities where no cause of death was determined, despite some evidence of human causes, and it is likely a proportion of these cases also resulted from an entanglement. For a more detailed description of the status and threats to the right whale population in U.S. and Canadian waters see Chapters 2 and 4 in the 2021 FEIS (NMFS 2021d).

Table 3.2: The estimated abundance, potential biological removal level, average annual observed mortality, and total average annual mortality for Atlantic large whale species likely to be impacted by the proposed action. Though the Draft 2021 Stock Assessment Report (2015-2019) is still under review, the values are not likely to change significantly in the final publication (NMFS 2021d). The humpback whale chapter has not been updated since 2019, thus values on population abundance, stock status, and PBR are from the 2019 SAR (Hayes et al. 2020) and average annual observed mortality is from Henry et al. 2021. Because observed mortalities and serious injuries only represent a fraction of observed cases, some of these species may be experiencing human-caused mortalities at higher rates once unobserved mortalities are taken into account.

Species	Estimated Abundance	Potential Biological Removal Level	Average Annual Observed Mortality
Right Whale	**368**	0.7	7.7
Humpback Whale	**1,396**	22	15.25
Fin Whale	**6,802**	11	1.85
Sei Whale	**6,292**	6.2	0.8
Minke Whales	**21,968**	170	10.55

Gulf of Maine Humpback Whale

The Gulf of Maine humpback whale (formerly Western North Atlantic) was previously listed as endangered under the ESA. In 2016, several distinct population segments were removed from listing, including the West Indies distinct population segment. The Gulf of Maine stock is largely composed of whales that reproduce in the West Indies (81 FR 62259, September 2016). The Gulf of Maine stock is still protected under the MMPA.

Since the early 1990s, humpbacks, particularly juveniles, have been observed stranded dead with increasing frequency in the mid-Atlantic (Swingle et al. 1993, Wiley et al. 1995) and have been sighted in wintertime surveys in the Southeast and mid-Atlantic (Hayes et al. 2020). In the Gulf of Maine, sightings are most frequent from mid-March through November, with a peak in May and August, from the Great South Channel east of Cape Cod northward to Stellwagen Bank and Jeffreys Ledge (CETAP 1982). Acoustic detections of humpbacks indicate year-round presence in New England waters, including the waters of Stellwagen Bank (Davis et al. 2020). Distribution in these waters appears to be correlated with prey species, including herring (*Clupea harengus*), sand lance (*Ammodytes spp.*), and other small fishes, as well as euphausiids (Paquet et al. 1997). Changes in humpback distribution in the Gulf of Maine have been found to be associated with changes in herring, mackerel, and sand lance abundance associated with local fishing pressures (Payne et al. 1986).

Current data suggest that the Gulf of Maine humpback whale stock is increasing (Hayes et al. 2020). The most recent population estimate calculated an abundance of 1,396 animals (Table 3.2) in this stock and the minimum population estimate is 1,380 (Hayes et al. 2020). The maximum productivity rate is 0.065 and the “recovery” factor is assumed to be 0.50, the default for stocks of unknown status, because the listing for the distinct population segment was

removed in 2016. Thus, the PBR for the Gulf of Maine humpback whale stock is 22 whales per year (NMFS 2020).

As with right whales, the primary known sources of anthropogenic mortality and serious injury of humpback whales are commercial fishing gear entanglements and ship strikes. Robbins et al. (2009) found that 64.9 percent of the North Atlantic population had entanglement scarring in 2003, and humpback whales experience new scarring at an annual rate of 12.1 percent. From 2010 to 2019, 38.8 percent of all observed mortalities and serious injuries were attributed to entanglements from interactions with trap/pot, monofilament line, netting, and unidentified gear (see Chapter 2 of 2021 FEIS, NMFS). From 2014 through 2018, observed human-caused mortalities averaged 15.25 animals per year (Table 3.2), with 9.45 incidental fishery interactions and 5.8 vessel collisions (Henry et al. 2021). These results include only observed mortality and serious injury. Unobserved anthropogenic impacts on humpback whales is likely, but has not been calculated to date. An Unusual Mortality Event was declared in 2017 after a spike in humpback whale strandings along the East Coast of the U.S. and fifty percent of the cases where cause of death was examined had evidence of ship strike or entanglement.

Fin Whales

The fin whale is found in all major oceans and was considered to be composed of three subspecies until recently: *Balaenoptera physalus physalus* in the Northern Hemisphere, and *B. p. quoyi* and *B. p. patachonica* (a pygmy form) in the Southern Hemisphere. New genetic data suggest that fin whales in the North Atlantic and North Pacific oceans represent two different subspecies (Archer et al. 2019). The International Whaling Commission defines a single stock of the North Atlantic fin whale off the eastern coast of the U.S., north to Nova Scotia, and east to the southeastern coast of Newfoundland (Donovan 1991). Fin whales are common in the waters of the U.S. EEZ, principally from Cape Hatteras northward (Hayes et al. 2021). In a globally scaled review of sightings data, Edwards et al. (2015) found evidence to confirm the presence of fin whales in every season throughout much of the U.S. EEZ north of 35º N; however, densities vary seasonally. Acoustic detections of fin whale singers in Massachusetts Bay, New York Bight, and deep-ocean areas confirm whale presence September through June throughout the western North Atlantic (Watkins et al. 1987, Clark and Gagnon 2002, Morano et al. 2012). Davis et al. 2020 detected year-round acoustic presence of fin whales within the EEZ, particularly in areas north of Cape Hatteras, NC.

Of the three to seven stocks thought to occur in the North Atlantic Ocean, one occurs in U.S. waters, where NMFS best estimate of abundance is 6,802 individuals (NMFS 2021b; Table 3.2). The maximum productivity rate is 0.04, the default value for cetaceans. The “recovery” factor is assumed to be 0.10 because the fin whale is listed as endangered under the ESA. Thus, PBR for the western North Atlantic fin whale is 11 (NMFS 2021b). The species’ overall population size may provide some resilience to current threats, but trends remain largely unknown (NMFS 2021b) and the fin whale is listed as endangered under the ESA.

Like right whales and humpback whales, documented sources of anthropogenic mortality of fin whales include entanglement in commercial fishing gear and ship strikes. Additional threats include reduced prey availability and anthropogenic sound. Experts believe that fin whales are

struck by large vessels more frequently than any other cetaceans (Laist et al. 2001). Between 2010 and 2019, approximately 22.7 percent of all observed mortalities and serious injuries were attributed to entanglements, with most interactions occurring with trap/pot and unidentified gear (see Chapter 2 of 2021 FEIS, NMFS 2021d). Between 2015 and 2019, the minimum annual rate of anthropogenic mortality and serious injury to fin whales was 1.85 per year, 1.5 of those from fishing entanglement, and 0.4 per year from ship strikes (NMFS 2021b).

Sei Whales

Sei whales are listed as endangered throughout their range under the ESA. The western North Atlantic sei whale population belongs to the Northern Hemisphere subspecies (*B. b. borealis*) and consists of two stocks, a Nova Scotian Shelf stock and a Labrador Sea stock (Baker and Clapham 2004, Mitchell and Chapman 1977). The Nova Scotian Shelf stock is the only sei whale stock within ALWTRP boundaries and ranges from the U.S. East Coast to Cape Breton, Nova Scotia and east to 42°00'W longitude (Hayes et al. 2021). The Nova Scotia stock in the North Atlantic is estimated to be 6,292 individuals with a minimum population size of 3,098 individuals (NMFS 2021b; Table 3.2). Population growth rates for sei whales are not available at this time as there are little to no systematic survey efforts to study sei whales.

Sei whales are often found in the deeper waters that characterize the edge of the continental shelf (Hain et al. 1985), but NMFS aerial surveys also found substantial numbers of sei whales south of Nantucket in spring and summer (Stone et al. 2017) and on Georges Bank in the spring and summer (CETAP 1982). Sei whales have also been documented inshore, near the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986). Davis et al. 2020 detected sei whale acoustic presence along the U.S. and Canadian East Coast year round, with the highest detections north of Cape Hatteras, NC during the spring through fall. Sei whales (like right whales) are largely planktivorous, primarily feeding on euphausiids and copepods, which has resulted in reports of sei whales in more inshore locations. Sei whales are also opportunistically piscivorous, consuming species of small schooling fish and squid (Wiles 2017, Prieto et al. 2012).

Current threats include vessel strikes, fisheries interactions (including entanglement), climate change, habitat loss, reduced prey availability, and anthropogenic sound. Between 2010 and 2019, 18 serious injuries and mortalities were observed: 8 with unknown causes, 5 vessel strikes (all confirmed U.S.), 2 entanglements, and 3 non-human caused mortality. Between 2015 and 2019, the average annual rate of confirmed human-caused mortality and serious injury to sei whales is 0.8 incidents per year (NMFS 2021b; Table 3.2). This value includes incidental fishery interaction records (0.4), records of vessel collisions (0.2), and other human-induced mortalities (0.2). Possible causes of natural mortality, particularly for compromised individuals, are shark attacks, killer whale attacks, and endoparasitic helminthes (Perry et al. 1999).

Minke Whales

The minke whale is not listed as endangered or threatened under the ESA but is protected under the MMPA. Minke whales off the East Coast of the U.S. are considered to be part of the Canadian East Coast population, which inhabits the area from the eastern half of Davis Strait south to the Gulf of Mexico. They are common and widely distributed within the U.S. Atlantic

EEZ (CETAP 1982). Minke whales are most frequently observed in New England waters from spring to fall (Hayes et al. 2021), and acoustic surveys have commonly detected their presence on the shelf (Risch et al. 2013). From September through April, acoustic detection is highest in deep-ocean waters (Hayes et al. 2021).

Data are insufficient for determining a population trend for this species. The best estimate of population size is 21,968 (CV=0.31) minke whales, with the minimum population size calculated at 17,002 (NMFS 2021b; Table 3.2). The observed annual estimated average human-caused mortality and serious injury for the Canadian East Coast stock of minke whales is 10.55, including 9.5 mortalities due to incidental fishery interactions, 0.2 from observed fishery interaction, and 0.8 caused by vessel collisions (NMFS 2021b).

As with other large whales, documented sources of anthropogenic mortality of minke whales include entanglement in commercial fishing gear and vessel strikes. Minke whales have been entangled in a variety of fishing gear, including unspecified fishing nets, unspecified cables or lines, fish traps, weirs, seines, gillnets, and lobster gear. Between 2010 and 2019, nearly 30 percent of all observed mortalities and serious injuries were attributed to entanglements, most of which resulted from interactions with trap/pot, netting, and unidentified gear (see Chapter 2 for the 2021 FEIS, NMFS 2021d). An Unusual Mortality Event was declared in 2017 following an uptick in strandings along the East Coast of the U.S. Though the specific cause of the high mortality has not been determined, several stranded whales have shown evidence of human interaction.

3.1.2 Species and Critical Habitat Not Likely to be Impacted

Based on the best available information, Table 3.1 provides a list of species not likely to be impacted by the proposed action. This determination has been made because either the occurrence of the species has either limited or no overlap with the trap/pot fisheries operating in the proposed action area and/or interactions have never been documented or are extremely rare between the species and trap/pot gear (see Marine Mammal Stocks Assessment Reports at https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; NMFS 2021a; Sea Turtle Disentanglement Network, unpublished data; NMFS Observer Program, unpublished data; see OBIS-SMAP at https://seamap.env.duke.edu/). The proposed actions will not affect the essential physical and biological features of critical habitat designated for North Atlantic right whales, the Northwest Atlantic Ocean DPS of loggerhead sea turtle, or Gulf of Maine DPS of Atlantic salmon; therefore, will not result in the destruction or adverse modification of any designated critical habitat (NMFS 2014, NMFS 2015a,b).

3.2 Habitat

Modification of the ALWTRP may affect Essential Fish Habitat (EFH), which is defined by the Magnuson-Stevens Act as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” (16 U.S.C. 1802(10)). Regulations developed by NMFS encourage Regional Fishery Management Councils to describe and identify EFH, and, to the extent practicable, to minimize adverse effects caused by fishing activities. Atlantic trap/pot

fisheries are geographically widespread on the Atlantic coast and target a diverse array of fish and shellfish species. In the context of this Environmental Assessment, EFH includes the habitat for all non-target species during relevant life history stages that take place within the proposed area (Figure 3.1; Table 3.3). Because this action is not expected to affect pelagic habitats, the species and life stages listed in Table 3.3 are all benthic. For detailed discussion of Essential Fish Habitat and Habitat Areas of Particular Concern regulatory requirements, key components of lobster habitat in detail, and how the Atlantic Large Whale Take Reduction Plan can influence habitat, reference Section 4.2 of the 2021 FEIS (NMFS 2021d).

Figure 3.1: The Habitat Areas of Particular Concern (HAPC) and Essential Fish Habitat (EFH) currently protected from fishing within the proposed area, including those overseen by the New England Fishery Management Council (NEFMC).

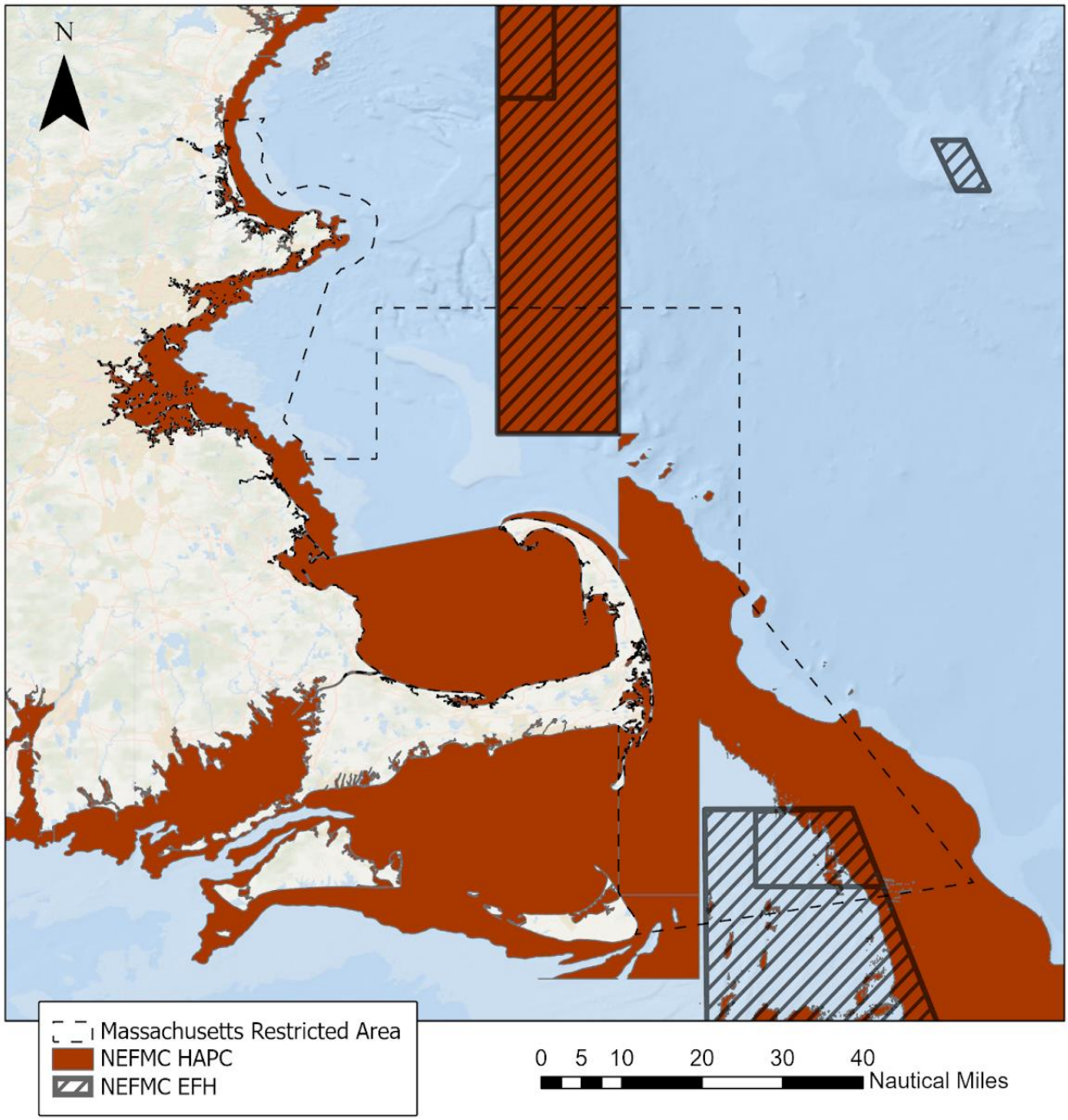


Table 3.3: A list of Essential Fish Habitat for different species and life history stages that are within the proposed area.

Species	Life Stage	Depth (meters)	Habitat Type and Description
Acadian redfish	Juveniles	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
American plaice	Juveniles	40-180	Subtidal benthic habitats on mud and sand, also found on gravel and sandy substrates bordering bedrock
American plaice	Adults	40-300	Subtidal benthic habitats on mud and sand, also gravel and sandy substrates bordering bedrock
Atlantic cod	Juveniles	Mean high water-120	Structurally-complex intertidal and subtidal 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	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	60-140 and 400-700 on slope	Benthic habitats on sand, gravel, or clay substrates
Atlantic herring	Eggs	5-90	Subtidal benthic habitats on coarse sand, pebbles, cobbles, and boulders and/or macroalgae
Atlantic sea scallop	Eggs	18-110	Inshore and offshore benthic habitats (see adults)
Atlantic sea scallop	Larvae	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	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	18-110	Benthic habitats with sand and gravel substrates
Atlantic surfclams	Juveniles and adults	Surf zone to about 61, abundance low >38	In substrate to depth of 3 ft
Atlantic wolffish	Eggs	<100	Subtidal benthic habitats under rocks and boulders in nests
Atlantic wolffish	Juveniles	70-184	Subtidal benthic habitats
Atlantic wolffish	Adults	<173	A wide variety of sub-tidal sand and gravel substrates once they leave rocky spawning habitats, but not on muddy bottom
Black sea bass	Juveniles and adults	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
Haddock	Juveniles	40-140 and as shallow as 20 in coastal Gulf of Maine	Subtidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel
Haddock	Adults	50-160	Subtidal 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	Mean high water-80	Intertidal and subtidal benthic habitats on sand and gravel, also found on mud
Little skate	Adults	Mean high water-100	Intertidal and subtidal benthic habitats on sand and gravel, also found on mud
Monkfish	Juveniles	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Subtidal 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	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Subtidal benthic habitats on hard sand, pebbles, gravel, broken shells, and soft mud, but seem to prefer soft sediments, and, like juveniles, utilize the edges of rocky areas for feeding
Ocean pout	Eggs	<100	Sub-tidal hard bottom habitats in sheltered nests, holes, or rocky crevices
Ocean pout	Juveniles	Mean high water-120	Intertidal and subtidal benthic habitats on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel
Ocean pout	Adults	20-140	Subtidal 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	9-244	In substrate to depth of 3 ft
Pollock	Juveniles	Mean high water-180 in Gulf of Maine, Long Island Sound, and Narragansett Bay; 40-180 on Georges Bank	Intertidal and subtidal 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	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	Mean high water-80	Intertidal and subtidal soft bottom habitats, esp those that that provide shelter, such as depressions in muddy substrates, eelgrass, macroalgae, shells, anemone and polychaete tubes, on artificial reefs, and in live bivalves (e.g., scallops)
Red hake	Adults	50-750 on shelf and slope, as shallow as 20 inshore	Subtidal benthic habitats in shell beds, on soft sediments (usually in depressions), also found on gravel and hard bottom and artificial reefs
Scup	Juveniles	No information	Benthic habitats, in association with inshore sand and mud substrates, mussel and eelgrass beds
Scup	Adults	No information, generally overwinter offshore	Benthic habitats
Silver hake	Juveniles	40-400 in Gulf of Maine, >10 in Mid-Atlantic	Pelagic and sandy subtidal benthic habitats in association with sand-waves, flat sand with amphipod tubes, shells, and in biogenic depressions

Silver hake	Adults	>35 in Gulf of Maine, 70-400 on Georges Bank and in the Mid-Atlantic	Pelagic and sandy subtidal 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	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	100-400 offshore Gulf of Maine, to 900 on slope	Benthic habitats, mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks in the Gulf of Maine
Summer flounder	Juveniles	To maximum 152	Benthic habitats, including inshore estuaries, salt marsh creeks, seagrass beds, mudflats, and open bay areas
Summer flounder	Adults	To maximum 152 in colder months	Benthic habitats
Thorny skate	Juveniles	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 on slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
Thorny skate	Adults	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 on slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
White hake	Juveniles	Mean high water-300	Intertidal and subtidal estuarine and marine habitats on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats
White hake	Adults	100-400 offshore Gulf of Maine, >25 inshore Gulf of Maine, to 900 on slope	Subtidal benthic habitats on fine-grained, muddy substrates and in mixed soft and rocky habitats
Windowpane flounder	Juveniles	Mean high water-60	Intertidal and subtidal benthic habitats on mud and sand substrates
Windowpane flounder	Adults	Mean high water-70	Intertidal and subtidal benthic habitats on mud and sand substrates
Winter flounder	Eggs	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	Mean high water-60	Intertidal and subtidal 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	Mean high water-70	Intertidal and subtidal benthic habitats on muddy and sandy substrates, and on hard bottom on offshore banks; for spawning adults, also see eggs
Winter skate	Juveniles	0-90	Subtidal benthic habitats on sand and gravel substrates, are also found on mud

Winter skate	Adults	0-80	Subtidal benthic habitats on sand and gravel substrates, are also found on mud
Witch flounder	Juveniles	50-400 and to 1500 on slope	Subtidal benthic habitats with mud and muddy sand substrates
Witch flounder	Adults	35-400 and to 1500 on slope	Subtidal benthic habitats with mud and muddy sand substrates
Yellowtail flounder	Juveniles	20-80	Subtidal benthic habitats on sand and muddy sand
Yellowtail flounder	Adults	25-90	Subtidal benthic habitats on sand and sand with mud, shell hash, gravel, and rocks

A reduction in fishing effort is likely to decrease the time that fishing gear is in the water, thereby reducing the potential for interactions between fishing gear and habitat. However, most habitat areas where lobsters are fished have been heavily fished by multiple fishing fleets over many decades and are unlikely to see a measurable improvement in their condition in response to a short-term decrease in effort of an individual fishery.

Experts believe that fixed fishing gear (e.g. traps/pots) has a more direct impact on benthic habitat than on non-benthic (water column) habitat because it generally comes in contact with the seafloor. Therefore, the sections below review how fixed-gear fishing can affect habitat, with a primary focus on benthic habitat. The potential effects examined include:

- Alteration of physical structure;
- Mortality of benthic organisms;
- Changes to the benthic community and ecosystem;
- Sediment suspension; and,
- Chemical modifications.

3.2.1 Alteration of Physical Structure

Any type of fishing gear that is towed, dragged, or dropped on the seabed will disturb the sediment and the resident community to varying degrees. The intensity of disturbance is dependent on the type of gear, how long the gear is in contact with the bottom, sediment type, sensitivity of habitat features in contact with the gear, and frequency of disturbance. Physical effects of fishing gear, such as plowing, smoothing of sand ripples, removal of stones, and turning of boulders, can act to reduce the heterogeneity of the sediment surface. For example, boulder piles, crevices, and sand ripples can provide fish and invertebrates hiding areas and a respite from currents and tides. Removal of taxa, such as tube worms, corals, and gorgonians that provide relief, and the removal or shredding of submerged vegetation, can also occur, thereby reducing the number of structures available to biota as habitat.

Most studies on habitat damage due to fishing gear focus on the effects of bottom trawls and dredges. It has been noted by Rogers et al. (1998) that the reason there are few accounts of static gear (e.g. traps/pots) having measurable effects on benthic biota may be because the area of seabed affected by such gear is almost insignificant when compared to the widespread effects of mobile gear. It is possible that benthic structures (both living and non-living) could be affected as traps/pots are dropped or dragged along the bottom. Most studies investigating small numbers of traps or pots per buoy line (1-3) have found minimal, short-term impacts on physical structures

(Eno et al. 2001, Chuenpagdee et al. 2003, Stephenson et al. 2017). Similarly, a panel of experts that evaluated the habitat impacts of commercial fishing gears used in the Northeast of the U.S. (Maine to North Carolina) found bottom-tending static gear (e.g. traps/pots) to have a minimal effect on benthic habitats when compared to the physical and biological impacts caused by bottom trawls and dredges (NMFS 2002). The vulnerability of benthic Essential Fish Habitat for all managed species in the region to the impacts of pots/traps and bottom gillnets is considered to be low (NMFS 2004). However, less is known about longer trap/pot trawls and there is limited information that trawls with 20 or more pots may have impacts more similar to mobile gear, though at a smaller spatial scale (Schweitzer et al. 2018).

3.2.2 Mortality of Benthic Organisms

In addition to effects on physical habitat, fishing gear can cause direct mortality to emergent epifauna. In particular, erect, foliose fauna, or fauna that build reef-like structures have the potential to be destroyed by towed gear, longlines, or traps/pots (Hall 1999). Physical structure of the biota sometimes determines their ability to withstand and recover from the physical impacts of fishing gear. For example, thinner shelled bivalves and sea stars often suffer higher damage than solid shelled bivalves (Rumohr and Krost 1991). Animals that can retract below the penetration depth of the fishing gear and those that are more elastic and can bend upon contact with the gear also fare much better than those that are hard and inflexible (Eno et al. 2001). Longer trap/pot trawls likely pose a greater threat to benthic organisms than individual trap/pots or short trap/pot trawls (Schweitzer et al. 2018).

3.2.3 Changes to Benthic Communities and Ecosystems

The mortality of benthic organisms as a result of interaction with fishing gear can alter the structure of the benthic community, potentially causing a shift in the community from low-productive long-lived species to highly-productive, short-lived, rapidly-colonizing species. For example, motile species that exhibit high fecundity and rapid generation times will recover more quickly from fishery-induced disturbances than non-mobile, slow-growing organisms, which may lead to a community shift in chronically fished areas (Levin 1984).

Increased fishing pressure in a certain area may also lead to changes in species distribution. Changes (e.g., localized depletion) could be evident in benthic, demersal, and even pelagic species. Scientists have also speculated that mobile fishing may lead to increased populations of opportunistic feeders in chronically fished areas.

3.2.4 Sediment Suspension

Resuspension of sediment can occur as fishing gear is pulled or dragged along or immediately above the seafloor (NMFS 2002). Although resuspension of sediment is typically associated with mobile fishing gear, it also can occur with gear such as traps/pots.

Chronic suspension of sediments and resulting turbidity can affect aquatic habitat by reducing available light for photosynthesis, burying benthic biota, smothering spawning areas, and causing negative effects on feeding and metabolic rates. If it occurs over large areas, resuspension can

redistribute sediments, which has implications for nutrient budgets (Mayer et al. 1991, Messieh et al. 1991, Black and Parry 1994, Pilskaln et al. 1998).

Species' reaction to turbidity depends on the particular life history characteristics of the organism. Effects are likely to be more significant in waters that are normally clear as compared to areas that typically experience high natural turbidity (Kaiser 2000). Mobile organisms can move out of the affected area and quickly return once the turbidity dissipates (Coen 1995). Even if species experience high mortality within the affected area, those with high levels of recruitment or high mobility can re-populate the affected area rapidly. However, sessile or slow-moving species would likely be buried and could experience high mortality. Furthermore, if effects are protracted and occur over a large area, recovery through recruitment or immigration will be hampered. Additionally, chronic resuspension of sediments may lead to shifts in species composition by favoring those species that are better suited to recover or those that can take advantage of the additional nutrient supply as the nutrients are released from the seafloor to the euphotic zone (Churchill 1989).

3.2.5 Chemical Modifications

Disturbances associated with fishing gear also can cause changes in the chemical composition of the water column overlying affected sediments. In shallow water, the impacts may not be noticeable relative to the mixing effects caused by tidal surges, storm surges, and wave action. However, in deeper, calmer areas with more stable waters, the changes in chemistry may be more evident (NMFS 2002). Increases in ammonia content, decreases in oxygen, and pulses of phosphate have been observed in North Sea waters, although it is not clear how these changes affect fish populations. Increased incidence of phytoplankton blooms could occur during seasons when nutrients are typically low. The increase in primary productivity could have a positive effect on zooplankton communities and on organisms up the food chain.

Eutrophication, often considered a negative effect, could also occur. However, it is important to note that these releases of nutrients to the water recycle existing nutrients and make them available to benthic organisms (ICES 1992). This recycling is thought to be less influential in the eutrophication process than the input of new nutrients from rivers and land runoff.

3.2.6 American Lobster Habitat

Bottom dwelling American lobster (*Homarus americanus*) is distributed throughout the Northwest Atlantic Ocean from Newfoundland to Cape Hatteras, North Carolina. Juvenile and adult American lobsters occupy a wide variety of benthic habitats from the intertidal zone to depths of 700 meters. They are most abundant in relatively shallow coastal waters. Temperature and salinity, as well as substrate and diet, are critical habitat components (ASMFC 2015). Lobsters feed on a variety of plants and animals according to seasonal availability, and bait in lobster traps is believed to be an important food source in areas of intense fishing pressure ((Lawton and Lavalli 1995, Grabowski et al. 2010) cited in ASMFC 2015).

The affected area includes the Massachusetts portion of Lobster Management Area 1 (LMA 1), including Massachusetts Bay (Alternative 2 and 3), Ipswich Bay, and other waters offshore of

northern Massachusetts (Alternative 3). Water depth ranges from 3.3 feet (1 meter) to 656.2 feet (200 meters) in depth (CZM 1999). Within this area, the affected habitat can be further categorized into inshore and offshore lobster habitat. A full description of lobster habitat that includes estuarine inshore and offshore canyon in addition to rock inshore and other offshore lobster habitats can be found in Chapter 4 of the 2021 FEIS (NMFS 2021d).

Inshore estuarine and rock areas make up two key components of inshore lobster habitat. For the purpose of this proposed action, only the inshore rock areas are included within this discussion because inshore estuarine areas are outside the scope of the action area.
Inshore rock habitat areas for lobster include the following:

- **Mud Base with Burrows:** These habitats occur primarily in harbors and quiet estuaries with low currents. Lobster shelters are formed from excavations in soft substrate. This is an important habitat for juveniles, and densities can be very high, reaching 20 animals per square meter.
- **Rock, Cobble, and Gravel:** Juveniles and adolescents have been reported on shallow bottom with gravel and gravelly sand substrates in the Great Bay Estuary, New Hampshire; on gravel/cobble substrates in outer Penobscot Bay, Maine (Steneck and Wilson 1998); and in rocky habitats in Narragansett Bay, Rhode Island (Lawton and Lavalli 1985). Densities in Penobscot Bay exceeded 0.5 juveniles and 0.75 adolescents/m2. According to unpublished information cited by Lincoln (1998), juvenile lobsters in Great Bay prefer shallow bottoms with gravelly sand substrates.
- **Rock/Shell:** Adult lobsters in the Great Bay Estuary utilize sand and gravel habitats in the channels, but appear to prefer a rock/shell habitat more characteristic of the high temperature, low salinity regimes of the central bay.
- **Sand Base with Rock:** This is the most common inshore rock type in depths greater than 40 meters. It consists of sandy substrate overlain by flattened rocks, cobbles, and boulders. Lobsters are associated with abundant sponges, Jonah crabs, and rock crabs. Lobsters excavate sand under a rock to form U-shaped, shallow tunnels for shelter. Densities of sub-adult lobsters are fairly high in these areas.
- **Boulders Overlaying Sand:** This habitat type is relatively rare in inshore New England waters. Compared to other inshore rocky habitats, lobster densities are low.
- **Cobbles:** Lobsters occupy shelters of varying size in the spaces between rocks, pebbles, and boulders. Densities as high as 16 lobsters per square meter have been observed, making this the most densely populated inshore rock habitat for lobsters in New England.
- **Bedrock Base with Rock and Boulder Overlay:** This rock type is relatively common inshore, from low tide to depths of 15 to 45 meters. Shelters are formed by rock overhangs or crevices. Encrusting coralline algae and attached organisms such as anemones, sponges, and mollusks cover exposed surfaces. Green sea urchins and starfish are common. Cunner, tautog, sculpin, sea raven, and redfish are the most abundant fish. Lobster densities generally are low.
- **Mud-Shell/Rock Substrate:** This habitat type is usually found where sediment discharge is low and shells make up the majority of the bottom. Lobster densities in this habit type are generally low.

Other lobster habitat types are significant. For example, kelp beds represent another form of lobster habitat. Kelp beds in New England consist primarily of *Laminaria longicruris* and *L. saccharina*. Lobsters were attracted to transplanted kelp beds at a nearshore study site in the mid-coast region of Maine, reaching densities almost ten times higher than in nearby control areas (Bologna and Steneck 1993). Lobsters did not burrow into the sediment, but sought shelter beneath the kelp. Only large kelp (greater than 1.6 feet (50 cm) in length) was observed sheltering lobsters and was used in the transplant experiments.

Lobster shelters also are formed from excavations cut into peat. Reefs form from blocks of salt marsh peat that break and fall into adjacent marsh creeks and channels. The reefs appear to provide moderate protection for small lobsters from predators (Barshaw and Lavalli 1988). Densities are high—up to 61.4 square feet (5.7 square meters) in these areas.

Offshore lobster habitats can be subdivided into canyons and other offshore habitats. The canyon offshore lobster habitats are beyond the scope of the proposed emergency closures. Other offshore habitat includes the following:

- **Sand Base with Rocks:** Although common inshore, this habitat is rather restricted in the offshore region except along the north flank of Georges Bank.
- **Clay Base with Burrows and Depressions:** This habitat is common on the outer continental shelf and slope. Lobsters excavate burrows up to 1.5 meters long. There are also large, bowl-like depressions that range in size from one to five meters in diameter and may shelter several lobsters at a time. Minimum densities of 0.001 lobsters per square meter have been observed in summer.
- **Mud-Clay Base with Anemones:** This is a common habitat for lobsters on the outer shelf or upper slope. Forests of mud anemones (*Cerianthus borealis*) may reach densities of three or four per square meter. Depressions serve as shelter for relatively small lobsters at minimum densities of 0.001 per square meter.
- **Mud Base with Burrows:** This habitat occurs offshore mainly in the deep basins, in depths up to 250 meters. This environment is extremely common offshore. Lobsters occupy this habitat, but no density estimates are available.

3.3 Human Community

3.3.1 Affected Fisheries

American Lobster

The American lobster (*Homarus americanus*) is a bottom-dwelling, marine crustacean characterized by a large shrimp-like body and ten legs, two of which are enlarged to serve as crushing and gripping appendages. The American lobster range extends from Newfoundland south to the Mid-Atlantic region. In U.S. waters, the species is most abundant from the inshore waters of Maine to Cape Cod, Massachusetts, and abundance declines from north to south (ASMFC 2015). In Massachusetts, the trap/pot fishery has consistently landed about 17 million pounds of live lobsters per season in the past few years. Based on federal VTR data from 2015 to 2019, most of the vessels affected by the action alternatives fished from the ports of Gloucester,

Rockport, and Beverly in Essex County, Cohasset in Norfolk County, and Scituate in Plymouth County.[3] However, human communities can extend beyond the boundaries of a particular port or city, so our analysis focuses on the county level. Essex and Plymouth county land the most lobsters, Barnstable and Bristol County also land a significant amount of lobsters, while Suffolk and Norfolk land a small fraction of the total amount. Table 3.4 displays the lobster landing pounds by county in Massachusetts from 2015 to 2019.

Table 3.4: Lobster Landing Pounds in Each Massachusetts County from 2015 to 2019.

	Barnstable	Bristol	Dukes	Essex	Middlesex	Nantucket	Norfolk	Plymouth	Suffolk	Not ified	Total
2015	3,122,435	1,701,142	115,949	7,186,104	357	13,190	399,017	3,299,383	614,035	1,284	16,452,896
2016	2,928,402	1,888,373	112,992	8,074,927	48	5,146	452,085	3,636,170	688,487	1,272	17,787,902
2017	3,352,764	1,993,809	90,894	6,660,862	0	2,891	426,428	3,333,791	635,355	232	16,497,026
2018	2,969,095	2,106,149	80,099	8,166,340	0	5,577	425,454	3,270,447	675,159	0	17,698,320
2019	2,671,806	2,262,500	75,686	7,641,421	342	2,583	398,521	3,346,899	630,182	0	17,029,940
Average	3,008,900	1,990,395	95,124	7,545,931	249	5,877	420,301	3,377,338	648,644	929	17,093,217

Data source: NMFS dealer reports 2015-2019.

Jonah Crab

Jonah crab (*Cancer borealis*) is distributed in the waters of the Northwest Atlantic Ocean primarily from Newfoundland, Canada to Florida. The life cycle of Jonah crab is poorly described and what is known is largely compiled from a patchwork of studies. Female crabs are believed to move nearshore during the late spring and summer and then return offshore in the fall and winter.

Jonah crab is managed under the Interstate Fishery Management Plan (FMP) for Jonah Crab (ASMFC 2015) and its three addenda. The plan lays out specific management measures in the commercial fishery, including a 4.75 inch (12.07 cm) minimum size with zero tolerance, a prohibition on the retention of egg-bearing females, and requiring harvesters to have a lobster permit. Addendum I (May 2016) establishes a bycatch limit of 1,000 crabs per trip for non-trap gear (e.g., otter trawls, gillnets) and non-lobster trap gear (e.g., fish, crab, and whelk pots). Addendum II (February 2017) establishes a coast-wide standard for claw harvest to respond to

[3] Vessels that only have lobster permits are not required to submit VTR; therefore, there is some uncertainty in quantifying the number of affected vessels. Vessels that do not have VTR requirements may be underestimated in this analysis. See more details at Subsection 4.4.1.1.

concerns regarding the equity of the claw provision established in the FMP. Specifically, the Addendum allows Jonah crab fishermen to detach and harvest claws at sea, with a required minimum claw length of 2.75 inches (6.99 cm) if the volume of claws landed is greater than five gallons. Addendum III (February 2018) addresses concerns regarding deficits in existing lobster and Jonah crab reporting requirements by expanding the mandatory harvester reporting data elements, improving the spatial resolution of harvester data, establishing a 5-year timeline for implementation of 100 percent harvester reporting, and prioritizing the development of electronic harvester reporting.

Jonah crabs are primarily caught in pots and traps and have long been taken as incidental catch in the lobster fishery, or more recently as a secondary target, in the lobster fishery. In Massachusetts, most Jonah crabs are landed in Barnstable and Bristol counties. Table 3.5 displays the yearly landing pounds of Jonah crab by county from 2015 to 2019.

Table 3.5: Jonah Crab Landing Pounds in Each Massachusetts County from 2015 to 2019.

	Barnstable	Bristol	Dukes	Essex	Middlesex	Norfolk	Plymouth	Suffolk	Not Specified	Total
2015	2,485,137	6,496,985	123	110,783	58	360		13,137	22,366	9,128,949
2016	3,986,431	6,400,827	184	227,604	112	25	18,475	36,300	16,575	10,686,533
2017	2,084,672	9,416,030	3,763	171,210	1,410	721	64	20,550		11,698,420
2018	1,642,723	11,370,068	672	223,049	151	6,010		7,844		13,250,517
2019	1,606,745	7,507,008	331	513,091		2,068		44,361	505	9,674,109
Average	2,361,142	8,238,184	1,015	249,147	433	1,837	9,270	24,438	13,149	10,887,706

Data source: NMFS dealer report 2015-2019.

3.3.2 Affected Human Communities

When considering the effect of this Emergency Rule on human communities, one approach is to focus the analysis on the affected vessels' individual ports or municipalities. However, human communities can extend beyond the boundaries of a particular port or city. Fish can be landed in one town and processed in a neighboring town. Likewise, a fisherman can land catch in one town, live in a neighboring town, and register his vessel in yet another location. In recognition of these factors, this analysis focuses on the county level.[4] While a county's political boundaries do not limit the network of social interactions and economic resource flows, the use of counties as an analytic focus offers two advantages. First, the geographic range of the county includes individual towns/ports as well as the areas in between with which they likely interact. In addition, many of the data used to characterize communities (e.g., unemployment rate, population) are readily available at the county level. This analysis focuses on four counties in

[4] This discussion uses the terms "counties" and "communities" interchangeably.

Massachusetts adjacent to the proposed restricted areas: Essex County, Norfolk County, Suffolk County, and Plymouth County.

In both fishing and non-fishing communities, the ability to adapt to change varies with social, political, and economic considerations. The vulnerability of fishing communities, however, is influenced by additional factors, including the importance of familial relationships, the vulnerability of infrastructure, and the commitment to fishing as a culture and way of life (Clay and Olson 2008). From an analytic perspective, vulnerability includes the characteristics of "exposure, sensitivity, and capacity of response to change or perturbation" ((Gallopín 2006) cited in Colburn and Jepson 2012). Consistent with Gallopin's definition, this social impact assessment considers each county's vulnerability to be a function of the extent to which its fishing industry is affected by the regulations (i.e., exposure), the significance of the fishing industry within the county (i.e., sensitivity), and baseline factors that may affect each community's ability to absorb the economic costs imposed by the regulations (i.e., capacity to respond to change). The discussion that follows briefly describes the parameters used to evaluate each aspect of vulnerability.

Exposure - The analysis first considers the extent to which the local fishing industry is exposed to the new regulations. Exposure is defined in two ways:

- **Value/proportion of harvest associated with affected gear** – The counties most likely to experience adverse social impacts are those close to the restricted area, and in which the lobster and Jonah crab trap/pot fishery is an important source of commercial fishing revenue, either on an absolute or a relative basis.
- **Number of entities affected** – Similarly, the most vulnerable counties are likely to be those that are home to the greatest number of vessels that fish with lobster trap/pots in the closed area.

Sensitivity - Those communities that are more heavily dependent (both economically and socially) on the fishing industry are more likely to experience adverse social impacts due to fishing regulations. This analysis relies upon a measure of fishing dependence designed to take additional factors into account. This measure, the Occupational Alternative Ratio Summary, emphasizes the importance of fishing as an occupation to participants in the labor force as a whole, and the dependence of the local economy on the fishing industry. In general, a higher score indicates a greater dependence on fishing as an occupation, and a lower likelihood that displaced fishermen can easily enter into alternate occupations.[5]

Capacity to Respond to Change - A number of economic and demographic factors will influence a community's ability to absorb economic stress, tempering or exacerbating vulnerability to social impacts stemming from regulations:

[5] Measures of fishing dependence and gentrification (see below) are based on Hall-Arber et al. (2001). At the time the analysis was developed, these data represented the most recent published attempt to address these issues systematically, allowing for a direct comparison between counties. Colburn and Jepsen (2012) have developed additional indices allowing for evaluation of fishing dependence and gentrification; however, they have yet to be broadly applied. For a qualitative discussion of these issues, see the Community Profiles for Northeast U.S. Marine Fisheries developed by the NMFS Northeast Fisheries Science Center (2010). These profiles are available online at: http://www.nefsc.noaa.gov/read/ socialsci/communityProfiles.html

- **Unemployment Rate, Poverty Rate, Median Income** – Fundamental economic indicators such as the unemployment rate, poverty rate, and median income can indicate the local economy's resilience to regulatory impacts. Communities that are already economically depressed may find it more difficult to absorb the economic effects of regulatory changes and may be subject to greater social impacts.
- **Gentrification** – Gentrification can be a key source of coastal community vulnerability ((Jacob et al. 2010, Clay and Olson 2008) cited in Colburn and Jepson 2012). According to Hall-Arber et al. (2001), as former working waterfronts succumb to the pressures of gentrification, community character and culture are lost, diversity diminishes, and the fishing community is less able to adapt to changes in the environment. Additional fishing regulations can make it even more difficult for individuals to maintain a "fishing way of life." Communities that are already experiencing gentrification will likely be more susceptible to social impacts as new regulations are implemented. Hall-Arber et al. (2001) integrate various measures of gentrification into a score that can be used to characterize community vulnerability.

The major ports in the affected area that land lobsters and Jonah crabs include Rockport, Gloucester, Boston, Cohasset, Scituate, and Plymouth. Complete community profiles for these ports can be found in Appendix 3.1. As described in the community profiles, except for Boston, which lands mostly groundfish, and Gloucester, which lands a significant amount of both groundfish and lobsters, all other ports land lobsters as their primary seafood harvest. Table 3.6 shows the social-economic indicators of each affected community. Essex and Plymouth county have more traditional fishing ports, and their commercial reliance scores are higher than Suffolk and Norfolk county. Norfolk County has the highest income level and lowest unemployment rate. Its low commercial engagement rate indicates that fishermen might have more alternative occupations when fishing is not available. The only major port in Suffolk County is Boston Harbor. It lands a small amount of lobsters and Jonah crabs from a very limited number of vessels.

Table 3.6: Social-economic indicators for coastal communities.

State	County	Key Ports	Population (2018)	Median Household Income (2014-2018)	Persons below Poverty Level (2014-2018)	Unemployment Rate (2018)	Population Composition	Personal Disruption	Housing Disruption	Urban Sprawl	Commercial Engagement	Commercial Reliance
MA	Essex	Gloucester, Rockport, Marblehead	790,638	75,878	10.70%	3.60%	1.24	1.21	1.55	2.79	1.42	1.06
MA	Suffolk	Boston Harbor	807,252	64,582	17.50%	4.50%	3.33	2.33	2.67	4.00	2.00	1.00
MA	Norfolk	Cohasset	705,388	99,511	6.50%	3.00%	1.16	1.08	1.68	2.84	1.04	1.00
MA	Plymouth	Plymouth, Scituate, Hingham	518,132	85,654	6.20%	3.20%	1.11	1.11	2.25	2.46	1.50	1.04

Source: NMFS social indicator data from 2016.
U.S. Census Bureau 2018: ACS 1-year estimates data profiles; FRED https://fred.stlouisfed.org/series/MADUKE7URN

Notes: social indicator data are categorical, ranging from 0 to 4. Higher numbers indicate communities that are more vulnerable.

4 IMPACTS OF THE MANAGEMENT ALTERNATIVES

4.1 Impact Designation Descriptions

Using the criteria outlined above and summarized in Table 4.1, this Environmental Assessment (EA) analyzes the expected impacts of the proposed alternatives for the valued ecosystem components (VECs): protected species, habitat, and human communities as defined in Section 3. For each alternative, impacts to each VEC will be evaluated against the current condition of the VEC (i.e., resource described in the affected environment), as well as relative to the other alternatives proposed. Impacts are described both in terms of their direction (negative, positive, or no impact) and their magnitude (slight, moderate, or high) based on the guidelines shown in Table 4.1 and Figure 4.1.

Table 4.1: A key of the direction and magnitude of the actions being assessed in the effects analysis. ESA = Endangered Species Act. MMPA = Marine Mammal Protection Act. PBR = potential biological removal level. The Zero Mortality Rate Goal is the requirement for commercial fisheries to reduce incidental mortality and serious injury of marine mammals to insignificant levels approaching a zero mortality and serious injury rate.

		General Definitions		
VEC	**Resource Condition**	**Direction of Impact**		
		Positive (+)	**Negative (-)**	**No Impact (0)**
Protected Species	For ESA listed species: populations at risk of extinction (endangered) or endangerment (threatened). For MMPA protected species: stock health may vary but populations remain impacted	For ESA listed species: alternatives that contain specific measures to ensure no interactions with protected species (i.e., no take). For MMPA protected species: alternatives that will maintain takes below PBR and approaching the Zero Mortality Rate Goal	For ESA listed species: alternatives that result in interactions/take of listed resources, including actions that reduce interactions. For MMPA protected species: alternatives that result in interactions with/take of marine mammals that could result in takes above PBR	For ESA listed species: alternatives that do not impact ESA listed species, For MMPA protected species: alternatives that do not impact marine mammals
Habitat	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 Community (Socio-economic)	Highly variable but generally stable in recent years	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
	Magnitude of Impact			

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	To a lesser degree / minor	e.g. Slight Negative or Slight Positive
	Moderate	To an average degree (i.e., more than "slight," but not "high")	e.g. Moderate Negative or Moderate Positive
	High	To a substantial degree (not significant unless stated)	e.g. High Negative or High Positive
	Significant	Affecting the resource condition to a great degree, see 40 CFR 1508.27.	
	Likely	Some degree of uncertainty associated with the impact	

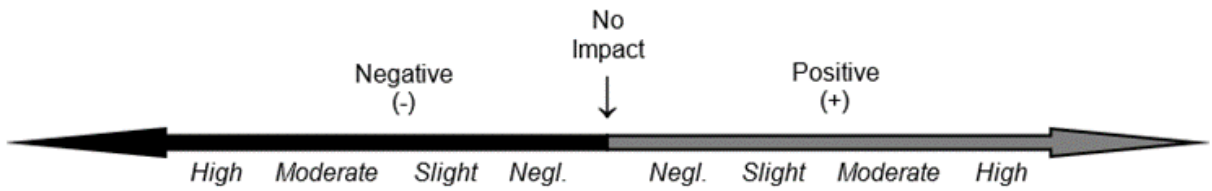


Figure 4.1: A depiction of the relative direction and magnitude of impacts on valued ecosystem components.

4.1.1 Protected Species

The impacts of the alternatives on protected species take into account impacts to ESA-listed species, as well as impacts to non-ESA listed MMPA protected species in good condition (i.e., marine mammal stocks whose potential biological removal level (PBR) have not been exceeded) or poor condition (i.e., marine mammal stocks that have exceeded or are near exceeding their PBR). These impact descriptors apply to the Protected Species VEC.

4.1.1.1 ESA-Listed Species

For ESA-listed species, any action that results in an interaction or take is expected to have negative impacts, including actions that reduce but do not prevent 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). None of the alternatives considered in this document would ensure no interactions with ESA-listed species. By definition, all ESA-listed species are in poor condition and any take can negatively impact their recovery.

4.1.1.2 MMPA Protected Species

The stock conditions for marine mammals not listed under the ESA varies by species; however, all are legally protected under the MMPA. For non-ESA listed marine mammal stocks, negative impacts would be expected from alternatives that result in the potential for interactions between

fisheries and those stocks. For species with PBR that have not been exceeded, alternatives not expected to increase fishing behavior or effort may positively benefit the species by maintaining takes below the PBR and approaching the Zero Mortality Rate Goal, which is the MMPA requirement for commercial fisheries to reduce incidental mortality and serious injury of marine mammals to insignificant levels approaching a zero mortality and serious injury rate. However, none of the alternatives considered in this document ensure no interactions with MMPA protected species, and therefore would be expected to have negative impacts.

4.1.2 Habitat

Alternatives that improve the quality or quantity of habitat are expected to have positive impacts on habitat. Alternatives that degrade the quality or quantity, increase disturbance of habitat, or allow for continued fishing effort are expected to have negative impacts. A reduction in fishing effort is likely to decrease the time that fishing gear is in the water, thus reducing the potential for interactions between fishing gear and habitat.

4.1.3 Human Community

Socioeconomic impacts are considered in relation to potential changes in landings, prices, revenues, and fishing opportunities. Alternatives which could lead to increased availability of target species and/or an increase in catch per unit effort could lead to increased landings. Increased landings are generally considered to have positive socioeconomic impacts because they could result in increased revenues; however, if an increase in landings leads to a decrease in price or a decrease in future availability for any of the landed species, then negative socioeconomic impacts could also occur. Conservation measures that drastically reduce catch and revenue may have negative impacts in the short term, but could ensure access to the fishery in the future, potentially with fewer restrictions.

On the other hand, similar conservation measures could have different impacts on communities depending on their vulnerability and resilience. Communities with lower income and higher fishery dependency, like ports in Essex County, would be more sensitive to stricter restrictions. These communities have less business diversity, and so the communities are less resilient than those with more diverse options, like the Boston-area ports.

4.2 Evaluating the Protected Species Impacts of the Alternatives

4.2.1 Overview of the Decision Support Tool Analysis

The Right Whale Decision Support Tool (DST; version 3.1.0 used in the 2021 FEIS, NMFS 2021d) was developed by the Northeast Fisheries Science Center to assist managers, decision makers, and stakeholders with understanding spatiotemporal overlap between fishing gear and North Atlantic right whale (right whale) distributions along the East Coast and how risk of entanglement may change after implementing new management measures. This model calculates right whale entanglement risk based on three components: the density of buoy lines in the water, the distribution of right whales, and the threat that gear poses to serious injury as a function of rope strength.

The line density component of the DST for the geographic area relevant to this action is based on the peer-reviewed NMFS Vertical Line Model and Co-occurrence model developed by Industrial Economics, Inc (IEc; see Appendix 5.1 in the 2021 FEIS for a description of the IEc Vertical Line Model, NMFSc 2021). It estimates the number of buoy lines associated with trap/pot configurations within a given spatial area. The main model uses buoy line estimates from 2017, the latest data available and considered representative of current fishery management measures and associated effort. The DST evaluates all changes against the 2017 baseline, chosen because it was the year NMFS determined that the population was in decline, it was the year that an Unusual Mortality Event was declared for the population, and it still represents the most recent data available.

A second layer in the model assesses the risk associated with different gear configurations, accounting for the use of lines with different breaking strengths. Gear with higher breaking strength is expected to be more risky to whales because it is harder to break out of and therefore more likely to result in serious injury or mortality. An empirical gear threat model was built using information on the strength of ropes involved in serious whale entanglements and how the strength of the ropes observed in entanglements compares to the strength of ropes that whales would be expected to encounter. The model estimates uncertainty within the gear threat model and can provide an upper and lower bound within the model output. Models for the upper and lower confidence bounds were calculated by bootstrapping the observed line strength data to generate a ratio of observed to expected line strengths and fitting the data to a binomial generalized linear model. See Appendix 3.1 of the 2021 FEIS (NMFS 2021d) for more detail about the development of the gear threat model and associated uncertainty.

The final layer is a right whale habitat density model. The DST employs a right whale habitat density model built by researchers at Duke University that predicts the spatiotemporal distribution and density of right whales throughout the proposed area based on observations of whale from standardized surveys from 2010 through 2018 and co-located oceanographic and habitat variables (Roberts et al. 2016; Roberts et al. 2020). The right whale habitat density model then uses oceanographic and habitat variables across the region to create a map of likely whale presence. The DST also includes a humpback whale habitat density model and a fin whale habitat density model for the period of 1999 through 2017 (Roberts et al. 2017). The fin whale habitat density model currently does not support the use of a gear threat model and can only be used to examine co-occurrence of whales and commercial fishing gear.

The DST analyzes information on a common spatial grid with consistent positioning and resolution (i.e., cell size). It employs two spatial resolutions for analysis: a low resolution (10 square nautical miles) and a high resolution (1 square nautical mile) option. The analysis in this EA was conducted using the high resolution setting on a one nautical mile grid. For detailed information on the model, including its limitations and uncertainties, refer to Volume I, Chapter 3 of the 2021 FEIS and the model documentation in Volume II, Appendix 3.1 (NFMS 2021d).

Each model run allows for the selection of a variety of spatially explicit management measures for a particular month with a focus on measures that reduce the number or strength of lines in the water column, such as changes in the number of traps per trawl, the proportion of traps fished, line strength, line number, restricted areas with lines out and/or lines moved to adjacent fishing

areas, and number of lines per trawl. The output provides the mean reduction in risk throughout an entire year as well as reduction in co-occurrence of whales and fishing lines. Suites of measures can be run in tandem to best estimate overall changes in risk while taking into account how different management measures may interact with one another to alter the risk landscape.

We used two indices to estimate the change in entanglement risk to right whales: co-occurrence and entanglement risk reduction. Co-occurrence is a product of estimated right whale density and buoy line density and was used to estimate the relative change in chances of a right whale entanglement occurring. Risk reduction estimates the combined risk of a serious entanglement because it also takes into account the strength of the line, where mortality and serious injury increase with line strength. Together, these components roughly estimate the approximate risk of an entanglement that will result in mortality or serious injury, where a higher density of lines, predicted right whales, and/or high line strength increase risk. This enables a semi-quantitative comparison of how different management scenarios and gear modifications are predicted to change the risk of entanglements that result in serious injury or mortality.

Relative risk was calculated by spatially constraining the DST model in two ways. First, the model was constrained to the Massachusetts portion of Lobster Management Area 1 (LMA 1; the action area). The Massachusetts portion of LMA 1 limits the analysis to the action area and calculates entanglement risk and co-occurrence risk reduction relative to the total risk landscape within the spatial scope of this emergency action (that is, risk reduction relative to all risk in Massachusetts LMA 1). The second round of analyses expanded the spatial constraint to the American lobster and Jonah crab trap/pot fishery in the Northeast Region Trap/Pot Management Area (Northeast Region), which makes up approximately 93 percent of fixed gear buoy lines in the right whale range within U.S. waters (risk reduction of the action relative to all of the Northeast Management Area evaluated in the 2021 FEIS (NMFS 2021d)). Increasing the spatial constraint to the Northeast Region provides a much broader analysis of entanglement risk and co-occurrence risk reduction provided by the proposed Alternatives and allows a comparison of the emergency rule with the new measures implemented in 2021.

It is important to model fishing effort across the region to understand how this emergency action may redistribute effort, and consequently entanglement and co-occurrence risk, across the Northeast Region. Within the Massachusetts portion of LMA 1 and Northeast Region spatial constraints, restricted areas were analyzed two ways, taking into account gear location and whether gear would be removed or relocated. First, it was assumed that 100 percent of the vessels would suspend fishing within the MRA as defined in the 2021 Final Rule. We know from existing closures that this is more likely for nearshore restricted areas, particularly the MRA, when fishermen would have a long transit to open areas and where those without federal permits are restricted in area choices. However, some fishermen with federal permits would be able to move their lines and could increase risk outside of restricted areas, as may have occurred in 2021. Recent discussions with Massachusetts fishermen suggested that due to good lobster prices in 2021 and again in the spring of 2022, relocating gear outside of the closure is attractive to fishermen (Robert Martin, pers. comm. 2022). This analysis considered both extremes (gear reduction under which all lines were removed and a closure under which all lines were relocated outside of the emergency closure) to estimate the maximum and minimum level of risk reduction anticipated based on fishing behavior. The effects of these two responses differ slightly

depending on how co-occurrence changes whale entanglement risk. When fishing is suspended or ropeless technologies are employed and lines are removed from the water entirely, there is typically a straightforward decrease in co-occurrence and, as a result, a reduced risk of entanglement. For optimal conservation, the emergency restricted area needs to be sufficiently large to provide protection for whales, but not designed such that fishermen would relocate large numbers of lines to other areas of high risk and/or create a fencing effect along the borders of the restricted area. Hotspots of high buoy line and right whale co-occurrence were identified and tested with the DST to look for overall risk reduction.

In this EA, the DST is used in a similar manner as in Phase 1 of the modifications to the Plan to assess the possible risk reduction of the two action alternatives on large whale species. The analyses evaluated three combinations of management actions within the two spatial constraints (Massachusetts portion of LMA 1 and the entire Northeast Region) to evaluate the average annual co-occurrence and risk reduction achieved by the two anticipated fishery behavior options in which fishermen either remove gear from the water (Gear Reduction) or relocate gear outside of the emergency restricted area (Closure):

- The emergency closure areas were evaluated independently (Table 4.3)
- The emergency closure areas were evaluated together with the new MRA North (Table 4.4)
- The emergency closure areas were added to the suite of management measures selected in the 2021 Final Rule to see the additive value relative to the entire Northeast Region (Table 4.5)

Closure scenarios assume that the number of buoy lines within the water is the same before and after a management intervention. In all scenarios, it is assumed that 100 percent of gear is removed from the MRA North (i.e. the new area added to the MRA in 2021). The analysis of status quo assumes compliance with these current requirements and assumes suspension of all activity during the times the closures are in place. For a detailed description of model settings and results see Appendix 4.1

4.2.2 The Impacts of Alternative 1 on Protected Species

Under Alternative 1 (No Action), the current Plan management regime consisting of time/area closures, minimum trap per trawl requirements, use of weak links in the surface system, and gear marking requirements remains in place. The closures included in the Preferred Alternative of the 2021 Final Rule are considered part of the status quo for this proposed action (see Section 2.1) because they went into effect on October 18, 2021. Under Alternative 1, high negative impacts are expected because there would be a risk of entanglement due to the present number of buoy lines that would remain in the water when right whales are abundant in the area.

In the Massachusetts portion of LMA 1, there are an estimated 3,993 trawls of lobster trap/pots and 7,002 buoy lines present during the month of April (Table 4.2). During this same month, it is estimated that 94 right whales inhabit this portion of LMA 1, reflecting the high density right whale aggregations essential to their foraging and survival within Massachusetts and Cape Cod Bay. The high density aggregation of right whales in Cape Cod Bay motivated the

implementation of the large seasonal Massachusetts Restricted Area that was designed to reduce the overlap of right whales with fishing gear. On average, trawls are longer and lines are stronger in federal waters compared to state waters within the action area, so the gear present in the alternative closure areas poses a higher risk in the region (Table 4.2).

The Plan's 2021 Final Rule risk reduction measures require that weak rope (engineered rope that breaks at 1,700 pounds/771 kilograms or less) or weak insertions (e.g. sleeves, links, or 3-foot lengths of rope) be used in the buoy lines at certain intervals, depending on the area. Compliance with the weak inserts/rope in LMA 1 management measure is not required until May 1, 2022. During April 2022, buoy lines present in federal waters under a No Action scenario are not required to have the modifications that would reduce the likelihood of mortality or serious injury should an entanglement occur. The Plan's consideration of weak line as a precautionary mitigation measure was largely based on Knowlton et al. (2016) findings that no ropes retrieved from entangled right whales of all ages had expected breaking strengths that were below 7.56 kN (1,700 pounds/771 kilograms) at the time the ropes were new. The authors concluded that most right whales can break free from these weaker ropes, avoiding a life threatening entanglement. Without these measures in place, there is a higher likelihood of a mortality or serious injury in large whale entanglement incidents with strong buoy lines in the action area.

Table 4.2: Comparison of Alternative 1 (No Action), Alternative 2 (Preferred), and Alternative 3 (Non-Preferred) emergency closures within the action area, closure period, mean fishing gear configuration, and the total number of right whales estimated to be present within the area in April at any given time. The LMA 1 Massachusetts area data do not account for the MRA seasonal closure that prohibits trap/pot fishing in federal and state waters February 1 through April 30.

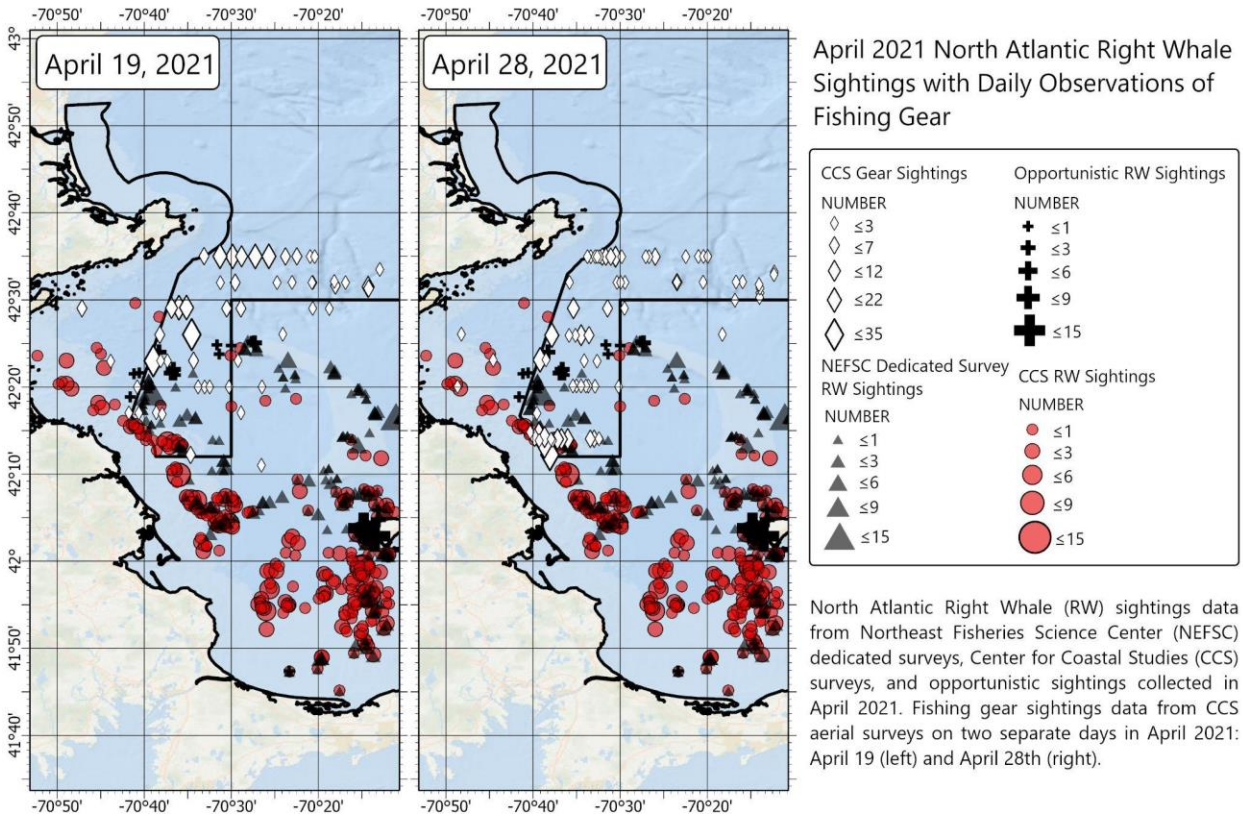
Area	Emergency Closure Area (square miles)	Seasonal Closure Area (square km)	Closure Period	Total Number of Trawls	Total buoy Lines	Mean Trawl Length	Mean Rope Strength (lb)	Mean Rope Strength (kg)	Estimated Number of Whales in April
LMA 1: MA	-	-	-	3,933	7,002	18	3,175	1,440	94
MRA Wedge	200	518	April 1 - 30	318	626	26	3,660	1,660	5
MRA Wedge North	1,297	3,359	April 1 - 30	1,142	2,274	27	3,716	1,686	6

The DST model uses whale survey data from 2010 through 2018 to predict whale distribution. The model does not capture more recent whale distribution data, such as the empirical data collected during aerial surveys conducted by the Center for Coastal Studies (CCS) and aerial and shipboard surveys conducted by Northeast Fisheries Science Center (NEFSC) in April 2021, and may be underestimating right whale density in some areas. The CCS observations include right whales within the affected wedge and observations of aggregated fishing gear (Figure 4.2). The fishing gear is thought to be a mix of actively fished gear and staged gear that is set in preparation for the opening of the MRA. Federal waters within the MRA are open to the trap/pot fishery on May 1, although Massachusetts State regulations prohibit trap/pot fishing in any

waters under the jurisdiction of the Commonwealth from February 1 through May 15 (322 CMR 12.04(2)).

In the larger context of risk of Northeast lobster and Jonah crab fisheries to right whales before the 2021 Final Rule, MRA North reduces annual risk by 4 percent and co-occurrence by 3.8 percent (Table 4.4). These risk reduction values provide a baseline upon which comparisons can be made between the status quo (post Final Rule) risk reduction landscape and the proposed Alternative 2 and Alternative 3 emergency closures risk and co-occurrence reduction measures. Without taking emergency action, the aggregation of gear remains an imminent threat to the right whale population as well as to other large whales in the area. Alternative 1 continues the status quo of Phase I implementation of new seasonal closures and presents a high to moderate negative risk to ESA-listed (right, fin, and sei whales) and MMPA protected species (humpback and minke whales) within the affected area. Relative to Alternative 2, Alternative 1 has a moderate negative impact because Alternative 1 would allow fishing activities with buoy lines that present an entanglement risk to protected species in a relatively small area (200 square miles/518 square kilometers) of federal waters outside of the MRA. Relative to Alternative 3, Alternative 1 will have a high negative impact because Alternative 3 would close a substantial area (1,297 square miles/3,359 square kilometers) to the lobster and Jonah crab fishery that Alternative 1 would allow to remain open. As has been noted, buoy lines used by the lobster and Jonah crab fishery present an entanglement risk, particularly when the rope breaking strength exceeds the maximum of 1,700 pounds (771 kilograms) believed to reduce mortality and serious injury incidents for large whales. Under Alternative 1, the No Action Alternative, no additional risk reduction to prevent mortality and serious injury would occur, meaning that ESA and MMPA protected species would experience high negative to moderate negative impacts.

Figure 4.2: Sightings of right whales during April 2021 (red, gray, and black) and gear observed (white) on two different days are overlaid. Red circles show right whale sightings from the Center for Coastal Studies (CCS) aerial surveys, gray triangles show sightings by the Northeast Fisheries Science Center's (NEFSC) dedicated aerial and shipboard surveys, and black crosses are opportunistic sightings collected by NEFSC. Fishing gear observed by CCS on April 19, 2021 and April 28, 2021, two days that were selected as representative snapshots of fishing gear present in survey areas, are represented by white diamonds. Surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA. These maps are used for qualitative not quantitative comparison, and differ from Decision Support Tool data.



4.2.3 The Impacts of Alternative 2 on Protected Species

Alternative 2 would implement an emergency closure prohibiting lobster and Jonah crab trap/pot fishery buoy lines from April 1 to April 30 within the 200 square miles (518 square kilometers) of federal waters referred to as MRA Wedge (Table 4.2). The boundary of MRA Wedge lies between state and federal waters within the MRA and coincides with only a portion of the existing Massachusetts Restricted Area (MRA) closure season.

Alternative 2 would remove 626 buoy lines within the MRA Wedge emergency closure (Table 4.2). Within the Massachusetts portion of LMA 1, MRA Wedge has an average of 26 traps per trawl during the month of April. Mean buoy line strength is 3,660 pounds (1,660 kilograms), double the maximum 1,700 pound (771 kilograms) breaking strength that will be required when weak inserts requirements go into effect on May 1, 2022. In the month of April, it is estimated that there are an average of about 5 right whales within the MRA Wedge at any given time (Table 4.2).

The maximum and minimum relative risk reduction for Alternative 2 was estimated based on two assumptions of what happens to gear during a closure, as discussed in Section 4.2.1. The maximum relative risk reduction relies on the assumption that all lines are removed from the water, whereas the minimum risk reduction estimate assumes a closure redistributes the gear to areas outside of the emergency closure. The actual risk reduction will likely fall between the two analyzed extremes. The greater the reduction of right whale and buoy line co-occurrence, such as when all lines are removed, the smaller the likelihood of a right whale dying or becoming

seriously injured in buoy lines. Removing lines, particularly lines with a maximum breaking strength above 1,700 pounds (771 kilograms), provides greater benefit to right whales present during the month of April than if the lines are moved elsewhere within the range of the right whales.

Within the Massachusetts portion of LMA 1, the MRA Wedge emergency closure in April 2022 reduces the annual mean risk by 5.1 to 5.6 percent and co-occurrence of trap/pot gear and right whales decreases by 2.9 to 3.3 percent, depending on whether gear is relocated outside of the emergency closure or removed (Table 4.3). For comparison, the MRA North in the status quo provides an annual maximum risk reduction of 10.2 percent and co-occurrence reduction of 8.5 percent (Table 4.4) when gear is removed from the water. MRA North and MRA Wedge implemented together in the Massachusetts portion of LMA 1 reduce mean risk 15.3 to 15.8 percent when gear is relocated or removed, respectively (Table 4.4). Co-occurrence is reduced 11.4 percent (when gear is relocated) to 11.8 percent (when gear is removed) (Table 4.4). These estimates suggest that the difference in risk reduction between gear removal and relocation may be fairly small, particularly relative to the MRA North, but there are limitations in the ability of the model to predict where gear is reset and in what density. As the May 1 opening of the Federal MRA and emergency closure area approaches, fishermen may relocate gear along the boundaries of these waters, staging for a rapid relocation after May 1. Since right whales are expected to disperse during this period, the potential for a gear fence is of some concern, but this risk is outweighed by the high risk during April across the closed area. Whale density outside along the border of MRA Wedge is expected to lower than within the emergency closure area. Gear that is relocated in particular areas in high numbers could pose more of a risk than the model results reflect.

Table 4.3 Comparison of reductions in entanglement risk and North Atlantic right whale co-occurrence by proposed emergency closures within Alternative 1 (No Action), Alternative 2 (Preferred), and Alternative 3 (Non-Preferred). Gear Removed scenarios that assume gear is removed from the waters, and Closure scenarios assume that the gear is relocated outside of the emergency restricted area, leaving the number of buoy lines within the water the same before and after a management intervention. The MA portion of LMA 1 refers to the Massachusetts portion of Lobster Management Area 1 and the Northeast Region refers to the lobster and Jonah crab trap/pot fishery in the Northeast Region Trap/Pot Management Area.

		100% Gear Removed		**Closure (100% Gear Relocated)**	
Spatial Constraint	**Emergency Closure Area**	**Mean Risk Reduction**	**Co-Occurrence Reduction**	**Mean Risk Reduction**	**Co-Occurrence Reduction**
MA portion of LMA 1	**Alternative 2 MRA Wedge**	5.6%	3.3%	5.1%	2.9%
MA portion of LMA 1	**Alternative 3 MRA Wedge North**	6.4%	3.7%	5.8%	3.3%
Northeast Region	**Alternative 2 MRA Wedge**	2.2%	1.5%	2.0%	1.3%

Northeast Region	**Alternative 3 MRA Wedge North**	2.5%	1.7%	2.2%	1.4%

In the entire Northeast Region, lobster and Jonah crab gear in the MRA Wedge in April represents about 2.2 percent of the annual risk of lobster and Jonah crab trap/pot fisheries (Table 4.3). The DST estimates that an emergency closure of this area to buoy lines in April would result in 2 to 2.2 percent risk reduction, and 1.3 to 1.5 percent reduction in co-occurrence between right whales and buoy lines, depending on whether gear is relocated or removed (Table 4.3). When combined with the estimated impacts of the 2021 Final Rule (86 FR 51970, September 17, 2021), this one-month closure is only an additional 1.6 to 1.7 percent total risk reduction (Table 4.5). Though this additional reduction seems small, it offers measurable risk reduction in a relatively small area for a very short time period.

There is uncertainty in whether fishermen will relocate or remove gear from the emergency closure area. However, the high price of lobster in March 2022 may encourage more fishermen to relocate their gear outside of the MRA Wedge rather than remove it from the water. The minimum risk reduction achieved by a closure in which the gear is relocated is not predicted to result in a new hotspot of high co-occurrence of fishing gear and right whales. The risk reduction of both possible responses to an emergency closure are very similar and within the range of error within the model, suggesting a similar risk reduction for either scenario.

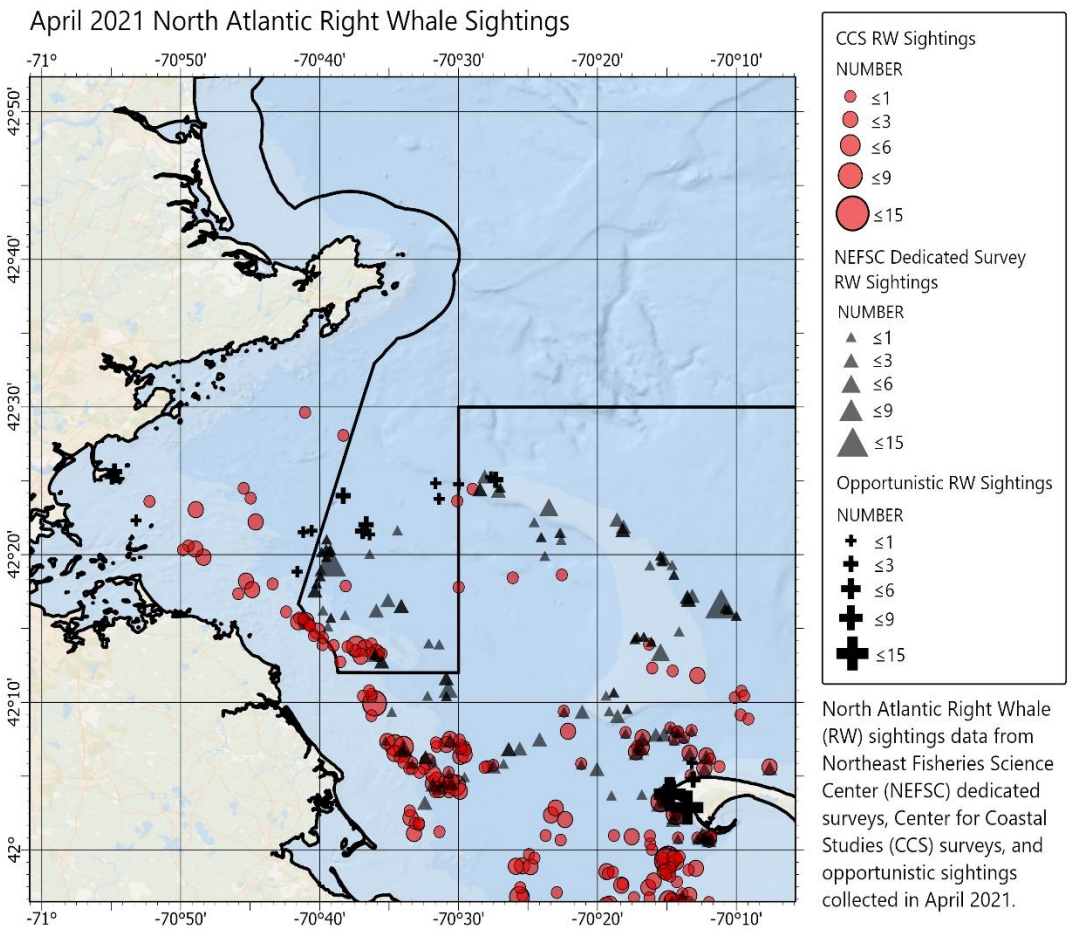
Table 4.4: Comparison of reductions in entanglement risk and North Atlantic right whale co-occurrence by proposed emergency closures within Alternative 1 (No Action), Alternative 2 (Preferred), and Alternative 3 (Non-Preferred) when the proposed emergency areas are implemented in tandem with the MRA North. Gear Removed scenarios that assume gear is removed from the waters, and Closure scenarios assume that the gear is relocated outside of the emergency restricted area, leaving the number of buoy lines within the water the same before and after a management intervention. In all scenarios, it is assumed that 100 percent of gear is removed from the MRA North. The MA portion of LMA 1 refers to the Massachusetts portion of Lobster Management Area 1 and the Northeast Region refers to the Lobster and Jonah crab trap/pot fishery in the Northeast Region Trap/Pot Management Area.

		100% Gear Removed in Emergency Restricted Area and MRA North		**Closure (100% Gear Relocated) in Emergency Restricted Area with 100% Gear Removed in MRA North**	
Spatial Constraint	**Emergency Closure Area**	**Mean Risk Reduction**	**Co-Occurrence Reduction**	**Mean Risk Reduction**	**Co-Occurrence Reduction**
MA portion of LMA 1	**Alternative 1**	10.2%	8.5%	-	-
MA portion of LMA 1	**Alternative 2 MRA Wedge**	15.8%	11.8%	15.3%	11.4%

MA portion of LMA 1	**Alternative 3 MRA Wedge North**	16.6%	12.2%	16.0%	11.9%
Northeast Region	**Alternative 1**	4.0%	3.8%	-	-
Northeast Region	**Alternative 2 MRA Wedge**	6.2%	5.3%	6%	5.1%
Northeast Region	**Alternative 3 MRA Wedge North**	6.5%	5.5%	6.2%	5.2%

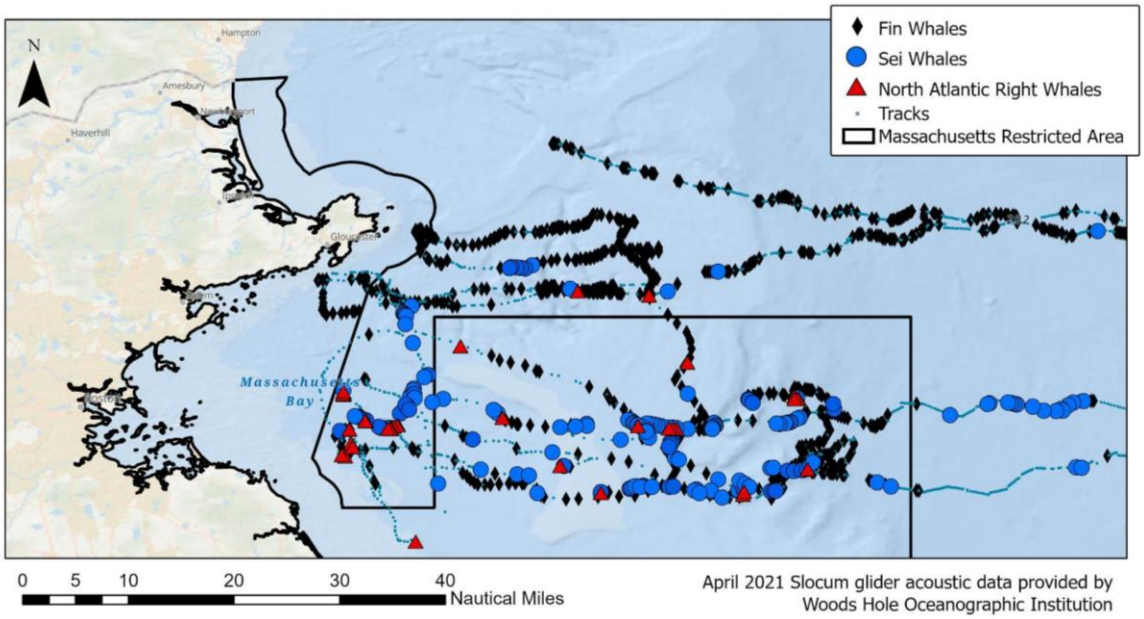
Relative to the recent empirical data, the right whale habitat density model underestimates the number of whales in this area in April (see Figure 4.3 for April 2021 right whale sightings data provided by CCS and NEFSC). As discussed in Section 4.2.1, the DST right whale habitat density model relies on oceanographic and habitat variables to create a map of likely whale presence using whale data from 2010 through 2018. Therefore, more recent data including survey, acoustic, and opportunistic detections of right whales in 2021 are not included. The 2021 observations of right whale distribution suggest a higher concentration of right whales in April than is estimated by the DST (Figure 4.3). Multiple aggregations of 3 to 6 right whales were observed by NEFSC dedicated aerial and shipboard surveys and reported as opportunistic sightings in the middle of the MRA Wedge area around 42°20′. The dedicated surveys captured more than 10 sightings of right whales, many of which were aggregations of 3 or more whales, throughout the month within the emergency closure area (Figure 4.3). However, the DST estimates a monthly average of 5 right whales in the same area throughout the month of April (Figure 4.3). The risk estimated by the DST likely underestimates the risk and co-occurrence reduction of the proposed emergency closure. The CCS dedicated aerial surveys also collected data on whale presence along the southern border of the MRA Wedge area, in numbers ranging from individual whales to groups as large as six. Dedicated right whale survey efforts conducted by CCS and NEFSC are centralized in Cape Cod Bay, and surveys northward in Massachusetts Bay are not conducted with the same frequency. Therefore, there are limited data on whale density in this area, and shifting right whale distribution within the last 5 years makes predicting whale aggregations and distribution challenging.

Figure 4.3: Sightings of right whales during April 2021 (red, gray, and black). Red circles show right whale sightings from the Center for Coastal Studies (CCS) aerial surveys, gray triangles show sightings by the Northeast Fisheries Science Center's (NEFSC) dedicated aerial and shipboard surveys, and black crosses are opportunistic sightings collected by NEFSC. CCS surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, offshore Rockport, MA. These maps are used for qualitative not quantitative comparison, and differ from Decision Support Tool data.



Acoustic detections of right whales also indicated that whale presence may be higher than what is estimated by the whale habitat model used in the DST. Acoustic data was collected by Slocum Glider surveys deployed near the Stellwagen Bank National Marine Sanctuary and Gulf of Maine for the purpose of surveying tagged fish and baleen whales, including right, fin, sei, and humpback whales (Baumgartner 2021). Of the 35 acoustic detections of right whales in Massachusetts Bay, 17 are definite and 18 are possible (Figure 4.4). Acoustic data does not confirm the number of individual whales present nor does the data localize the animals; however, this information does confirm sustained large whale presence in the action area during the time period of the proposed closures of Alternative 2 and Alternative 3 (Figure 4.4, Figure 4.6).

Figure 4.4: Definite and possible acoustic detections of fin, sei, and right whales in Massachusetts Bay from April 1, 2021 through April 30, 2021. The acoustic detection data comes from Slocum Glider surveys deployed near the Stellwagen Bank National Marine Sanctuary and Gulf of Maine (Baumgartner 2021). These maps are used for qualitative not quantitative comparison and differ from Decision Support Tool data.



Credit: Julianne Wilder and Gen Davis, acoustic analysts; Mark Baumgartner, glider operator; mission funding from SanctSound and NERACOOS.

Systematic surveys for whales are done differently than surveys for gear, and gear surveys are not typically conducted so are not available for comparison across seasons or years. Therefore, NMFS cannot compare gear placement in April 2021 with gear present in the action area in years prior due to a lack of information. More gear was observed east of Plymouth County on April 28, 2021, than was present on April 19, 2021 (Figure 4.2). Aggregations of gear were also observed along survey track lines east of Essex County suggesting an increase in set gear over the month of April, possibly in preparation for the opening of federal waters within MRA on May 1. It remains uncertain if the expansion of the MRA in 2021 resulted in an increase in the amount of trap/pot gear in this area in response to the Massachusetts state water closure. Changes in fishing effort distribution data would not be reflected by the DST, which models gear abundance and distribution based on 2017 fishing data. However, dense aggregations of gear were present within the action area in 2021, along with right whales in higher numbers than projected by the whale habitat model used in the DST. Alternative 2 would reduce co-occurrence of gear and whales through an emergency closure prohibiting the use of buoy lines by the lobster and Jonah crab trap/pot fishery in an area of observed right whale presence.

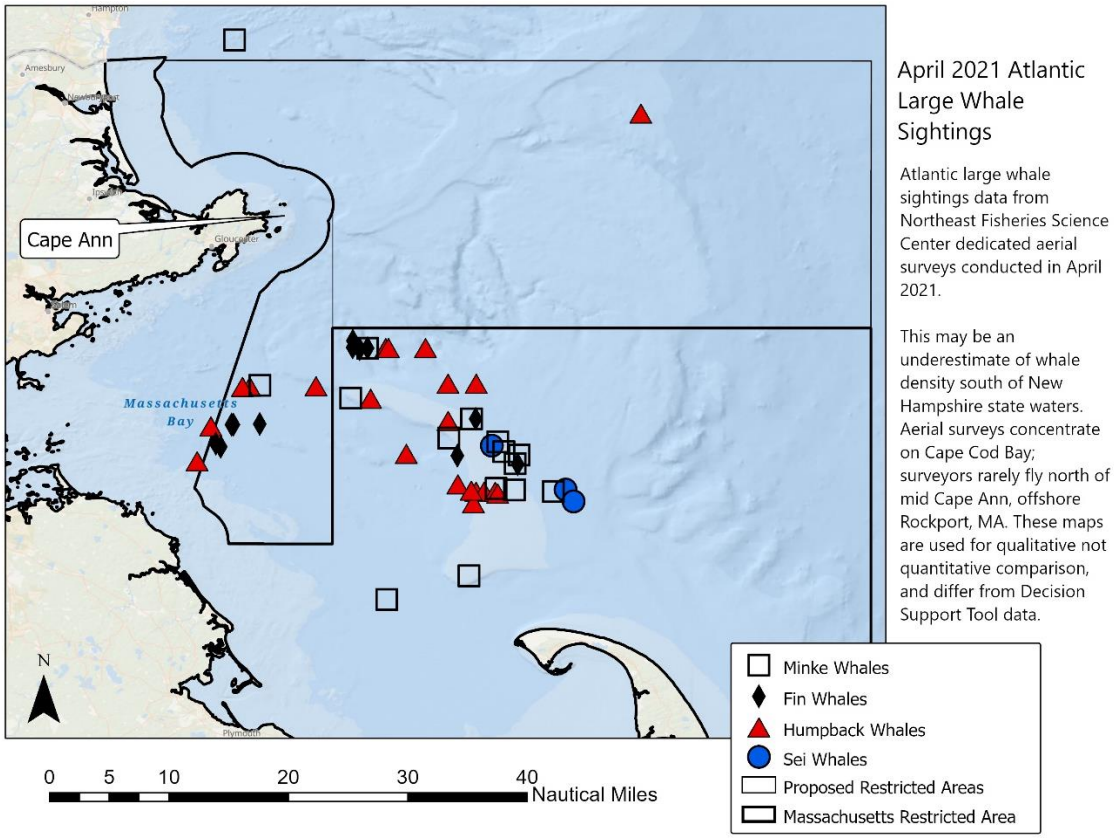
Introducing ropeless fishing, where buoy lines are stored on the bottom until retrieval, in the action area where right whale aggregations may be high, may pose a slightly higher threat of entanglement in the short-term compared to a full fishery closure, as gangions and sinking groundline would be present, and some on-demand gear includes short term deployment of a buoy line while a vessel is on site. However, there are long-term benefits to the accelerated development of gear that protects right whales and supports healthy lobster and Jonah crab fisheries. To reduce potential risks in the short term, an EFP would be required that would include conditions on fishing to reduce the impact of this gear on right whales. As few vessels would be operating under an EFP in April 2022, we anticipate that a very low level of lobster fishing using ropeless techniques, if any, would take place in the closure during April. Any EFP

fishing would not add any persistent buoy lines to the area and, as restricted under an EFP, would add only a negligible risk above a full closure.

Overall, co-occurrence of large whales with buoy lines and associated entanglement risk following the implementation of the emergency closure will likely decline substantially during a critical period when the right whales are likely to be exiting Cape Cod Bay. While entanglement risk is not completely eliminated, the action does significantly reduce risk in the action area. With the addition of 200 square miles (518 square kilometers) in April 2022, the risk reduction of the MRA North is increased by approximately 50 percent for right whales in that month. This emergency measure is expected to substantially reduce the potential of a right whale mortality or serious injury as a result of interactions with fishing gear.

Alternative 2 could reduce co-occurrence of humpback and fin whales with trap/pot buoy lines, but any reduction would be minimal—estimated to be less than one percent. While there is not a significant change in co-occurrence under Alternative 2, the DST does not indicate that the MRA Wedge would result in an unintended increase in humpback or fin whale entanglement due to relocation of gear. The MRA Wedge emergency closure is estimated to reduce the relative entanglement risk in the Massachusetts LMA 1 for fin whales by 0 to 0.3 percent and for humpback whales by 0.3 to 0.7 percent depending on whether gear was relocated or removed from the water, respectively. Fin and humpback whales are present in the Massachusetts portion of LMA 1. Acoustic detection of fin whales indicates abundance in Massachusetts Bay peaks in September to January, though fin whales may be present throughout the year (Hain et al. 1992, Morano et al. 2012). Passive acoustic monitoring data indicate that humpback whales persistently utilize Massachusetts Bay April through December to feed (Murray et al. 2013, Clapham et al. 1993). April 2021 observation data show low numbers of confirmed visual sightings of fin and humpback whales within the action area **(**Figure 4.5).

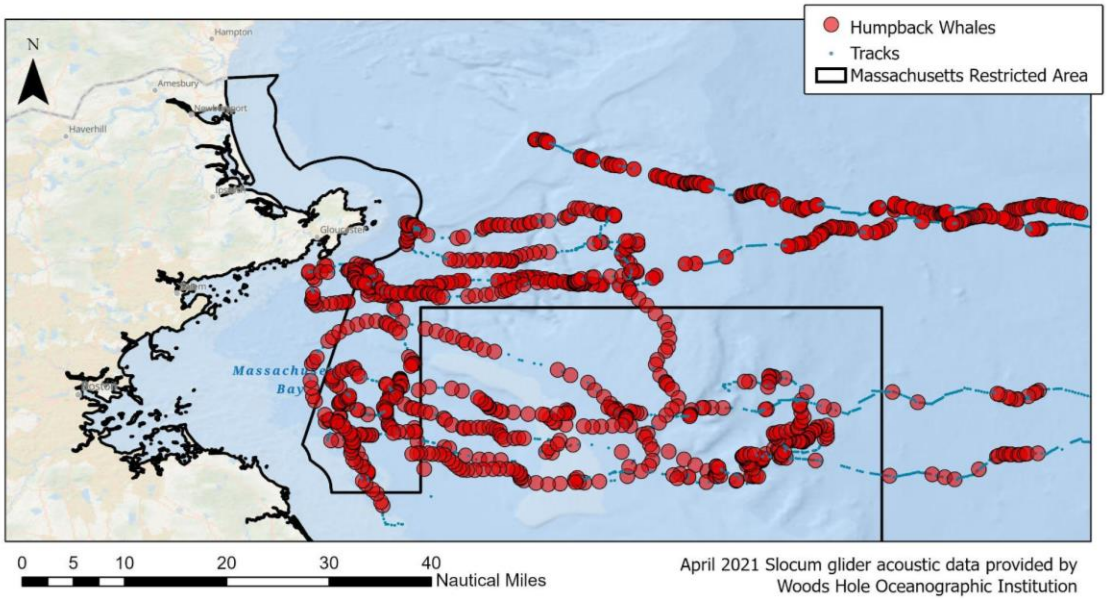
Figure 4.5: Atlantic large whale sightings in the Massachusetts portion of LMA 1 reported during Northeast Fisheries Science Center dedicated aerial surveys conducted in April 2021. Dedicated surveys are concentrated on Cape Cod Bay, Massachusetts, which may underestimate whale abundance north of Cape Ann.



The DST is unable to provide a quantitative estimate of risk reduction for minke or sei whales, both of which have been observed in the action area during the month of April in low numbers. Minke whales have been frequently observed in Massachusetts Bay and Cape Cod Bay throughout the year. Feeding behavior was observed most frequently May through October, and the highest abundance of minke whale sightings were documented July through October (Murphy 1995). NEFSC aerial surveys in 2021 reported a single minke whale within the MRA Wedge in April and the remaining minke whale observations during that time period were documented within the MRA (Figure 4.5) and on the continental shelf south of Rhode Island. Sei whale sightings in April 2021 were limited to the federal waters of the MRA (Figure 4.5) and offshore waters beyond LMA 1. Though sei whales have been observed in the Great South Channel and Stellwagen Bank in the spring, they typically remain offshore in the deeper waters (Payne et al. 1990, Schilling et al. 1992, Waring et al. 2009).

Acoustic detections of fin, humpback and sei whales confirm their presence in federal waters east of Massachusetts Bay, Massachusetts (Baumgartner 2021; Figure 4.4, Figure 4.6). Humpback and fin whales were detected closer inshore than sei whales, but the acoustic detections do indicate sei whales were also present in the MRA Wedge April 2021. Detectability for baleen whales may vary depending on abundance, distance from the glider, whale calling behavior, and environmental conditions affecting interfering noise (Baumgartner et al. 2020). However, the acoustic data does confirm continued presence of these 3 species of Atlantic large whales in the action area during the time period of the proposed closures of Alternative 2 and Alternative 3 (Figure 4.4, 4.6).

Figure 4.6: Definite and possible detections/sightings of humpback whales in Massachusetts Bay from April 1, 2021 through April 30, 2021. The acoustic detection data comes from Slocum Glider surveys deployed near the Stellwagen Bank National Marine Sanctuary and Gulf of Maine (Baumgartner 2021). These maps are used for qualitative not quantitative comparison and differ from Decision Support Tool data.



Credit: Julianne Wilder and Gen Davis, acoustic analysts; Mark Baumgartner, glider operator; mission funding from SanctSound and NERACOOS.

The evidence available for large whales does not suggest that new hotspots would be created by relocated gear outside of the emergency closure area. Therefore, the implementation of Alternative 2 is unlikely to further negatively impact protected species. Relative to Alternative 1, Alternative 2 would have a negligible to slight positive impact on ESA-listed (right, fin, and sei whales) and MMPA protected species (humpback and minke whales) because entanglement risk and co-occurrence between large whales and fishing gear is reduced. Relative to Alternative 3, Alternative 2 has a negligible to slight negative impact because the proposed emergency closure area of Alternative 2, MRA Wedge, provides less risk and co-occurrence reduction than the proposed emergency closure of Alternative 3, MRA Wedge North. Considered alone, ESA-listed and MMPA protected species would be moderately negative to slightly negatively impacted by Alternative 2 because this proposed emergency action does not eliminate the potential for all interaction risk between fishing gear and marine mammals that could result in takes above PBR.

4.2.4 Protected Species Impacts of Alternative 3: Non-preferred Alternative

Alternative 3 would also implement an emergency closure, similar to Alternative 2, but would close an area more than six times larger than Alternative 2 (1,297 square miles/3,359 square kilometers; Table 4.2). The proposed emergency restricted area in Alternative 3, MRA Wedge North, would remain closed to the use of buoy lines by the trap/pot fishery from April 1, 2022 to April 30, 2022 (Table 4.2). Alternative 3 would remove 2,274 buoy lines from MRA Wedge North, each with a mean rope strength of 3,716 pounds (1,686 kilograms). In the month of April, the total number of right whales within the MRA Wedge at any given time is estimated to be 6 (Table 4.2). This may be an underestimate of whale density south of Cape Ann, Massachusetts

according to survey data as discussed in Section 4.2.3. Surveys are less frequent north of Cape Ann; therefore, similar 2020 and 2021 sightings data are not available and it is unknown how the right whale habitat density model aligns with more recent distribution of whales. All age classes have been observed near Jeffreys Ledge located in offshore waters of Massachusetts, and sightings data indicate whales may be traveling from coastal waters of Massachusetts north toward this region (Weinrich et al. 2006) suggesting that right whales may be present north of Cape Ann more often than is being reported by dedicated surveys. Further information is needed to confirm abundance in this area.

Implementing the MRA Wedge North emergency closure during April reduces mean risk in the Massachusetts portion of LMA 1 by 5.8 to 6.4 percent and co-occurrence by 3.3 to 3.7 percent depending on if gear is relocated outside the emergency closure or removed, respectively (Table 4.3). When the MRA Wedge North is paired with the MRA North added in 2021, mean risk is reduced by 16.0 to 16.6 percent and co-occurrence is reduced by 11.9 to 12.2 percent (Table 4.4). As discussed in Section 4.2.2, the DST is likely underestimating the risk and co-occurrence reduction benefits of an emergency closure to right whales because empirical survey sightings indicate a larger presence of whales than the DST average. Additionally, by extending the closure north and east, more lines are likely to be removed rather than moved, as discussed below, and the potential for dense concentrations of gear along the closed area border is diluted given the larger and offshore border. Removal of gear reduces entanglement risk while also preventing the formation of new hotspots where newly relocated gear and right whales overlap. The MRA Wedge North restricted area with the MRA North provides approximately 50 percent more risk and co-occurrence reduction than the MRA North in the Massachusetts portion of LMA 1 alone. This is a significant portion of risk reduction for an emergency closure enacted for a single month in April.

In the entire Northeast Region, MRA Wedge North represents 2.5 percent of risk of the lobster and Jonah crab trap/pot fisheries (Table 4.3). If gear is relocated or removed from this area, mean risk reduction ranges from 2.2 to 2.5 percent and co-occurrence is reduced by 1.4 to 1.7 percent (Table 4.3). The MRA Wedge North emergency closure in tandem with the MRA North would provide a mean risk reduction of 6.2 to 6.5 percent and 5.2 to 5.5 percent co-occurrence reduction, depending on whether gear is fully removed or fully relocated (Table 4.4). Alternative 3 provides an additional 1.8 to 2.0 percent risk reduction and 1.5 to 1.6 co-occurrence reduction when combined with the 2021 final rule in the Northeast Region (86 FR 51970, September 17, 2021; Table 4.5). For reasons discussed in Section 4.2.3, annual risk reduction may be underestimated but nevertheless provides a precautionary benefit to large whales through the removal of buoy lines within the affected area. It is unlikely that gear would be relocated outside of this area because the remaining waters in LMA 1 require a Maine Zone permit. Only vessels with dual LMA permits for LMAs 1 and 3 would be able to relocate into LMA 3 during the closure. Therefore, we assume lines would be removed from the water.

Similar to Alternative 2, introducing ropeless fishing may slightly increase the entanglement risk in the groundline in the short-term, compared to a full closure, but the amount of gear expected to be introduced to this area during the emergency closures is very small relative to current effort. Co-occurrence of large whales with buoy lines and associated entanglement risk will likely decline temporarily during the closure period. The addition of 1,297 square miles (3,359

square kilometers) in one month, the risk reduction of the MRA North is increased by approximately 50 percent for right whales (Table 4.4). This emergency measure would be expected to substantially reduce the potential of a right whale mortality or serious injury as a result of interactions with fishing gear.

Removing buoy lines from MRA Wedge North from the Massachusetts portion of LMA 1 would decrease co-occurrence by 1.2 and 1.0 percent for humpback and fin whales respectively. If gear is relocated elsewhere, co-occurrence would decrease by 0.5 percent for humpback whales and 0.2 percent for fin whales. While there is not a significant amount of co-occurrence risk removed in Alternative 3, the DST does indicate that the MRA Wedge North would not contribute to an increase in overlap between buoy lines and humpback and fin whales.

As discussed in Section 4.2.3, fin and humpback whales are present in the Massachusetts portion of LMA 1 during April, and visual observations and acoustic detection data indicate they are also present within the boundaries of MRA Wedge North during the closure period. While fin whales were not sighted north of MRA during NEFSC dedicated aerial surveys in April 2021 (Figure 4.5), they were detected acoustically in the MRA Wedge North area by the Slocum G3 Glider (Baumgartner 2021; Figure 4.4, Figure 4.6). These fin whale observations suggest they do feed or travel within the boundaries of the emergency closure, and the sightings and acoustic data confirm the importance of multiple survey efforts to monitor stock status, presence, and abundance for Atlantic large whales. Humpback whales were observed visually in Massachusetts Bay, but the locations of sightings were largely concentrated within the boundaries of MRA (Figure 4.5). However, acoustic detection data strongly indicates that they are present throughout federal waters north of MRA to the New Hampshire border (Figure 4.6). More information is needed to fully quantify fin and humpback whale abundance and habitat use in this area.

The DST is unable to provide a quantitative estimate of risk reduction for minke or sei whales, both of which have been observed in low numbers within the action area during the month of April. NEFSC aerial surveys in 2021 reported a single minke whale within the MRA Wedge in April and the remaining minke whale observations during that time period were documented within Massachusetts Bay (Figure 4.5). Sei whales were sighted less frequently by NEFSC aerial surveys in April 2021, and no sei whales were sighted within the MRA Wedge North (Figure 4.5). The Slocum Glider detected sei whales acoustically in Massachusetts Bay and federal waters (Baumgartner 2021; Figure 4.4). As discussed in Section 4.2.3, dedicated aerial surveys conducted by NEFSC focus on Cape Cod Bay. The lack of sightings may be attributed to either lack of whale presence or lack of survey effort in the region, or both. The sightings and acoustic data indicate that humpback, fun, minke, and sei whales would not be negatively impacted by the MRA Wedge North closure; however, according to the DST, extending the boundary of MRA to the New Hampshire state waters boundary does not provide measurable reduction in co-occurrence.

Reducing lines through a closure may lower entanglement risk during April for these species. Compared to Alternative 1, Alternative 3 would have a moderate positive impact on protected species because the emergency closure proposed in Alternative 3, MRA Wedge North, would close a large area to the lobster and Jonah crab fishery which reduces the risk of entanglement in buoys lines for ESA-listed (right, fin, and sei whales) and MMPA protected species (humpback

and minke whales). Relative to Alternative 2, Alternative 3 has a negligible impact on ESA-listed and MMPA protected species. Alternative 3 would close a larger area than Alternative 2; however the risk and co-occurrence reduction for Alternative 3 is only slightly higher than the risk and co-occurrence reduction provided by Alternative 2 suggesting that the impacts between the two Alternatives are negligible. When considered alone, Alternative 3 would have moderate negative to slight negative impacts on large whales due to the continued operation of the fishery, and potential risk of interaction between the fishery and take of ESA-listed and MMPA protected species remains.

4.2.5 Comparison and Summary of the Alternatives

The primary difference in biological impacts between the Alternatives is the removal of buoy lines within the water column that are directly related to the reduction in right whale entanglement risk. Alternative 2 would remove or relocate fewer lines than Alternative 3 (626 and 2,274, respectively; Table 4.2), but the Alternative 2 emergency closure occurs in an area of higher co-occurrence between right whales and the lobster and Jonah crab fishery than Alternative 3. The average rope strength of vertical buoy lines being fished in the action area exceeds 3,600 pounds (1,633 kilograms), suggesting a high risk of mortality and serious injury should an entanglement incident occur. Removing these lines from April 1, 2022 to April 30, 2022 would reduce entanglement risk for large whales.

Table 4.5: Comparison of mean risk and co-occurrence reductions by proposed emergency closures within Alternative 1 (No Action), Alternative 2 (Preferred), and Alternative 3 (Non-Preferred) in addition to Phase 1 measures included in the 2021 Final Rule. The risk reduction is relative to annual total risk within the entire Northeast Region.

		100% Gear Removed		**Closure (100% Gear Relocated)**	
Spatial Constraint	**Seasonal Closure Area**	**Mean Risk Reduction**	**Co-Occurrence Reduction**	**Mean Risk Reduction**	**Co-Occurrence Reduction**
Northeast Region	**Alternative 2 MRA Wedge**	1.7%	1.4%	1.6%	1.3%
Northeast Region	**Alternative 3 MRA Wedge North**	2.0%	1.6%	1.8%	1.5%

The removal of buoy lines under Alternatives 2 and 3 are expected to have a slightly positive impact on ESA-listed (right, fin, and sei whales) and MMPA protected species (humpback and minke whales) when compared to Alternative 1, the No Action Alternative. The MRA Wedge North (Alternative 3) is 1.5 times bigger in area than MRA Wedge (Alternative 2), but the larger emergency restricted area provides very little additional co-occurrence reduction when combined with the 2021 Final Rule (Table 4.5). Despite differences in closure size, Alternative 2 provides a similar percent risk reduction (1.6 to 1.7 percent) compared to Alternative 3 (1.8 to 2.0 percent) when added to the 2021 Final Rule (86 FR 51970, September 17, 2021; Table 4.5). Co-occurrence reduction is also similar between the Alternatives and ranges from 1.3 to 1.4 under Alternative 2 and 1.5 to 1.6 under Alternative 3 (Table 4.5). There are a substantially higher

number of buoy lines that would be removed within the federal waters bounded by MRA Wedge North. However, co-occurrence within the expanded area is not substantially reduced. This may be the result of lower habitat use by right whales in the northern waters towards the New Hampshire state line or an underestimation of the use of this area during this time period. Risk reduction and co-occurrence reduction for the proposed emergency closures are not proportional to their size, and there is less evidence to support the larger MRA Wedge North (Alternative 3) over the smaller MRA Wedge (Alternative 2). Additional analysis of risk north of the MRA Wedge is needed before a larger closure is considered.

4.3 Habitat Impacts of the Alternatives

4.3.1 Alternative 1: No Action

The No Action alternative (Alternative 1) would maintain current regulations seasonally closing the MRA to trap/pot gear, while continuing to allow access to trap/pot fisheries in the portion of LMA 1 primarily used by Massachusetts vessels. Although the footprint of each trap on the bottom is minimal, as the gear will be weighted to sit on the ocean floor, some level of disturbance to the habitat is likely, particularly when placed in long trawls. The Plan currently requires a minimum of 10 to 20 traps per trawl throughout the action area but average trawl length is closer to 25 traps. Baseline conditions may already contribute to some disturbance on the seafloor when the gear is hauled and set.

Alternative 1 represents the status quo and will likely continue to have a moderately negative to slightly negative impact on the habitat. Lobster and Jonah crab trap/pot fishing will continue at current levels and disturbance of the habitat will not change. Relative to Alternative 2 and Alternative 3, Alternative 1 is expected to result in negligible to slight negative impacts because fishing gear will be concentrated within the MRA Wedge or MRA Wedge North Area during the emergency closure period.

4.3.2 Alternative 2: Preferred Action

Under Alternative 2, fishing and setting trap/pot gear with buoy lines would be restricted in the MRA Wedge from April 1, 2022 through April 30, 2022. As noted in Section 2.2, authorizations for fishing without buoy lines (ropeless fishing) in the MRA Wedge must be obtained through an Exempted Fishing Permit. At this time, there are no significant efforts within the fishery to obtain EFPs that could be issued for April 2022.

Alternative 2 would close the MRA Wedge to trap/pot fishing only during the month of April 2022. Outside of this, fishing operations will continue to occur. The removal of traps may decrease benthic community disturbance, protect local community structure, and may increase local lobster and/or Jonah crab abundance (Uhrin 2016). However, trap/pot gear may be relocated outside of the emergency closure, and there is uncertainty around what percentage of gear will be removed from the water and what percentage of gear will be relocated elsewhere. It is difficult to predict and quantify impacts to habitat if gear is displaced because there is uncertainty around where the gear will be relocated for active fishing operations or “wet storage” of gear being hauled only once per 30 days (consistent with regulations) set near or along closed

area borders for a quick move once seasonal restrictions are lifted on May 1. There is a potential for trap/pot gear to be redistributed in an area that has not historically been disturbed by fishing. Operational trap/pot gear is not considered to cause long-term benthic impacts and lobster fishing is believed to negligible impact EFH (Uhrin 2016, Goode et al. 2021). At this point, it is unlikely that ropeless fishing could expand widely during the emergency closure, but if it did, the habitat could experience similar levels of disturbance as described in Alternative 1.

Relative to Alternative 1, impacts of Alternative 2 on the habitat are expected to be negligible because while fishery operations for the lobster and Jonah crab fishery will be prohibited in this area in April 2022, other fisheries will continue to operate in this area. Relative to Alternative 3, impacts of Alternative 2 on the habitat are expected to be negligible. The emergency closure area of Alternative 3 is 6 times larger than the emergency closure area of Alternative 2 meaning that a much smaller area will be temporarily closed to disturbances created by fishing operations of the lobster and Jonah crab fishery in Alternative 2. Relocated gear may disturb benthic habitat not previously utilized by the fishery. However, given the temporary nature of the proposed emergency closure, these habitat impacts are not considered to be significant. The overall impacts to biological communities would be the same since most affected organisms would require more than a few months to recover from disturbance. Considered alone, Alternative 2 has a negligible to slight negative impact on the habitat because fishing activity outside of the lobster and Jonah crab fishery would continue to operate within the emergency closure that may disturb the benthic habitat. The overall impacts to biological communities would be the same since most affected organisms would require more than a few months to recover from disturbance.

4.3.3 Alternative 3: Non-Preferred Action

Alternative 3 would restrict the fishing and setting of lobster and Jonah crab trap/pot gear with buoys lines within MRA Wedge North during April 2022, potentially reducing the impact of the fishery on the habitat VEC. More than 1000 trap/pot trawls, each with an average of 27 traps (Table 4.2), would be removed from the emergency restricted area under Alternative 3. As discussed in Subsection 4.2.4; it is unlikely that gear would be relocated outside of this area because the remaining waters in LMA 1 require a Maine Zone permit. Only vessels with dual LMA permits for LMAs 1 and 3 would be able to relocate into LMA 3 during the closure. Therefore, we assume lines would be removed from the water, reducing the likelihood that fishing gear will be relocated to habitat areas previously undisturbed by trap/pots. Removing the gear may decrease short-term disturbances, maintain local community structure, and may increase local lobster and/or Jonah crab abundance (Uhrin 2016). Similar to Alternative 2, if ropeless fishing expands widely under Alternative 3, the habitat could experience similar levels of disturbance as described in Alternative 1, but it is unlikely that ropeless fishing levels will reach existing effort by April 2022.

Relative to Alternative 1, impacts of Alternative 3 on the habitat are expected to be negligible because the emergency closure, MRA Wedge North, would only temporarily suspend fishing activity by the lobster and Jonah crab fishery and other fisheries would continue to operate in this area. Relative to Alternative 2, impacts of Alternative 3 on the habitat are expected to negligible because while Alternative 3 restricts fishing activities in a larger area than the emergency area proposed in Alternative 2, the benefits of suspended fishing activities are limited given the brief

time period of the emergency closure and continued disturbance by other fisheries. Alone, Alternative 3 has a negligible to slight negative impact on the habitat because other fisheries will continue to operate in the emergency closure area that may disturb the benthic habitat. The overall impacts to biological communities would be the same since most affected organisms would require more than a few months to recover from disturbance.

4.3.4 Comparison and Summary of the Alternatives

No quantitative criteria are available to formally compare the biological effect of the alternatives on habitat. Alternative 1 will maintain baseline levels of biological impacts on benthic habitats, negligible to slight negative impacts to habitat due to disturbance to benthic habitat.

Given the information above, in comparison to Alternative 1, Alternative 2, and Alternative 3 are expected to have negligible impact on the Massachusetts LMA 1 habitat. If ropeless fishing is implemented in closed areas, it is not expected that Alternative 2 or 3 will significantly change the amount of gear that comes into contact with the seafloor and is unlikely to occur at levels similar to those prior to the closure. Similarly, Alternatives 3 would likely have a negligible impact compared to Alternative 2. Compared to Alternative 2 and Alternative 3, Alternative 1 is expected to have negligible impacts on affected fish habitats. Considered on their own, Alternative 2 and 3 will likely have a negligible to slight negative impact on the environment due to continued disturbance from long trawls outside of the closure period.

4.4 Human Community Impacts of the Alternatives

4.4.1 Economic Impacts

Three Alternatives were analyzed for this Emergency Rule. Alternative 1 would leave the provisions of the Plan unchanged, and thus would have no economic impact relative to current regulatory requirements. Alternative 2, the Preferred Alternative, proposes to temporarily expand the Massachusetts Restricted Area (MRA) to include the MRA Wedge northward to Cape Ann, Massachusetts during April 2022, which would add 200 square miles (518 square kilometers) to the current MRA and bring short-term negative economic impacts to a number of lobster vessels in Southern Essex County, Suffolk County, Norfolk County and Northern Plymouth County. Alternative 3, the Non-Preferred Alternative, expands the boundary of the MRA during April 2022 to include a larger area that is approximately 1,297 square miles (3,359 square kilometers) that is bounded landward by the Massachusetts state waters, north at 42°52.58′, seaward at 69°45′, and south along the northern border of the MRA. Alternative 3 would impact additional vessels in Northern Essex County compared to Alternative 2.

4.4.1.1 Analytic Approach

Vessels that fished within the proposed closure have two options to comply with the Emergency Rule: relocate their traps to the northern waters adjacent to the closure and keep fishing, or bring their traps back to dock and suspend fishing activity for April 2022. VTR gear distribution data from the past few seasons shows that at least half of the traps were placed at the southern portion

of the proposed Alternative 2 and 3 closures. Because these traps are about 20 to 30 miles from the northern boundary of the proposed closures, they would be difficult to relocate, as the distance is beyond the normal range of fishing vessels.

For this analysis, we evaluate two scenarios for the economic impacts on lobster vessels: we assume half of the vessels would relocate their traps, and the other half would stop fishing. For relocated vessels, the cost differences come from reduced revenue on the new ground, and extra operating costs to move gear. For vessels that stop fishing, the cost differences involve lost revenue, gear moving costs, and saved operating costs from not fishing. The lower and higher end of cost estimates come from the range of lost revenue of the relocated vessels, and a range of gear moving costs for all vessels (see details in the following section).

To estimate catch impacts of the Emergency Rule, we first used the Vessel Trip Report (VTR) data for 2015-2019 to identify the vessels impacted by each alternative by using their self-reported fishing coordinates. Although the VTR coordinates only represent the general location of the vessels, it is the best available data for spatial analysis. We then determined the number of vessels and their landing weight for both lobster and Jonah crab. And finally, we calculated the landing value by multiplying the weight and price. The monthly average prices for April were calculated from NMFS dealer data for 2015-2019. All final values are adjusted to 2021 U.S. dollars by using GDP deflator from U.S. Bureau of Economic Analysis (2022).

It should be noted that federal permitted fishing vessels that only carry lobster permits are not required to submit VTRs. In order to determine the total number of vessels fishing in this area, we divided the VTR landing value by the percent of VTR vessel coverage. NMFS federal permit data show that from 2015 to 2019, about 42 percent of Massachusetts federal lobster vessels in LMA 1 do not have VTR requirement, which means the landing value from VTR data need to be divided by 58 percent.

Another factor that needs to be considered is the operating cost savings from vessels that stop fishing for the month of April. Vessel operating costs usually include fuel, bait, ice, fresh water, food and other incidentals. Labor costs are not included because many nearshore vessels are owner-operated, and mates are often paid based on landings rather than by the hour. These costs occur only when the vessel goes on a fishing trip. If a vessel doesn’t fish, these costs are not incurred, and therefore should be considered as savings. To determine cost savings, we use VTR data to determine the total number of fishing days in April, then we apply an average daily operating cost to calculate the total costs.

For operating costs of transporting gear back to the dock or to resume fishing outside the restricted area, we estimate the fishing days and apply the daily operating costs based on the average annual operating costs and fishing days for lobster vessels. The detailed results are presented in the next section.

4.4.1.2 Analysis Results

Vessel Lost Revenue

By using methods described above, preliminary data shows 22 vessels fishing in the area affected by Alternative 2, with a total lost revenue of $110,000 (Table 4.6). If Alternative 3 is

implemented, 33 vessels known to fish in this area would lose $217,000 in total in April. Lobster values are much higher than Jonah crab values. These numbers represent preadjusted estimates. Numbers will be adjusted based on the VTR coverage percentage in Table 4.7.

Table 4.6: Pre-adjusted number of vessels and landing values by year in 2015-2019 VTR data (in $2021).

	Alternative 2				Alternative 3			
	Vessel Number	Jonah Crab Value	Lobster Value	Total Value	Vessel Number	Jonah Crab Value	Lobster Value	Total Value
2015	20	$740	$114,496	$115,236	31	$1,627	$213,201	$214,828
2016	25	$3,838	$111,643	$115,481	34	$4,847	$205,986	$210,833
2017	24	$1,056	$98,486	$99,541	33	$2,035	$165,751	$167,787
2018	19	$267	$144,314	$144,581	37	$794	$347,847	$348,641
2019	20	$225	$74,428	$74,652	32	$320	$144,530	$144,850
Average	22	$1,225	$108,673	$109,898	33	$1,924	$215,463	$217,388

Vessel Operating Cost Savings

We estimated vessel operating costs based on the cost surveys conducted by the Social Science Branch of the Northeast Fisheries Science Center for fishing years 2011, 2012, and 2015. Survey data show the average annual operating costs for lobster vessels in the Northeast Region is about $50,365 (in 2021 dollars). From 2015-2019 VTR data, we determined that April trips account for only 5.7 percent of the total number of annual trips. Therefore, we assigned $2,878 in operating costs to each vessel in April.

For vessels that need to transport traps back to the dock or to a new fishing ground, we use the daily operating costs to evaluate the economic impacts. VTR data shows that on average, a lobster vessel fishes about 50 days a year, so the operating costs for one fishing day would be around $1,000 based on the annual operating costs from the survey. VTR data also indicates that each vessel in the closed area fishes about 260 traps on average. With a single-trip carrying capacity of 40 to 50 traps for a medium-sized lobster vessel, it would take five to six trips to remove all the gear from the closure area. Regardless of whether the vessel heads back to the

dock or moves traps to another area, it takes about 20 to 30 miles of traveling each way. Therefore, on average, we assume each vessel needs three full working days to transport all traps assuming they could run two trips a day without actively fishing. If we consider the time for them to move the traps back to the ground after the closure, it could be six days of effort.[6]

4.4.1.3 Final Results

After dividing the vessel number and lost revenue in VTR data by the percent of vessels with reporting requirements (58 percent), we estimated that 37 and 58 vessels would be affected by Alternatives 2 and 3, respectively. For Alternative 2, the total costs range from $158,701 to $275,968. For vessels moving their gear to new fishing grounds, the total costs are around $61,000 to $122,000, and the cost for each vessel is between $3,300 and $6,600; for vessels that stop fishing, the costs are around $98,000 to $154,000, and the cost per vessels is from $5,300 to $8,300. For Alternative 3, 58 vessels could incur a total cost of $289,000 to $472,000. Total costs for vessels moving their gear to new fishing grounds range from $96,000 to $193,000, and the cost per vessel is similar to the Alternative 2. Total costs for vessels that stop fishing are from $192,000 to $279,000, and the cost per vessel ranges from $6,600 to $9,600 (Table 4.7).

The lobster prices we used for the analysis are from 2015 to 2019, which range from $6 to $8 per pound in Massachusetts in April. Dealer data in April 2021 show that the lobster price was about $8.8 per pound ($19.4/kg), and so far in 2022, the cost is about $8.7 per pound ($19.2/kg). Depending on April 2022 lobster value, the lost revenue in the analysis might be underestimated. Additionally, if the price keeps rising, fishermen might make different decisions on whether and where to move gear.

Table 4.7: Adjusted final costs for vessels in Alternatives 2 and 3 (in $2021).

	Alternative 2		Alternative 3	
	Lower cost	Higher cost	Lower cost	Higher cost
Relocating costs (half vessels)				
Lost revenue	$4,770	$9,540	$9,435	$18,870
Gear moving	$56,249	$112,497	$86,977	$173,954
Total costs	$61,018	$122,037	$96,412	$192,824

[6] Six days would be on the higher end of gar moving cost, we assume they need three more days to put the traps back to the ground, although this cost might not be an extra to all fishermen as they need to move around at this time of year anyway.

Cost/vessel	$3,298	$6,597	$3,325	$6,649
Stop fishing costs (half vessels)				
Lost revenue	$95,395	$95,395	$188,700	$188,700
Gear moving	$56,249	$112,497	$86,977	$173,954
(Cost savings)	$53,961	$53,961	$83,440	$83,440
Total costs	$97,683	$153,931	$192,237	$279,214
Cost/vessel	$5,280	$8,321	$6,629	$9,628
Total cost	$158,701	$275,968	$288,649	$472,038

Notes:
1. Total affected vessels in Alternative 2 is 37 and in Alternative 3 is 58.
2. We estimate lost revenue of the relocating vessels to be between 5 and 10 percent of the total landing value.
3. We estimate gear moving costs to take between 3 and 6 days at $1,000/day.

4.4.2 Social Impacts of the Alternatives

Both Table 3.6 and 4.8 present socio-economic data for each county identified as potentially vulnerable to social impacts due to either Alternative 2 or 3. Essex and Plymouth counties have the most potentially affected vessels and land a large amount of seafood that are from the regulated gear. They also have a higher commercial reliance score than Suffolk and Norfolk counties. Norfolk County has a small number of vessels, but almost all of its seafood landings are from the lobster and Jonah crab trap/pot fishery. The fishermen in these two counties are the most impacted by this Emergency Rule at the individual level, but not the community level. Norfolk County has the highest income level and lowest unemployment rate. Its low commercial engagement rate indicates that fishermen might have more alternative occupations when fishing is not available. The only major port in Suffolk County is Boston Harbor. It lands a small amount of lobsters and Jonah crabs from a very limited number of vessels. Both Suffolk and Norfolk counties have a much lower commercial reliance score than Essex and Plymouth counties.

Considering all factors, lobster and Jonah crab trap/pot vessels in Plymouth County could be the community most vulnerable to the implementation of this Emergency Rule. Essex County could also be heavily impacted, but its fisheries are more diversified so individual fishermen may be more flexible. The Norfolk County fishery would be totally shut down during the restricted time period, which came with only one month's notice, so although the community has more access to alternative jobs than some other counties, it may be difficult to make up lost income given the short notice of the closure. Suffolk County might be the least vulnerable to the Emergency Rule.

Table 4.8: Socio-economic Profile of Affected Counties – Harvest Parameters

State	County	Major Ports	Top Species by Value	2018 lobster/Jonah Crab Harvest ($)	Lobster/Jonah Crab Value as Percentage of Total Value	Number of Vessels with Lobster and Jonah Crab Trap/pot	Total Lobster and Jonah Crab Vessel Employment -Lower	Total Lobster and Jonah Crab Vessel Employment -Upper
MA	Essex	Gloucester, Rockport, Marblehead	Lobster, cod, pollock	30,202,297	39%	277	579	856
MA	Suffolk	Boston Harbor	Cod, lobster, pollock	2,631,553	16%	28	18	25
MA	Norfolk	Cohasset	Lobster, softshell clam, bluefin tuna	1,916,586	99%	24	47	70
MA	Plymouth	Plymouth, Scituate, Hingham	Lobster, oysters, cod	13,502,085	49%	192	421	613

4.4.3 Comparison and Summary of Impacts to Human Communities

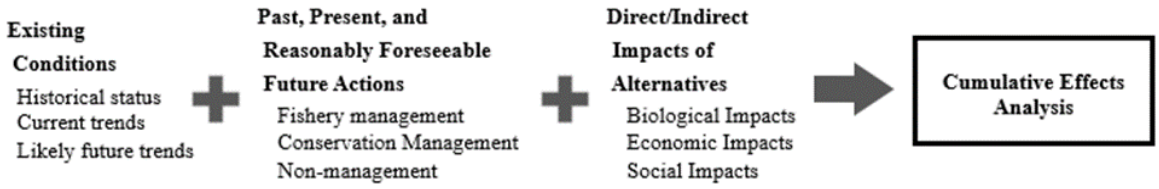
Alternative 1 would maintain the status quo, which has a slight negative to moderate positive impact on fishing communities. Alternative 2, the Preferred Alternative, is expected to have a slight negative impact on the fishing communities impacted by this action. Overall, the economic impacts of the Alternative 2 results in an estimated total cost (including lost revenue) of from $159,000 to $276,000 with about 37 affected vessels, compared to Alternative 1. Alternative 2 would impact lobster and Jonah crab vessels in Southern Essex County, Suffolk County, Norfolk County, and Northern Plymouth County. Vessels in Plymouth County could be the most vulnerable to the Emergency Rule, while Suffolk County might be the least vulnerable. Alternative 3 is expected to have a moderate negative impact on the human community VEC, as defined here. Alternative 3 is estimated to impact 58 vessels for a total estimated cost (including lost revenue) of $289,000 to $472,000, compared to Alternative 1. Alternative 3 has similar social impacts to Alternative 2, except it will affect a few more vessels in Essex County that fish in the Northern waters offshore and north of Cape Ann.

4.5 Cumulative Impacts of the Alternatives

4.5.1 Introduction

A cumulative effects analysis (CEA) is required by the Council on Environmental Quality (CEQ; 40 CFR part 1508.7) and NOAA policy and procedures for the National Environmental Policy Act (NEPA), found in NOAA Administrative Order 216-6A (Companion Manual, January 13, 2017). A CEA examines the impact of the actions in conjunction with other factors that affect the physical, biological, and socioeconomic resource components of the affected environment. The purpose of the CEA is to ensure that federal decisions consider the full range of an action's consequences, incorporating this information into the planning process. The CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective, but, rather, the intent is to focus on those effects that are truly meaningful. This CEA is based upon a more detailed analysis that was conducted in a 2021 FEIS (NMFS 2021d) and follows the steps depicted in Figure 4.5. The CEA analysis relies upon the impact designations defined in section 4.1 to determine the cumulative effects of each VEC.

Figure 4.5: Cumulative effects analysis steps, and how they inform the cumulative effects analysis (adapted from Canter 2012).



4.5.1.1 Geographic and Temporal Scope

The geographic scope of this CEA is focused on the southern portion of LMA 1 that includes waters from New Hampshire state waters south to the Massachusetts Restricted Area boundary at 40° 12′ N. latitude bounded on the west by Massachusetts state waters, and on the east by the LMA 1/LMA 3 boundary. This is an area currently subject to the requirements of the Plan and includes the seawater and sea bottom of the Atlantic Ocean within U.S. jurisdiction. Though some of the activities included in this analysis do not occur within the small geographic scope of this Environmental Assessment (EA), they are still considered in this analysis for each VEC due to the potential for negative impacts on the right whale population.

The temporal scope of the analysis varies by resource. In all instances, the analysis attempts to take into account past (primarily the past two decades), present, and reasonably foreseeable future actions (within five years) that could affect valuable physical, biological, or socioeconomic resources. The discussion here focuses on impacts of management actions as well as the direct impact of potential stressors: interactions with commercial and recreational fisheries, vessel strikes, pollution, noise, climate change, renewable energy development, oil and gas development, harmful algal blooms, and prey availability. Stressors that are not expected to impact a VEC may be noted but will not be analyzed.

4.5.1.2 Analysis of Total Cumulative Effects

A CEA ideally makes effect determinations based on the combination of: 1) impacts from past, present, and reasonably foreseeable future actions; 2) status quo condition of the VECs (the combined effects from past, present, and reasonably foreseeable future actions plus the present condition of the VEC); and 3) impacts of the alternatives under consideration for this action.

4.5.2 Summary of Direct and Indirect Impacts of the Alternatives

The direct and indirect impacts of the alternatives on the VECs were discussed in Sections 4.1 to 4.4 and summarized in Table 4.9.

Table 4.9: The direct and indirect impacts of the alternatives on the three VECs.

Alternatives	*Protected Species*	*Habitat*	*Human Communities*
1 (No Action)	**High Negative to Moderate Negative** Mortality and serious injury would continue to occur and impact ESA-listed species' population health. More so for right whales and other large whales, and to a lesser degree for other ESA-listed or MMPA protected species.	**Negligible to Slight Negative** Areas with trawls above 15 traps per trawl may have a short-term impact.	**Slight Negative to Moderate Positive** Positive in that there are no new impacts or costs to harvesters and markets, but the lack of recovery of whale species has a slight negative impact on public intrinsic value benefits due to whale population declines.
2 (Preferred)	**Moderate Negative to Slight Negative** Would reduce entanglement risk for ESA-listed and MMPA protected species. However, risk of interactions will not be entirely eliminated.	**Negligible to Slight Negative** Areas with trawls above 15 traps per trawl may have a short-term impact.	**Slight Negative** Fisheries would experience extra costs and catch reduction in the short term that could ease over the long term.
3 (Non-Preferred)	**Moderate Negative to Slight Negative** Would reduce entanglement risk for ESA-listed and MMPA protected species. However, risk of interactions will not be entirely eliminated.	**Negligible to Slight Negative** Areas with trawls above 15 traps per trawl may have a short-term impact.	**Moderate Negative** Costs of gear modifications and catch reduction would be significant.

4.5.3 Status Quo Conditions

The status and trends of each VEC is summarized in Table 4.10. Additional details can be found in the Affected Environment section of this document and Chapter 4 in the recent FEIS (NMFS 2021d).

Table 4.10: A summary of the current status and trends of the three VECs.

VEC	*Historical Conditions*	*Current Conditions*	*Possible Future Conditions*	*Implications of Conditions Relative to Sustainability*
Protected Species	Stocks were depleted by whaling and other anthropogenic impacts.	Right, fin, and sei whales are endangered. Right whale stock is declining, humpbacks are slightly increasing, and the trends of the others are unknown. Trends are unavailable for other whale species.	Under current conditions, right whales are likely to continue declining. Certain protected species may be more resilient to future changes while others may remain small or continue to decline.	Certain stocks that are still depleted are still vulnerable to additional anthropogenic stressors and population decline (right whales and fin whales).
Habitat	The habitat has slowly degraded over time with increasing exposure to anthropogenic stressors.	The habitat is rapidly shifting from historical baselines from the impacts of climate change as well as other anthropogenic stressors.	Shifts in habitat features are expected to continue as the climate shifts and alters the frequency and magnitude of disturbance.	The habitat is vulnerable to additional disturbance.
Human Community	American lobster stocks have been abundant in GOM but depleted in SNE waters; Jonah crab fishery was supplement of lobster fishery.	Total lobster landings peaked in 2015 and started to decrease. GOM represents about 80 percent of all lobster landings; Southern MA and RI landed the most Jonah crabs.	GOM lobster landings may be trending down and SNE stock stays depleted; more Jonah crabs will be landed from SNE.	Target species, lobster and Jonah crab, are vulnerable to anthropogenic and environmental stressors, posing a threat to fishing communities that depend on commercial fisheries.

4.5.4 Past, Present, and Reasonably Foreseeable Future Actions

Detailed information on the past, present, and reasonably foreseeable future actions that may impact this action were evaluated as part of the cumulative effects assessment found in the environmental assessment prepared for the last substantial modification to the Plan (NMFS 2021d). Much of that information remains applicable, though unlikely to affect the implementation of Alternative 2 because the temporal scope of the action is limited to the month of April 2022. The following provides a brief summary of updates on the pertinent fishing activities, and the proposed rule expanding reporting and vessel tracking in the American lobster and Jonah crab fishery. Past, present, and reasonably foreseeable future fisheries management actions were summarized in more detail recently in an FEIS released on July 2, 2021 (NMFS 2021d). A summary of the impact of past, present, and anticipated actions on each VEC is summarized here, but more detail can be found in Chapter 8 of the FEIS.

4.5.4.1 Fisheries Management

Fishery management actions include the creation of a new Fishery Management Plan (FMP) and additional amendments and addenda that modify how the fishery is conducted. These amendments and addenda can include actions such as quotas, trap reductions, administration of taxes, and guidelines on how data is collected and shared with management agencies. These actions can have a variety of impacts on the economic aspects of fisheries as well as the environment.

A list of past, present, and reasonably foreseeable future actions listed in Table 8.3 of the FEIS (NMFS 2021d). There are several additional management actions underway that affect the Northeast lobster and Jonah crab fishery. Currently, the Atlantic States Marine Fisheries Commission (ASMFC) is reviewing public comments on the proposed Draft Addendum XXIX to Amendment 3 to the American Lobster Fishery Management Plan and Draft Addendum IV to the Jonah Crab Fishery Management Plan for the purposes of collecting high resolution spatial and temporal data to characterize fishing effort in the federal American lobster and Jonah crab fisheries for management and enforcement needs.

Protected Species

Fishery Management Plans and their amendments can mitigate the impact of fishing gear on protected large whale species. The amendments and addenda included in this analysis were primarily intended to optimize fishing practices, restrict overfishing, manage bycatch, and gather information to better manage the stock. Lobster and Jonah crab management measures that reduce rope in the water column would be an improvement compared to current conditions; improved reporting and monitoring would inform future management and may have an indirect net positive impact; and modifications to maintain or restrict fishing on other species would likely cause negligible impacts. However, any fishing generally has a negative effect on protected species because any gear in the water has some risk of interaction. While fisheries management can mitigate some of this, the overall effect is anticipated to be between slight negative to moderate negative. Future actions that aim to improve monitoring of lobster and Jonah crab trap/pot fisheries are likely to positively impact protected species by improving data collection on fishing effort, which will inform updates to the DST analysis and discussions to support fishery management decisions related to protected species, marine spatial planning, and offshore enforcement. Management actions in the past, present, and reasonably foreseeable future are likely to benefit or have negligible impacts on protected resources. Overall, the cumulative effects on large whales are likely to be a slight negative to moderate negative impact on the protected species VEC.

Habitat

Trap/pot fisheries that operate longer trap trawls could have a slightly deleterious impact on the habitat. Setting quotas and trap limits that reduce gear on the bottom are likely indirectly better for the habitat than unmanaged fisheries. Overall, the impact of trap/pot fisheries management on habitat is considered to be negligible to slight negative.

Human Communities

The aims of many of the fishery management actions in the past, present, and reasonably foreseeable future aim to improve the maintenance of the target stock and mitigating bycatch. Both of these goals are likely to have a slight positive impact on the economics of the fishery by allowing the continuation of a healthy fishery as a source of income for fishing communities.

4.5.4.2 Non-Fisheries Management

Several management actions have been implemented to mitigate the impact of stressors on protected species, habitats, and human communities. These include actions to reduce the impact of pollution, climate change, entanglement, and vessel strikes on the environment and protected species. The impact of other past, present, and foreseeable future conservation actions are discussed below.

Protected Species

Conservation mitigation measures aim to reduce the impact of known human or environmental stressors. Mitigating the impact of multiple stressors in the environment by protecting habitats and habitat quality can reduce the overall stress by reducing the energy necessary to adapt to new baselines. Many stressors are known to negatively impact large whales and, therefore, mitigating actions are expected to improve impacts on this VEC. Actions like speed reductions and observers would also benefit other large whale species. However, the risk of entanglement with buoy lines and vessel strikes remains, albeit less so for entanglement, after these mitigation measures are taken. Therefore, ESA-listed species of large whales (right, fin, and sei whales) are expected to experience moderate negative to slight positive impacts, and MMPA-protected species of large whales (humpback and minke whales) are expected to have slight positive impacts (i.e., PBR not exceeded).

Habitat

Some of the environmental mitigation actions that occurred in the past, present, and reasonably foreseeable future are likely to reduce the number or magnitude of stressors on fish habitat and benthic organisms in the Northeast Region, particularly those related to regulating pollutants. Pollution and climate change can contribute to habitat degradation through mechanical disruption of habitat structure and negative impacts on the health of organisms (see the next section). Measures that directly protect habitats, address the effects of climate change, or protect water and sediment quality via pollution mitigation will prevent additional environmental degradation as a result of these stressors. These measures are expected to have positive impacts on marine habitats. Other regulations likely have a negligible impact on habitat, such as vessel strike regulations, that are not expected to interact with the physical environment. However, 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 Alternative 2, the Preferred Alternative (i.e., slightly negative for the physical environment). The net impact of all actions is likely slightly negative to slightly positive.

Human Communities

Most of the mitigation actions included in this analysis are expected to have negligible impact on the fishing communities that rely on fisheries. Actions that have been implemented to mitigate entanglement likely have a negative impact on this VEC, whereas those that have a positive impact on fishery habitat are expected to have a slight positive impact by supporting healthy fisheries. It is expected that these management actions have a negligible impact on the VEC when combined.

4.5.4.3 Non-Management

There are several anthropogenic actions that could potentially impact the VECs included in this analysis, including fishing, aquaculture, manufacturing, agriculture, construction, oil and gas activities, wind farm exploration and operation, military activities, shipping, and climate change. These activities can have an impact individually as well as collectively and should be considered when proposing management actions. The impact of these individual activities on the VECs are discussed in greater detail in Table 8.4 of a 2021 FEIS and summarized below (NMFS 2021d).

Protected Species

Human activities have directly or indirectly increased the number and magnitude of stressors protected species are exposed to, which is a concern for vulnerable protected species such as the North Atlantic right whale. Climate change, vessel strikes, entanglement, and Canadian mortalities are all anticipated to have high negative impacts on protected species due to the severity of the impact on the declining right whale population in particular, though these do impact other large whale species in this VEC as well. Aquaculture, offshore wind farm exploration and operation, oil and gas related activities, prey availability, and harmful algal blooms are estimated to have a moderate negative impact on protected species. The use of aquaculture and offshore wind farms specifically are expected to grow in the foreseeable future and there is concern for the increase in risk of entanglement, vessel traffic and noise on protected species. Changes in prey availability related to climate change are expected to become more pronounced and variable over time. Noise more broadly likely has a slight to moderate negative impact on protected species depending on the source, severity, duration, and species. McCauley et al. (2017) suggest that noise pollution from seismic surveys cause significant mortality to zooplankton populations, an important prey species of large whales. Pollution and water quality likely have the least impact on protected species (slight negative) since baleen whales are typically less at risk of bioaccumulation compared to higher trophic level marine mammals. Together, non-management human activities have a moderate negative impact on this protected species VEC.

Habitat

Climate change is the factor that likely has the greatest impact on the habitat VEC and is anticipated to be a high negative. Offshore wind farms, oil and gas activities, and harmful algal blooms generally have a moderate negative impact on marine habitats due to the level of disturbance and disruption they can cause, though there are currently no new plans for offshore wind farms or oil and gas activities within the specific scope of this EA. Pollution has a slight negative impact on marine habitats, partly due to past mitigation that was discussed in the

previous section. Aquaculture likely has a negligible to slight negative impact on marine habitats in this area, though there are few aquaculture projects currently in the area analyzed in this EA. Overall, non-management human activities likely have a moderate negative to high negative impact on this VEC, given past, present and foreseeable future activities.

Human Communities

Climate change will also have a high negative impact on human communities due to the reliance of these communities on natural resources that are already being affected. Offshore wind development, oil and gas development, and harmful algal blooms likely have a moderate negative impact on fishing communities in general. However, the extent to which the fishing communities in the geographic scope of this are impacted by offshore wind or oil and gas activities may be slight negative to moderate negative within the scope of this analysis. Entanglements have a slight negative impact on fishing communities. Aquaculture is estimated to have a slight negative to negligible impact on fishing communities. The impact of noise and pollution has a negligible impact on the fishing community VEC. When combined, non-management human activities have a negligible to high negative impact on fishing communities.

4.5.5 Cumulative Effects Analysis

A summary of the cumulative impacts on all VECs for Alternative 2 (Preferred) is summarized in Table 4.11.

Table 4.11: A summary of the final cumulative impacts analysis of the Preferred Alternative (Alternative 2) on all three VECs

VECs	Direct and Indirect Impacts	Existing Conditions	All Management Actions and Stressors	Cumulative Impacts
Protected Species	**Slight to Moderate Negative** Would reduce entanglement risk for ESA-listed and MMPA protected species. However, interaction risk will not be entirely eliminated.	**Negative** Several protected species are still listed as endangered or threatened.	**Moderate Negative to Slight Positive** Fisheries negatively impact large whale species, though some management actions may have mitigated the risk. Non-fishery management actions likely improved ocean quality and reduced gear encounters, which benefitted large whales. Anthropogenic and natural stressors have had negative impacts on the VECs and likely will continue to do so in the future.	**Slight Negative to Negligible** Continued catch and effort controls, is likely to reduce gear encounters through effort reductions. Additional management actions taken under ESA/MMPA should also help mitigate the risk of gear interactions
Habitat	**Negligible to Slight Negative** Areas with trawls above 15 traps per trawl may have a short-term impact	**Negative** Habitats have experienced degradation from human activities and are shifting as a result of climate change.	**Slight Negative to Slight Positive** Fishery management actions likely have negligible to slight negative impacts on habitat. Non-fishery management actions likely improved ocean quality, which benefitted habitats.	**Negligible to Slight Positive** Continued management is not expected to measurably change habitat quality and existing cumulative impacts.

			Anthropogenic and natural stressors have had moderate negative impacts on habitats.	
Human Community	**Slight Negative –** Fisheries would experience extra costs and catch reduction in the short term.	**Negative** Commercial fisheries are shifting as a result of climate change.	**Slight Negative to Slight Positive** Overall, fisheries management positively impacts fishing communities, though certain management actions may have had a short term negative effect. Non-fishery management actions likely improved fisheries. Anthropogenic and natural stressors have had negative impacts.	**Slight Negative to Slight Positive** Continued fishery management is expected to positively benefit fishing communities but conservation measures will likely negatively impact fishing communities, except for the positive social benefits expected from protecting whale species.

4.6 Summary

NMFS believes that Alternative 2 (Preferred) offers the best option for reducing an acute risk of entanglement due to the observed density of fixed fishing gear and North Atlantic right whales (right whales) during the month of April 2022 within the area analyzed. The area analyzed in Alternative 3 (Non-Preferred) did not substantially add to the estimated risk reduction achieved by Alternative 2 (Preferred) during April. Alternative 2 provides important protection to right whales in a smaller area that poses more of an immediate threat, compared to the area analyzed in Alternative 3. Alternative 2 achieves important protection to ESA-listed (right, fin, and sei whales) and MMPA protected species (humpback and minke whales) of Atlantic large whales, particularly right whales, while minimizing the social and economic burden on human communities attributable to this emergency action. Despite the costs, the benefits of this approach would be to maintain the current level of operation and minimize lost revenue in the Northeast lobster and Jonah crab fishery to the extent practicable. When considered in conjunction with all other pressures placed on protected species by past, present, and reasonably foreseeable future actions, the Emergency Rule is expected to slightly reduce the impact of human activities on protected species. The Preferred Alternative will have a minor impact on fishing communities and, when combined with past, present and future foreseeable actions, insignificant negative cumulative impacts on the economic environment. Based on these considerations, NMFS has identified Alternative 2 as its preferred approach to address the immediate need to reduce acute risk of mortality or serious injury of a right whale in lobster and Jonah crab trap/pot gear.

5 APPLICABLE LAWS AND REGULATIONS

5.1 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions do not jeopardize the continued existence of any species listed as threatened or endangered or result in the destruction or adverse modification of the Critical Habitat of listed species. The ESA requires the “action”

agency to consult with an "expert" agency to evaluate the effects a proposed agency action may have on a listed species. If the action agency determines through preparation of an environmental assessment or informal consultation that the Preferred Alternative is "not likely to adversely affect" listed species or Critical Habitat, formal consultation is not required so long as the expert agency concurs.

A section 7 consultation on the Atlantic Large Whale Take Reduction Plan was completed on May 25, 2021 and determined that the Plan would have wholly beneficial effects to ESA-listed species or their critical habitat. An informal consultation concluded on February 11, 2022 that the 2022 emergency regulations modifying the Plan fall within the scope of the 2021 consultation. Given that the emergency rulemaking falls within the scope of the existing section 7 consultation, reinitiation of the existing consultation is not required.

5.2 Marine Mammal Protection Act

Under the Marine Mammal Protection Act (MMPA), federal responsibility for protecting and conserving marine mammals is vested with the Departments of Commerce (NMFS) and Interior (U.S. FWS) and the MMPA is the authority under which much of the current rulemaking is being undertaken. The MMPA prohibits the "take" of marine mammals, with certain exceptions, in waters under U.S. jurisdiction and by U.S. citizens on the high seas. The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. Section 118 of the MMPA specifies that NMFS develop and implement Take Reduction Plans (TRPs) to assist in the recovery or prevent the depletion of strategic marine mammal stocks that interact with Category I and Category II fisheries, which are fisheries that cause frequent (Category I) or occasional (Category II) serious injuries and mortalities to marine mammals. The goal is to reduce these takes incidental to fishing activities to levels below the PBR level, defined as the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

For species not managed under take reduction plans, the MMPA requires consultation within NMFS if impacts on marine mammals are unavoidable. An analysis of the potential impact of the management actions on all marine mammal species that may be affected by this management action are discussed in Section 4.2. NMFS has reviewed the impacts of this action on marine mammals and concluded that the management actions proposed are consistent with the provisions of the MMPA.

5.3 Paperwork Reduction Act

This action contains no information collection requirements under the PRA of 1995.

5.4 Magnuson-Stevens Fishery Conservation and Management Act including Essential Fish Habitat

The Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act require the National Marine Fisheries Service (NMFS) to provide recommendations to federal and state agencies for conserving and enhancing EFH if a determination is made that an action may adversely impact EFH. An EFH consultation, as required under the MSA, concluded on February 11, 2022 that adverse impacts to EFH have been minimized to the extent practicable and no further EFH Conservation Recommendations pursuant to 50 CFR 600.925(a) were provided.

5.5 Information Quality Act (Public Law 106-554)

The Information Quality Act (IQA) directed the Office of Management and Budget to issue government-wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies." Under the NOAA guidelines, the Plan is considered a Natural Resource Plan. It is a composite of several types of information, including scientific, management, and stakeholder input, from a variety of sources. An IQA pre-dissemination review was completed on February 11, 2022. Compliance of this document with NOAA guidelines is evaluated below.

- Utility: The information disseminated is intended to describe the current management actions and the impacts of those actions. A diversity of public interests may be affected by this emergency rule, but not limited to the Massachusetts fishing community, scientists, conservation groups, and state and federal resource managers. This document presents information in a manner that is understandable to a wide range of users and thoroughly explains why NMFS is publishing an emergency final rule, requirements of the rulemaking action, policy and science justifying the action, and the potential effects of the action.
- Integrity: Information and data, including statistics that may be considered as confidential, were used in the analysis of impacts associated with this document. This information was necessary to assess the biological, social, and economic impacts of the alternatives considered as required under NEPA for the preparation of an Environmental Assessment statement/regulatory impact review. NMFS complied with all relevant statutory and regulatory requirements as well as NMFS policy regarding confidentiality of data. For example, confidential data were only accessible to authorized federal employees and contractors for the performance of legally required analyses. In addition, confidential data are safeguarded to prevent improper disclosure or unauthorized use. Finally, the information to be made available to the public was done so in aggregate, summary, or other such form that does not disclose the identity or business of any person.
- Objectivity: The NOAA Information Quality Guidelines for Natural Resource Plans state that plans must be presented in an accurate, clear, complete, and unbiased manner. Because take reduction plans and their implementing regulations affect such a wide range of interests, NMFS strives to draft and present new management measures in a clear and easily understandable manner with detailed descriptions that explain the decision making process and the implications of management measures on marine resources and the public. Although the alternatives considered in this document rely upon scientific information, analyses, and conclusions, clear distinctions were drawn between policy

choices and the supporting science. In addition, the scientific information relied upon in the development, drafting, and publication of this EA was properly cited and a list of references was provided. Finally, this document was reviewed by a variety of biologists, policy analysts, economists, and attorneys from the Greater Atlantic Region and the Northeast Fisheries Science Center as well as the NMFS Headquarters office in Silver Spring, MD. In general, this team of reviewers has extensive experience with the policies and programs established for the protection of marine mammals, and specifically with the development and implementation of the Plan. Therefore, this Natural Resource Plan was reviewed by technically qualified individuals to ensure that the document was complete, unbiased, objective, and relevant. This review was conducted at a level commensurate with the importance of the interpreted product and the constraints imposed by legally-enforceable deadlines.

5.6 Administrative Procedure Act

The Administrative Procedure Act (APA) establishes procedural requirements applicable to informal rulemaking by federal agencies. The purpose of the APA is to ensure public access to the federal rulemaking process and to give the public notice and an opportunity to comment before the agency promulgates new regulations. Pursuant to 5 U.S.C. 553(b)(B), the Assistant Administrator for Fisheries finds prior notice and public comment is not required because it would be impracticable and contrary to the public interest. North Atlantic right whale (right whale) monthly distribution data identifies risk in unrestricted waters surrounded on three sides by the expanded Massachusetts Restricted Area (MRA) during the month of April. The 2021 expansion of the geographic extent of the MRA to include Massachusetts state waters north to the New Hampshire border mirrors the Massachusetts 2021 modification of the state water closure (322 CMR 12.04(2)). With the implementation of the MRA Expansion, approximately 200 square miles (518 square kilometers) of federal waters remain open to trap/pot fishing between state and federal closures, creating a wedge where 2021 data indicates that trap/pot gear is concentrated during the closure period (MRA Wedge, Figure 1). During aerial surveys in April 2021, the Center for Coastal Studies (CCS) observed right whales within the MRA Wedge alongside the presence of aggregated fishing gear (Figure 1). The gear in this area is thought to be a mix of actively fished gear and staged gear that is placed in preparation for the opening of MRA federal waters in May. This, in addition to the gear being actively fished outside of the buoy line closure area, could increase gear density in the area. Finally, weak insertion requirements that reduce risk of serious entanglements that are included in the 2021 Final Rule will not be required in federal waters until May 1, 2022. Given the dense concentration of high-strength buoy lines in an area with persistent right whale presence, the MRA Wedge area presents an imminent entanglement threat.

In summary, this Emergency Rule is necessary to protect right whales in an area of elevated risk in Massachusetts Bay in April 2022. Providing prior notice through proposed rulemaking and a public comment period in the normal rulemaking process would be counter to public interest, as it would delay these necessary emergency measures. For the reasons outlined above, NMFS finds it impracticable and contrary to the public interest to provide prior notice and public comment on these emergency measures. For the same reasons, the Assistant Administrator finds good cause under 5 U.S.C. 553(d)(3) to waive the 30-day delay of effectiveness period for this.

5.7 Coastal Zone Management Act

Section 307(c)(1) of the Coastal Zone Management Act of 1972 requires that all federal activities that affect any land or water use or natural resource of the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable.

NMFS has not conducted a full consistency review under the requirements of section 307 of the Coastal Zone Management Act for this Emergency Rule. NMFS has determined that the provisions of 15 CFR 930.32(b), which allow for deviation due to exigent circumstances that present a federal agency with a substantial obstacle that prevents complete adherence to the approved program, apply. NMFS will consult with the relevant state agency of Massachusetts to the extent possible prior to the effective date of the Emergency Rule and attempt to seek concurrence. Once the exigent circumstances have passed, if NMFS is still carrying out an activity with coastal effects, NMFS will comply with the applicable provisions of the CZMA consistency review requirements to ensure that the rule is consistent to the maximum extent practicable with the enforceable policies of those State's management programs. Once NMFS has addressed the exigent circumstance through issuance of this rule, NMFS will provide the state agencies with a description of its action and its coastal effects.

5.8 Executive Order (E.O.) 13132 Federalism

E.O. 13132, otherwise known as the Federalism E.O., was signed by President Clinton on August 4, 1999, and published in the *Federal Register* on August 10, 1999 (64 FR 43255). This E.O. is intended to guide federal agencies in the formulation and implementation of "policies that have federal implications." Such policies include regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. This rule does not contain policies with federalism implications as that term is defined in E.O. 13132.

5.9 Regulatory Flexibility Act

The purpose of the Regulatory Flexibility Act (RFA) is to reduce the impacts of burdensome regulations and recordkeeping requirements on small businesses. The Emergency Rule is exempt from the procedures of the RFA because the rule will not include prior notice or an opportunity for public comment.

5.10 E.O. 12866 Regulatory Planning and Review

The purpose of E.O. 12866, otherwise known as Regulatory Planning and Review, is to enhance planning and coordination with respect to new and existing regulations. This E.O. requires the Office of Management and Budget to review regulatory programs that are considered to be "significant." This Emergency Rule has been determined to be not significant for the purposes of

E.O. 12866. The analysis meeting the requirements of the EO are found in the Regulatory Impact Review for the Emergency Rule.

5.11 National Environmental Policy Act

The National Environmental Policy Act (NEPA) provides a mechanism for identifying and evaluating the full spectrum of environmental issues associated with federal actions and for considering a reasonable range of alternatives to avoid or minimize adverse environmental impacts. The Council on Environmental Quality has issued regulations specifying the requirements for NEPA documents (40 CFR 1500 – 1508), as has NOAA in its policy and procedures for NEPA (NAO 216-6A). This EA is being prepared using the 2020 CEQ NEPA Regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020, and reviews begun after this date are required to apply the 2020 regulations unless there is a clear and fundamental conflict with an applicable statute. 85 Fed. Reg. at 43372-73 (§§ 1506.13, 1507.3(a)).

5.11.1 Environmental Assessment

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

- The need for this action is in Section 1.2;
- The alternatives that were considered are in Section 2.1, 2.2, and 2.3;
- The environmental impacts of the proposed action are in Section 4.2, 4.3, and 4.4;
- The agencies and persons consulted on this action are in Sections 5.11.3; and
- A determination of significance is in the Finding of No Significance included with this EA.

While not required for the preparation of an EA, this document includes the following additional sections that are based on requirements for an Environmental Impact Statement (EIS).

- Background and purpose are in Section 1.1 and 1.2;
- A description of the affected environment is in Section 3.1, 3.2, and 3.3;
- Cumulative effects of the proposed action are in Section 4.5;
- A list of preparers is in Section 5.11.4

5.11.2 Point of Contact

For inquiries about the or to request a copy of the document, please contact the NMFS Greater Atlantic Region Protected Resources Division at (978) 281-9328.

5.11.3 Agencies Consulted

The following agencies, in alphabetical order, were consulted in preparing this document:

- Massachusetts Department of Marine Fisheries

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Staff members of NMFS GARFO and NEFSC were also consulted in preparing this Environmental Assessment.

6 References

Angliss, R.P. and D.P. DeMaster. 1998. Differentiating Serious and Non-Serious Injury of Marine Mammals Taken Incidental to Commercial Fishing Operation: Report of the Serious Injury Workshop. 1-2 April 1997, Silver Spring, Maryland. US Department of Commerce, NOAA Tech. Memo. NMFS-OPR-13, 48pp.

Archer, F. I., R. L. Brownell, B. L. Hancock-Hanser, P. A. Morin, K. M. Robertson, K. K. Sherman, J. Calambokidis, J. Urbán R, P. E. Rosel, S. A. Mizroch, S. Panigada, and B. L. Taylor. 2019. Revision of fin whale Balaenoptera physalus (Linnaeus, 1758) subspecies using genetics. Journal of Mammalogy 100:1653-1670.

ASMFC. 2015. American Lobster Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report. Atlantic States Marine Fisheries Commission.

Baker, C. S., and P. J. Clapham. 2004. Modeling the past and future of whales and whaling. Trends in Ecology and Evolution 19:365–371.

Barshaw, D. E., and K. L. Lavalli. 1988. Predation upon postlarval lobsters Homarus americanus by cunners Tautogolabrus adspersus and mud crabs Neopanope sayi on three different substrates: eelgrass, mud, and rock. Marine Ecology Progress Series 48:119-123.

Baumgartner, M. 2021. Robots4Whales. Woods Hole Oceanographic Institution.

Baumgartner, M. F., J. Bonnell, P. J. Corkeron, S.M. Van Parijs, C. Hotchkin, B. A. Hodges, J. Bort Thornton, B. L. Mensi, and S. M. Bruner. 2020. Slocum Gliders Provide Accurate Near Real-Time Estimates of Baleen Whale Presence From Human-Reviewed Passive Acoustic Detection Information. Front. Mar. Sci. 7:100.

Baumgartner, M., and B. Mate. 2003. Summertime foraging ecology of North Atlantic right whales. Marine Ecology Progress Series 264:123-135.

Baumgartner, M., F. Wenzel, N. Lysiak, and M. Patrician. 2017. North Atlantic right whale foraging ecology and its role in human-caused mortality. Marine Ecology Progress Series 581:165-181.

Baumgartner, M., T. V. N. Cole, P. J. Clapham, and B. R. Mate. 2003. North Atlantic right whale habitat in the lower Bay of Fundy and on the SW Scotian Shelf during 1999-2001. Marine Ecology Progress Series 264:137-154.

Black, K. P., and G. D. Parry. 1994. Sediment transport rates and sediment disturbance due to scallop dredging in Port Phillip Bay. Mem. Queensl. Mus. 36:327-341.

Bologna, P. A., and R. S. Steneck. 1993. Kelp beds as habitat for American lobster Homarus

americanus. Marine Ecology Progress Series 100:127-134.

Bourque, L., T. Wimmer, S. Lair, M. Jones, and P.-Y. Daoust. 2020. Incident Report: North Atlantic Right Whale Mortality Event in Eastern Canada, 2019 Collaborative Report Produced by: Canadian Wildlife Health Cooperative and Marine Animal Response Society 210 pp.

Cassoff, R., K. Moore, W. McLellan, S. Barco, D. Rotsteins, and M. Moore. 2011. Lethal entanglement in baleen whales. Diseases of Aquatic Organisms. 96, 175-85.

CETAP [Cetacean and Turtle Assessment Program]. 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the USA outer continental shelf. Final Report #AA551-CT8-48 Cetacean and Turtle Assessment Program, University of Rhode Island, Bureau of Land Management, Washington, DC.

Chuenpagdee, R., L. E. Morgan, S. M. Maxwell, E. A. Norse, and D. Pauly. 2003. Shifting gears: assessing collateral impacts of fishing methods in US waters. Frontiers in Ecology and the Environment 1:517-524.

Churchill, J. H. 1989. The effect of commercial trawling on sediment resuspension and transport over the Middle Atlantic Bight continental shelf. Continental Shelf Research 9:841-864.

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 novaengliae, in the southern Gulf of Maine. Canadian Journal of Zoology. 71(2): 440-443.

Clark, C.W., and G.C. Gagnon. 2002. Low-frequency vocal behaviors of baleen whales in the North Atlantic: Insights from IUSS detections, locations and tracking from 1992 to 1996. J. Underwater Acoust. (US Navy), 52(3):609-640.

Clay, P. M., and J. Olson. 2008. Defining ‘Fishing Communities’: Vulnerability and the Magnuson-Stevens Fishery Conservation and Management Act. Human Ecology Review 15(2): 143–60.

Coen, L. D. 1995. A review of the potential impacts of mechanical harvesting on subtidal and intertidal shellfish resources. South Carolina Department of Natural Resources, Marine Resources Research Institute.

Colburn, L.L., and M. Jepson. 2012. Social Indicators of Gentrification Pressure in Fishing Communities: A Context for Social Impact Assessment. Coastal Management 40(3): 289–300.

Conn, P. B., and G. K. Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. Ecosphere 4(4):43.

Corkeron, P., P. Hamilton, J. Bannister, P. Best, C. Charlton, K.R. Groch, K. Findlay, V. Rowntree, E. Vermeulen, and R.M. Pace. 2018. The recovery of North Atlantic right whales,

Eubalaena glacialis, has been constrained by human-caused mortality. R. Soc. Open Sci. 5:180892.
CZM [Massachusetts Office of Coastal Zone Management]. 1999. Offshore Bathymetry. 1:250,000. https://www.mass.gov/info-details/massgis-data-offshore-bathymetry-1250000#attributes- (accessed Feb 25, 2022)

Daoust, P.-Y., É. L. Couture, T. Wimmer, and L. Bourque. 2018. Incident report: North Atlantic right whale mortality event in the Gulf of St. Lawrence, 2017. Report, Canadian Wildlife Health Cooperative, Marine Animal Response Society, and Fisheries and Oceans Canada, Ottawa, Canada.

Davies, K., M. Brown, P. Hamilton, A. Knowlton, C. Taggart, and A. Vanderlaan. 2019. Variation in North Atlantic right whale Eubalaena glacialis occurrence in the Bay of Fundy, Canada, over three decades. Endangered Species Research 39:159-171.

Davis, G. E., M. F. Baumgartner, J. M. Bonnell, J. Bell, C. Berchok, J. Bort 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. Sirovic, 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, and 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. 00:1-29.

Dombroski, J., S. Parks, and D. Nowacek. 2021. Dive behavior of North Atlantic right whales on the calving ground in the Southeast USA: Implications for conservation. Endangered Species Research, 46: 35–48.

Donovan, G.P. 1991. A review of IWC stock boundaries. Rep. int. Whal. Common (special issue) 13:39-68.

Edwards, E.F., C. Hall, T.J. Moore, C. Sheredy and J. Redfern. 2015. Global distribution of fin whales (Balaenoptera physalus) in the post-whaling era (1980 to 2012). Mamm Rev. 45:197–214.

Eno, N. C., D. S. MacDonald, J. A. M. Kinnear, S. C. Amos, C. J. Chapham, R. A. Clard, F. P. D. Bunker, and C. Munro. 2001. Effects of crustacean traps on benthic fauna. ICES Journal of Marine Science 58:11-20.

Fortune, S., A. Trites, C. Mayo, D. Rosen, and P. Hamilton. 2013. Energetic requirements of North Atlantic right whales and the implications for species recovery. Marine Ecology Progress Series 478:253-272.

Gallopín, G.C. 2006. "Linkages between Vulnerability, Resilience, and Adaptive Capacity." Global Environmental Change, Resilience, Vulnerability, and Adaptation: A Cross-Cutting Theme of the International Human Dimensions Programme on Global Environmental Change, 16, no. 3 (August 1, 2006): 293–303.

Goode, A. G., J. H. Grabowski, and D. C. Brady. 2021. Evaluating benthic impact of the Gulf of Maine lobster fishery using the Swept Area Seabed Impact (SASI) model. Canadian Journal of Fisheries and Aquatic Sciences 78(6): 693-703.

Grabowski, J. H., E. J. Clesceri, J. Gaudette, A. Baukus, M. Weber, and P. O. Yund. 2010. Use of herring bait to farm lobster in the Gulf of Maine. PLoS One 5: e10188.

Grieve, B. D., J. A. Hare, and V. S. Saba. 2017. Projecting the effects of climate change on Calanus finmarchicus distribution within the U.S. Northeast Continental Shelf. Scientific Reports 7:6264.

Hain, J. H. W., M. A. M. Hyman, R. D. Kenney, and H. E. Winn. 1985. The role of cetaceans in the shelf edge region of the northeastern United States. Marine Fisheries Review 47:13-17.

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

Hall, S. J. 1999. The Effects of Fishing on Marine Ecosystems and Communities. Blackwell Science, Oxford.

Hall-Arber, M., C. Dyer, J. Poggie, J. McNally and R. Gagne. 2001. New England's Fishing Communities. MITSG 01-15, MIT Sea Grant College Program, 292 Main Street, E38-300, Cambridge, MA 02139

Hamilton, P., and S. Kraus. 2019. Frequent encounters with the seafloor increase right whales' risk of entanglement in fishing groundlines. Endangered Species Research 39:235-246.

Hamilton, P.K., A.R. Knowlton, M.N. Hagbloom, K.R. Howe, H.M. Pettis, M.K. Marx, M.A. Zani and S.D. Kraus. 2019. Maintenance of the North Atlantic right whale catalog, whale scarring and visual health databases, anthropogenic injury case studies, and near real-time matching for biopsy efforts, entangled, injured, sick or dead right whales. New England Aquarium, Boston, MA. Contract No. 1305M2-18-P-NFFM-0108.

Hartley, D., A. Whittingham, J. Kenney, T. Cole, and E. Pomfret. 2001. Large Whale Entanglement Report 2001. Report to the National Marine Fisheries Service, updated February 2003, 61 pp.

Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Page 479. Northeast Fisheries Science Center, Woods Hole, MA.

Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel and J.T. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Page 403. Northeast Fisheries Science Center, Woods Hole, MA.

Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, B. Byrd, S. Chavez-Rosales, T. V. N. Col, L. Engleby, L. P. Garrison, J. Hatch, A. Henry, S. C. Horstman, J. Litz, M. C. Lyssikatos, K. D. Mullin, C. Orphanides, R. M. Pace, D. L. Palka, M. Soldevilla, and F. W. Wenzel. 2018. TM 245 US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2017. Page 371 in NMFS, editor. NOAA Tech Memo.

Henry, A. G., T. V. N. Cole, L. Hall, W. Ledwell, D. Morin, and A. Reid. 2016. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2010-2014. Page 51.

Henry, A.G., M. Garron, D. Morin, A. Reid, W. Ledwell, and T. Cole. 2021. Serious Injury and Mortality Determinations for Baleen Whale Stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2014-2018. US Dept Commer.

ICES. 1992. Report of the Study Group on Ecosystem Effects of Fishing Activities, Copenhagen, 7-14 April. ICES CM 1992/G:11, International Council for the Exploration of the Sea, Study Group on Ecosystem Effects of Fishing Activities, Copenhagen.

Irvine, L. G., M. Thums, C. E. Hanson, C. R. McMahon, and M. A. Hindell. 2017. Quantifying the energy stores of capital breeding humpback whales and income breeding sperm whales using historical whaling records. R. Soc. open sci. 4:160290.

Jacob, S. P. Weeks, B. Blount, M. Jepson. 2010. Exploring Fishing Dependence in Gulf Coast communities. Marine Policy 34(6):1307-1314.

Johnson, A., G. Salvador, J. Kenney, J.Robbins, S. Kraus, S. Landry, and P. Clapham. 2005. Fishing Gear Involved in Entanglements of Right and Humpback Whales. Marine Mammal Science 21: 635-645.

Kaiser, M. J. 2000. The implications of the effects of fishing on non-target species and habitats. Pages 383-392 in M. J. Kaiser and S. J. de Groot, editors. The Effects of Fishing on Non- target Species and Habitats. Blackwell Science.

Kenney, R. D. 2001. Anomalous 1992 spring and summer right whale (Eubalaena glacialis) distributions in the Gulf of Maine. Journal of Cetacean Research and Management (Special Issue) 2:209-223.

Klanjscek, T., R. M. Nisbet, H. Caswell, and M. G. Neubert. 2007. A model for energetics and bioaccumulation in marine mammals with applications to the right whale. Ecological Applications 17:2233-2250.

Knowlton, A. and S. Kraus. 2001. Mortality and serious injury of northern right whales (Eubalaena glacialis) in the western North Atlantic Ocean. Journal of Cetacean Research and Management (Special Issue). 2.

Knowlton, A.R., J. Robbins, S. Landry, H.A. McKenna, S.D. Kraus, and T.B. Werner. 2016. Effects of fishing rope strength on the severity of large whale entanglements. Conservation Biology 30: 318-328.

Knowlton, A.R., P.K. Hamilton, M.K. Marx, H.M. Pettis, and S.D. Kraus. 2012. Monitoring North Atlantic right whale Eubalaena glacialis entanglement rates: a 30 yr retrospective. Mar Ecol Prog Ser 466:293-302.

Kraus, S. D., and R. M. Rolland. 2007. Right whales in the urban ocean. Pages 1-38 in S. D. Kraus and R. M. Rolland, editors. The Urban Whale: North Atlantic Right Whales at the Crossroads. Harvard University Press, Cambridge.

Kraus, S. D., R. D. Kenney, C. A. Mayo, W. A. McLellan, M. J. Moore, and D. P. Nowacek. 2016. Recent Scientific Publications Cast Doubt on North Atlantic Right Whale Future. Frontiers in Marine Science 3.

Krzystan, A., T. Gowan, W. Kendall, J. Martin, J. Ortega-Ortiz, K. Jackson, A. Knowlton, P. Naessig, M. Zani, D. Schulte, and C. Taylor. 2018. Characterizing residence patterns of North Atlantic right whales in the southeastern USA with a multistate open robust design model. Endangered Species Research 36:279-295.

Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17:35-75.

Lawton, P., and K. L. Lavalli. 1985. Postlarval, juvenile, adolescent, and adult ecology. Pages 47-88 in J. R. Factor, editor. Biology of the Lobster Homarus americanus. Academic Press, New Yorl, NY.

Levin, L. A. 1984. Life history and dispersal patterns in a dense infaunal polychaete assemblage: community structure and response to disturbance. Ecology 65:1185-1200.
Lincoln, D. 1998. Lobsters on the edge-essential lobster habitats in New England. Greenlite Consultants, Newton Highlands, MA.

Mayer, L. M., D. F. Schick, R. H. Findlay, and D. L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31:249-261.

Mayo, C. A., L. Ganley, C. A. Hudak, S. Brault, M. K. Marx, E. Burke, and M. W. Brown. 2018. Distribution, demography, and behavior of North Atlantic right whales (Eubalaena glacialis) in

Cape Cod Bay, Massachusetts, 1998-2013: Right Whales in Cape Cod Bay. Marine Mammal Science 34:979-996.

Mayo, C. A., and M. K. Marx. 1990. Surface behavior of the North Atlantic right whale, Eubalaena glacialis, and associated zooplankton characteristics. Canadian Journal of Zoology 68:2214-2220.

McCauley, R., R. Day, K. Swadling, Q. Fitzgibbon, R. Watson, and J. Semmens. 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. Nature Ecology and Evolution 1.

Messieh, S.N., T.W. Rowell, D.L. Peer, and P.J. Cranford. 1991. The effects of trawling, dredging and ocean dumping on the eastern Canadian continental shelf seabed. Continental Shelf Research, Volume 11, Issues 8–10: 1237-1263.

Meyer-Gutbrod, E. L., and C. H. Greene. 2018. Uncertain recovery of the North Atlantic right whale in a changing ocean. Global Change Biology 24:455-464.

Meyer-Gutbrod, E. L., C. H. Greene, P. J. Sullivan, and A. J. Pershing. 2015. Climate-associated changes in prey availability drive reproductive dynamics of the North Atlantic right whale population. Marine Ecology Progress Series 535:243-258.

Mitchell, E., and D. G. Chapman. 1977. Preliminary assessment of stocks of northwest Atlantic sei whales (Balaenoptera borealis). Rep. omt/ Whal. Common. Special Issue 1: 117-120.

Monsarrat, S., M. G. Pennino, T. D. Smith, R. R. Reeves, C. N. Meynard, D. M. Kaplan, and A. S. Rodrigues. 2016. A spatially explicit estimate of the prewhaling abundance of the endangered North Atlantic right whale. Conserv Biol 30:783-791.

Moore, M. J., and J. M. van der Hoop. 2012. The Painful Side of Trap and Fixed Net Fisheries: Chronic Entanglement of Large Whales. Journal of Marine Biology 2012:1-4.

Morano, J. L., A. N. Rice, J. T. Tielens, B. J. Estabrook, A. Murray, B. L. Roberts, and C. W. Clark. 2012. Acoustically Detected Year-Round Presence of Right Whales in an Urbanized Migration Corridor: Right Whales in Massachusetts Bay. Conservation Biology 26:698-707.

Murphy, M. A. 1996. Occurrence and group characteristics of minke whales, Balaenoptera acutorostrata, in Massachusetts Bay and Cape Cod Bay. Oceanographic Literature Review, 5(43), 506.

Murray, A., A. Rice, and C. Clark. 2013. Extended seasonal occurrence of humpback whales in Massachusetts Bay. Journal of the Marine Biological Association of the U.K. 94(6), 1117-1125.

NMFS. 2002. Workshop on the effects of fishing gear on marine habitats off the Northeastern United States October 23-25, 2001. Boston, Massachusetts. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, Massachusetts.

NMFS. 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.

NMFS. 2013. North Atlantic Right Whale (Eubalaena glacialis) Source Document for the Critical Habitat Designation: A review of information pertaining to the definition of "critical habitat". December 2012.166pp.

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

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

NMFS. 2015b. North Atlantic Right Whale (Eubalaena glacialis). Source Document for the Critical Habitat Designation: A review of information pertaining to the definition of "critical habitat" Prepared by National Marine Fisheries Service Greater Atlantic Regional Fisheries Office and Southeast Regional Office, July 2015.NMFS. 2017. 62nd Northeast Regional Stock Assessment Workshop (62nd SAW) Assessment Summary Report. US Department of Commerce, Northeast Fisheries Science Center, Woods Hole, MA.

NMFS. 2019. Guidance on the Application of NEPA for Emergency Response Actions. Memo to National Environmental Policy Act (NEPA) Practitioners. September 23, 2019.

NMFS. 2021a. 2017–2021 North Atlantic Right Whale Unusual Mortality Event. https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event.

NMFS. 2021b. Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2021. https://media.fisheries.noaa.gov/2021-10/Draft%202021%20NE%26SE%20SARs.pdf

NMFS 2021c. 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 Fisheries Management Council's Omnibus Essential Fish Habitat Amendment 2. NMFS GARFO May 28, 2021.

NFMS. 2021d. Final Environmental Impact Statement (FEIS), Regulatory Impact Review, and Final Regulatory Flexibility Analysis for Amending the Atlantic Large Whale Take Reduction

Plan: Risk Reduction Rule Volume I.
https://www.greateratlantic.fisheries.noaa.gov/public/nema/apsd/2021FEIS_Volume%20I.pdf

Oedekoven, C., E. Fleishman, P. Hamilton, J. Clark, and R. Schick. 2015. Expert elicitation of seasonal abundance of North Atlantic right whales Eubalaena glacialis in the mid- Atlantic. Endangered Species Research 29:51-58.

Pace, R. M. 2021. Revisions and Further Evaluations of the Right Whale Abundance Model: Improvements for Hypothesis Testing. Page 54. NOAA Tech. Memo. NOAA, Northeast Fisheries Science Center, Woods Hole, MA.

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. Ecol. and Evol. 7:8730-8741.

Paquet, D., C. Haycock, and H. Whitehead. 1997. Numbers and seasonal occurrence of humpback whales, Megaptera novaeangliae, off Brier Island, Nova Scotia. Canadian Field-Naturalist 111:548–552.

Payne, P. M., J. R. Nicolas, 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. Fishery Bulletin 84:271- 227.

Payne, M.P., 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. Fisheries Bulletin 88:687-696.

Perry, S. L., D. P. DeMaster, and G. K. Silber. 1999. The Great Whales: History and Status of Six Species Listed as Endangered Under the U.S. Endangered Species Act of 1973. The Marine Fisheries Review 61:74.
Pettis, H.M., Pace, R.M. III, Hamilton, P.K. 2022. North Atlantic Right Whale Consortium 2021 Annual Report Card. Report to the North Atlantic Right Whale Consortium.

Pilskaln, C. H., J. H. Churchill, and L. M. Mayer. 1998. Resuspension of sediment by bottom trawling in the Gulf of Maine and potential geochemical consequences. Conservation Biology 12:1223-1229.

Plourde, S., C. Lehoux, C. L. Johnson, G. Perrin, and V. Lesage. 2019. North Atlantic right whale (Eubalaena glacialis) and its food: (I) a spatial climatology of Calanus biomass and potential foraging habitats in Canadian waters. 00:19.

Prieto, R., D. Janiger, M. A. Silva, G. T. Waring, and J. M. Gonçalves. 2012. The forgotten whale: A bibliometric analysis and literature review of the North Atlantic sei whale Balaenoptera borealis: North Atlantic sei whale review. Mammal Review 42(3), 235–272.

Record, N. R., W. M. Balch, and K. Stamieszkin. 2019a. Century-scale changes in phytoplankton phenology in the Gulf of Maine. PeerJ 7:e6735.

Record, N. R., J. Runge, D. Pendleton, W. Balch, K. Davies, A. Pershing, C. Johnson, K. Stamieszkin, R. Ji, Z. Feng, S. Kraus, R. Kenney, C. Hudak, C. Mayo, C. Chen, J. Salisbury, and C. Thompson. 2019b. Rapid Climate-Driven Circulation Changes Threaten Conservation of Endangered North Atlantic Right Whales. Oceanography 32.

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

Robbins, J., S. Landry, and D. K. Mattila. 2009. Estimating entanglement mortality from scar-based studies. International Whaling Commission Scientific Committee, Madeira, Portugal.

Roberts, J. J., B. D. Best, L. Mannocci, E. Fujioka, P. N. Halpin, D. L. Palka, L. P. Garrison, K. D. Mullin, T. V. N. Cole, C. B. Khan, W. A. McLellan, D. A. Pabst, and G. G. Lockhart. 2016. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. Scientific Reports 6:22615.

Roberts J. J., L. Mannocci, P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts J.J., R.S. Schick, P.N. Halpin. 2020. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2018-2020 (Option Year 3). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Rogers, S. I., M. J. Kaiser, and S. Jennings. 1998. Ecosystem effects of demersal fishing: a European perspective. Pages 68-78 in E. D. Dorsey and J. Pederson, editors. Effect of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation, Boston, Massachusetts.

Rumohr, H., and P. Krost. 1991. Experimental evidence of damage to benthos by bottom trawling with special reference to Arctica islandica. Meeresforschung 33:340-345.

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.
Schweitzer, C.C., R.N. Lipcius, and G.S. Bradley. 2018. Impacts of a multi-trap line on benthic habitat containing emergent epifauna within the Mid-Atlantic Bight. ICES Journal of Marine Science, Volume 75(6): 2202–2212.

Sharp, S., W. McLellan, D. Rotstein, A. Costidis, S. Barco, K. Durham, T. Pitchford, K. Jackson, P. Daoust, T. Wimmer, E. Couture, L. Bourque, T. Frasier, B. Frasier, D. Fauquier, T. Rowles, P. Hamilton, H. Pettis, and M. Moore. 2019. Gross and histopathologic diagnoses from North Atlantic right whale Eubalaena glacialis mortalities between 2003 and 2018. Diseases of Aquatic

Organisms 135:1-31.

Sorochan, K. A., S. Plourde, R. Morse, P. Pepin, J. Runge, C. Thompson and C. L. Johnson. 2019. North Atlantic right whale (Eubalaena glacialis) and its food: (II) interannual variations in biomass of Calanus spp. on western North Atlantic shelves. Journal of Plankton Research 41(5): 687–708.

Steneck, R. S., and C. Wilson. 1998. Why are there so many lobsters in Penobscot Bay? Pages 72-75 in D. D. Platt, editor. Rim of the Gulf – Restoring Estuaries in the Gulf of Maine. The Island Institute, Rockland, ME.

Stephenson, F., A. C. Mill, C. L. Scott, N. V. C. Polunin, and C. Fitzsimmons. 2017. Experimental potting impacts on common UK reef habitats in areas of high and low fishing pressure. ICES Journal of Marine Science 74:1648-1659.

Stone, K. M., S. M. Leiter, R. D. Kenney, B. C. Wikgren, J. L. Thompson, J. K. D. Taylor, and S. D. Kraus. 2017. Distribution and abundance of cetaceans in a wind energy development area offshore of Massachusetts and Rhode Island. Journal of Coastal Conservation 21:527-543.

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. Marine Mammal Science 9: 309-315.

U.S. Bureau of Economic Analysis, "Table 1.1.4. Price Indexes for Gross Domestic Product," https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey (accessed Feb 10, 2022).

Uhrin, A.V. 2016. Tropical cyclones, derelict traps, and the future of the Florida Keys commercial spiny lobster fishery. Marine Policy 69: 84-91.
van Der Hoop, J. M., M. J. Moore, S. G. Barco, T. V. N. Cole, P.-Y. Daoust, A. G. Henry, D. F. McAlpine, W. A. McLellan, T. Wimmer, and A. R. Solow.n2013. Assessment of management to mitigate anthropogenic effects on large whales. Cons. Biol. 27:121-133.

van der Hoop, J. M., P. Corkeron, J. Kenney, S. Landry, D. Morin, J. Smith, and M. J. Moore. 2016. Drag from fishing gear entangling North Atlantic right whales. Marine Mammal Science 32:619-642.

van der Hoop, J.M., P. Corkeron, and M. Moore. 2017. Entanglement is a costly life-history stage in large whales. Ecol Evol 7:92-106.

Waring, G. T., E. Josephson, K. Maze-Foley, and P.E. Rosel eds. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2009. NOAA Tech. Memo. NMFS NE 213, Woods Hole, Massachusetts, USA.

Watkins, W. A., and W. E. Schevill. 1976. Right whale feeding and baleen rattle. Journal of Mammalogy 57:58-66.

Watkins, W.A., P. Tyack, K.E. Moore and J.E. Bird. 1987. The 20-Hz signals of finback whales (Balaenoptera physalus). J. Acoust. Soc. Am. 82: 901-1912.

Weinrich, M. T., R. D. Kenney, and P. K. Hamilton 2000. Right whales (Eubalaena glacialis) on Jeffreys Ledge: A Habitat of Unrecognized Importance?. Marine Mammal Science 16: 326-337.

Whittingham, A., M. Garron, J. Kenney, and D. Hartley. 2005. Large Whale Entanglement Report 2003. Report to the National Marine Fisheries Service, updated June 2005.

Wikgren, B., H. Kite-Powell, and S. Kraus. 2014. Modeling the distribution of the North Atlantic right whale Eubalaena glacialis off coastal Maine by aerial co-kriging. Endangered Species Research 24:21-31.

Wiles, G. 2017. Periodic status review for blue, fin, sei, North Pacific right, and sperm whales in Washington.

Wiley, D., R.A. Asmutis, T.D. Pitchford, and D.P Gannon. 1995. Stranding and mortality of humpback whales, Megaptera novaeangliae, in the mid-Atlantic and southeast United States, 1985-1992. Fishery Bulletin- National Oceanic and Atmospheric Administration 93: 196-205.

Williams, R., G. A. Vikingsson, A. Gislason, C. Lockyer, L. New, L. Thomas, and P. S. Hammond. 2013. Evidence for density-dependent changes in body condition and pregnancy rate of North Atlantic fin whales over four decades of varying environmental conditions. ICES Journal of Marine Science 70:1273-1280.

Wishner, K. F., E. Durbin, A. Durbin, M. Macaulay, H. Winn, and R. Kenney. 1988. Copepod patches and right whales in the Great South Channel off New England. Bulletin of Marine Science 43:825-844.

Wishner, K. F., J. R. Schoenherr, R. Beardsley, and C. Chen. 1995. Abundance, distribution and population structure of the copepod Calanus finmarchicus in a springtime right whale feeding area in the southwestern Gulf of Maine. Continental Shelf Research 15:475-507.

Woodley, T. H., and D. E. Gaskin. 1996. Environmental characteristics of North Atlantic right and fin whale habitat in the lower Bay of Fundy, Canada. Canadian Journal of Zoology 74:75

ENVIRONMENTAL ASSESSMENT OF A 2022 EMERGENCY RULE TO REDUCE RIGHT WHALE INTERACTIONS WITH LOBSTER AND JONAH CRAB TRAP/POT GEAR
VOLUME II

MARCH 2022

US DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE

Contents

Chapter 1 Appendices

Appendix 1.1 Letters of Concern

Following are three letters NMFS received regarding the overlap of North Atlantic right whales and fishing gear in unrestricted federal waters surround by Massachusetts Restricted Area.

The Commonwealth of Massachusetts
Division of Marine Fisheries

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CHARLES D. BAKER	KARYN E. POLITO	KATHLEEN A. THEOHARIDES	RONALD S. AMIDON	DANIEL J. MCKIERNAN
Governor	Lt. Governor	Secretary	Commissioner	Director

January 7. 2022

Michael Pentony
Regional Administrator
NOAA Fisheries GARFO
55 Great Republic Drive
Gloucester, MA 01930

RE: Seasonal entanglement risk for North Atlantic Right Whales in the EEZ west of Stellwagen Bank

Dear Mr. Pentony,

I am writing to inform you of an emerging entanglement risk to North Atlantic right whales (NARW) that occurs in a certain zone of federal waters sandwiched between the state and federal closures.

As you are aware, NOAA Fisheries created the Massachusetts Restricted Area (MRA) in 2015 to reduce the risk of entanglement risk to the large aggregations of NARW that occur there seasonally. This closure to fixed fishing gear included MA state waters within Cape Cod Bay and adjacent federal waters around Stellwagen Bank from February 1st through April 30th of each year. DMF immediately created analogous state regulations closing the area to fixed fishing gear.

Since 2016, DMF has also added dynamic management to the state waters portion of the MRA by extending the closure into the month of May when aerial surveillance shows that right whales remain present. In addition to this action, since the beginning of the closure, DMF has engaged in efforts, with assistance from the Massachusetts Environmental Police, to retrieve abandoned gear in the closure annually to ensure that the entanglement risk to right whales is effective as intended.

Since the advent of the MRA closure in 2015, seasonal usage of state and federal waters outside of Cape Cod Bay increased in certain areas and times where fixed gear fishing was allowed. Recent sighting data indicate that NARW stay for a longer time period than they have historically, and these whales are increasingly observed in state and adjacent federal waters in Massachusetts Bay and north to the NH state line. These changes in distribution increased the entanglement risk to NARW along the MA coastal waters. In response to these changes in entanglement risk, as well as continued declines in the population status of NARW, in 2021 DMF closed MA state waters from southeastern Cape Cod north the NH border to lobster fishing from February 1st to May 15th (Figure 1).

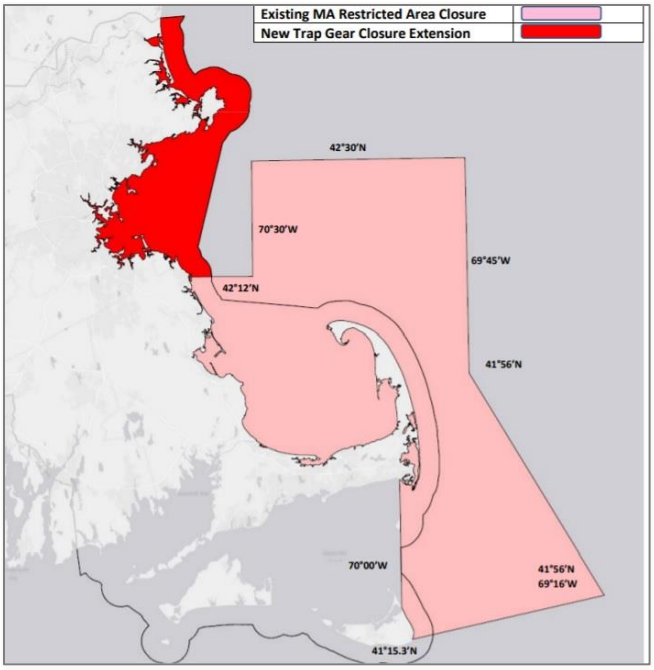


Figure 1. DMF trap/gear closure, February 1 – May 15

The National Marine Fisheries Service then mirrored the northern extension of the closure, known as Massachusetts North Restricted Area, in their Phase 1 amendment to the Atlantic Large Whale Take Reduction Plan in September of 2021. The Massachusetts North closure only runs through April 30 each year under the federal plan (Figure 2).

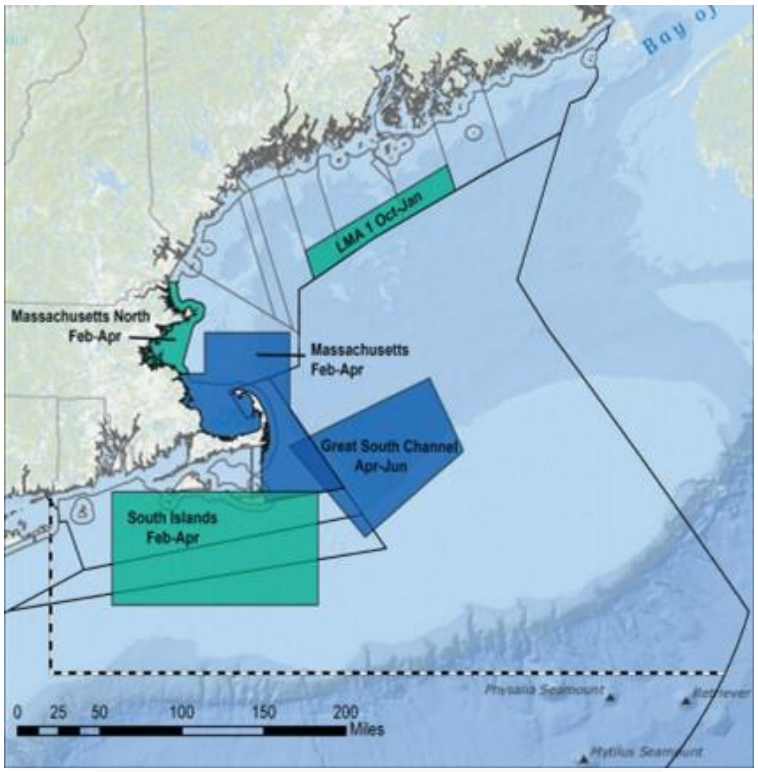


Figure 2. Map of Massachusetts Restricted Area

The increasing presence of NARW in these northern areas is not exclusive to state waters. In recent years, aerial surveillance conducted by the Center for Coastal Studies (CCS) has documented the presence of right whales in both open and closed portions of the waters north of Cape Cod Bay. The map below depicting gear and whales from 2018 demonstrates the necessity for DMF's northern extension of the state waters closure implemented in 2021 (Figure 3).

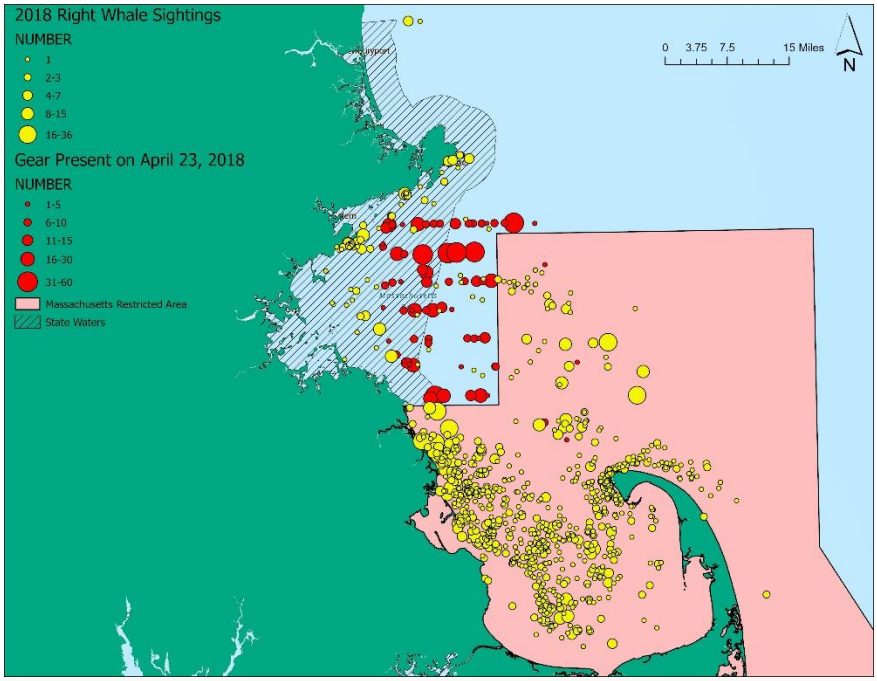


Figure 3. Right whale sightings in 2018 and buoy lines documented on April 23, 2018

However, the implementation of the Massachusetts North Restricted Area has created a gap between the closed areas between state waters of Massachusetts Bay and the northern federal waters portion of the original Massachusetts Restricted Area (Figure 2 and 4). Federally permitted vessels can continue to fish with persistent buoy lines in these areas adjacent to MA state waters during the closure period, and this area lies beyond the jurisdiction of the Commonwealth.

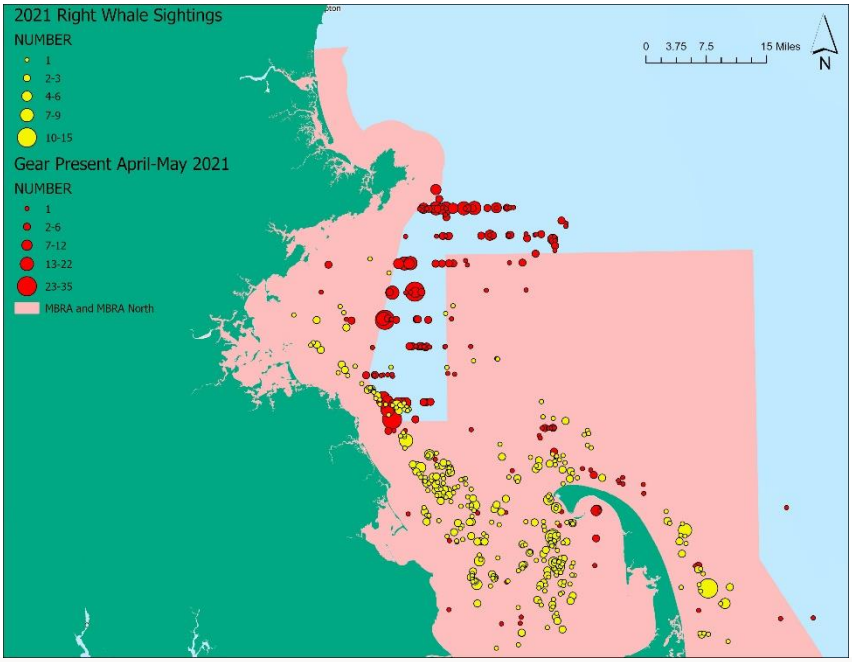


Figure 4. Right whale sightings in 2021 and buoy lines documented in April and May 2021

Given the current dire status of the NARW population and the need for continued reductions in entanglement risk we wanted to ensure that NOAA Fisheries was aware of this issue. We feel that continued overlap of persistent buoy lines with aggregations of NARW pose an entanglement threat and we are concerned that any future NARW entanglement in waters off the Massachusetts coast could threaten the opportunity of MA-based fishers to participate in fixed gear fisheries.

Sincerely,

Daniel J. McKiernan, Director

CC: Marine Fisheries Advisory Commission

Colleen Coogan
Lead, Marine Mammal Sea Turtle Team
NMFS, Greater Atlantic Region
Colleen.Coogan@NOAA.gov

January 5, 2022

Dear Colleen,

We are writing to ask the Agency to re-evaluate entanglement risk to right whales in the federal waters adjacent to the Massachusetts Bay Restricted Area. We intended to address this issue during the January Atlantic Large Whale Take Reduction Team (ALWTRT or Team) meeting but unfortunately that meeting was canceled. As a result, we ask NMFS to share this letter with the Team and to expeditiously seek additional input from them prior to the February 1 start of the 2022 Massachusetts Bay Restricted Area period.

As the attachments to this letter show, when the Massachusetts Department of Marine Fisheries (MADMF) expands its state water restrictions to the north (Scituate to the New Hampshire border) on February 1, a wedge of unprotected federal waters will be created parallel to the Massachusetts Bay Restricted Area. We are concerned that redistributed gear from both restricted areas could increase entanglement risk in the wedge. Any entanglement will further impact Massachusetts fishermen who are arguably already the most regulated portion of the industry when it comes to reducing risk to right whales.

In an effort to assess whether this area may pose unintentional risk to right whales, we made a public records request to MADMF for past sightings and gear data. Specifically, we requested:

- Data on whether and how much gear was set in this area in 2021, during the restricted season (Feb 1 – May 15).
- For comparison, any data from 2020 prior to the expansion of the MADMF state waters expansion to better understand if a shift in effort had occurred.
- Data on right whale detections (visual and acoustical) for these areas in the spring (2015-2021).
- The overlap of gear and right whales (detected visually or acoustically) in this area between Feb 1 and May 15 of 2021.

MADMF provided a serious of maps (attached to this document) with the following caveats:

- Because of how gear is documented during surveys, data on gear should be viewed as more qualitative than quantitative. Therefore, the most accurate way to view the gear data are comparing gear seen in a single day.
- To view potential overlap, a single day of gear was overlaid with multiple years of right whale sightings from 2018 and 2021.
- Sightings of right whales provided used NARWC data on right whale sightings for 2015-2020.

Understanding that past aerial survey effort has been focused on Cape Cod Bay (not this area), the maps are qualitative rather than quantitative and not effort corrected. We also recognize that the gear data are only occasionally collected and represent aggregations rather than individual buoys. Still, it appears

that the risk in this area is not negligible. As a result, we ask NMFS to analyze the following issues and to share the results with the Team:

1. Whether the gear aggregations represent potentially wet stored gear or actively fished gear between February 1st- May 15th (or the end of the restriction period)?

2. If wet stored, is that the result of a lack of land-based storage areas for fishermen using this area? If so, can NMFS and MADMF provide alternative land-based locations in support of the industry and to reduce entanglement risk to right whales?

3. Does NMFS intend to survey this area for gear and right whales during the upcoming restricted period? If so, how often will visual surveys be conducted?

4. How likely will it be for gear set in this area to be properly marked prior to February 1, 2021? Does NMFS and/or MADMF have a gear marking monitoring plan in place and will results be shared with members of the ALWTRT?

5. Should an entanglement occur in this area during the restricted period, does NMFS have a plan to prevent further risk to right whales?

As stated previously, we ask that you share our concerns with the Team and seek their additional input and suggestions as to how to prevent inadvertent risk during the upcoming restricted period. Our intention is not to further impact Massachusetts fishermen, but rather to ensure that all of the efforts put forward by them to date, are not thwarted by increasing gear in a small area where right whales are likely to be present.

Thank you in advance for your consideration,

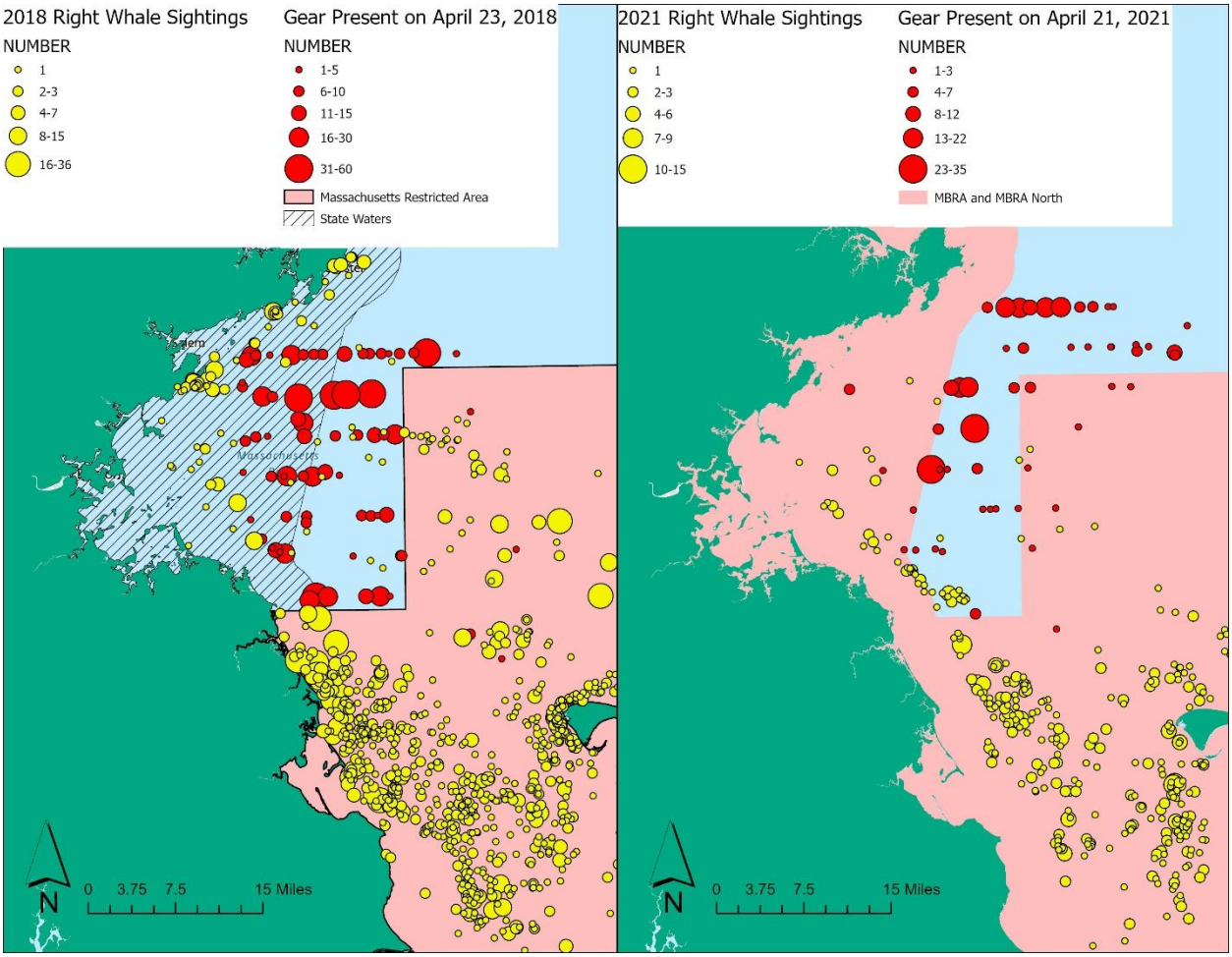
Regina Asmutis-Silvia
Whale and Dolphin Conservation

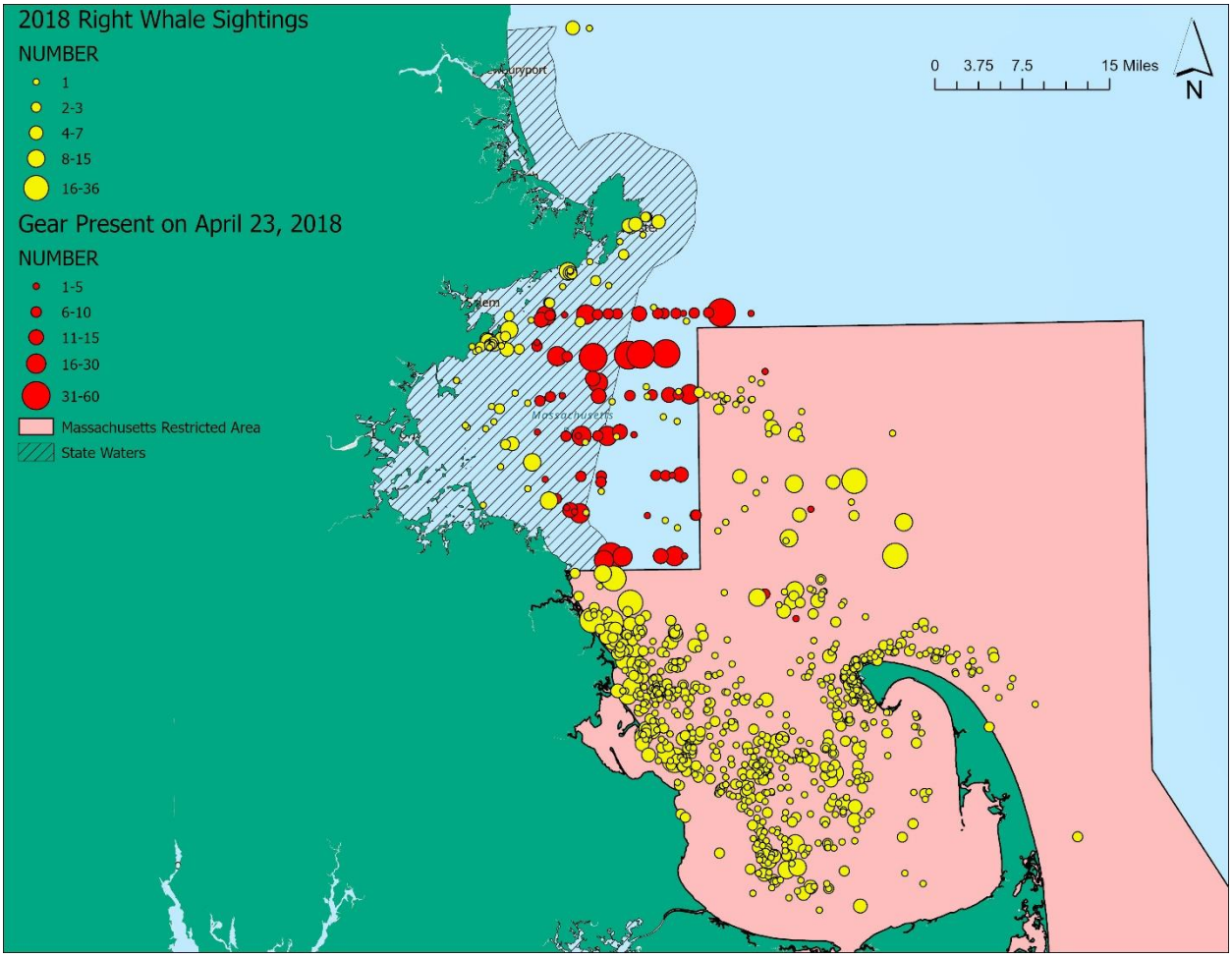
Erica Fuller
Conservation Law Foundation

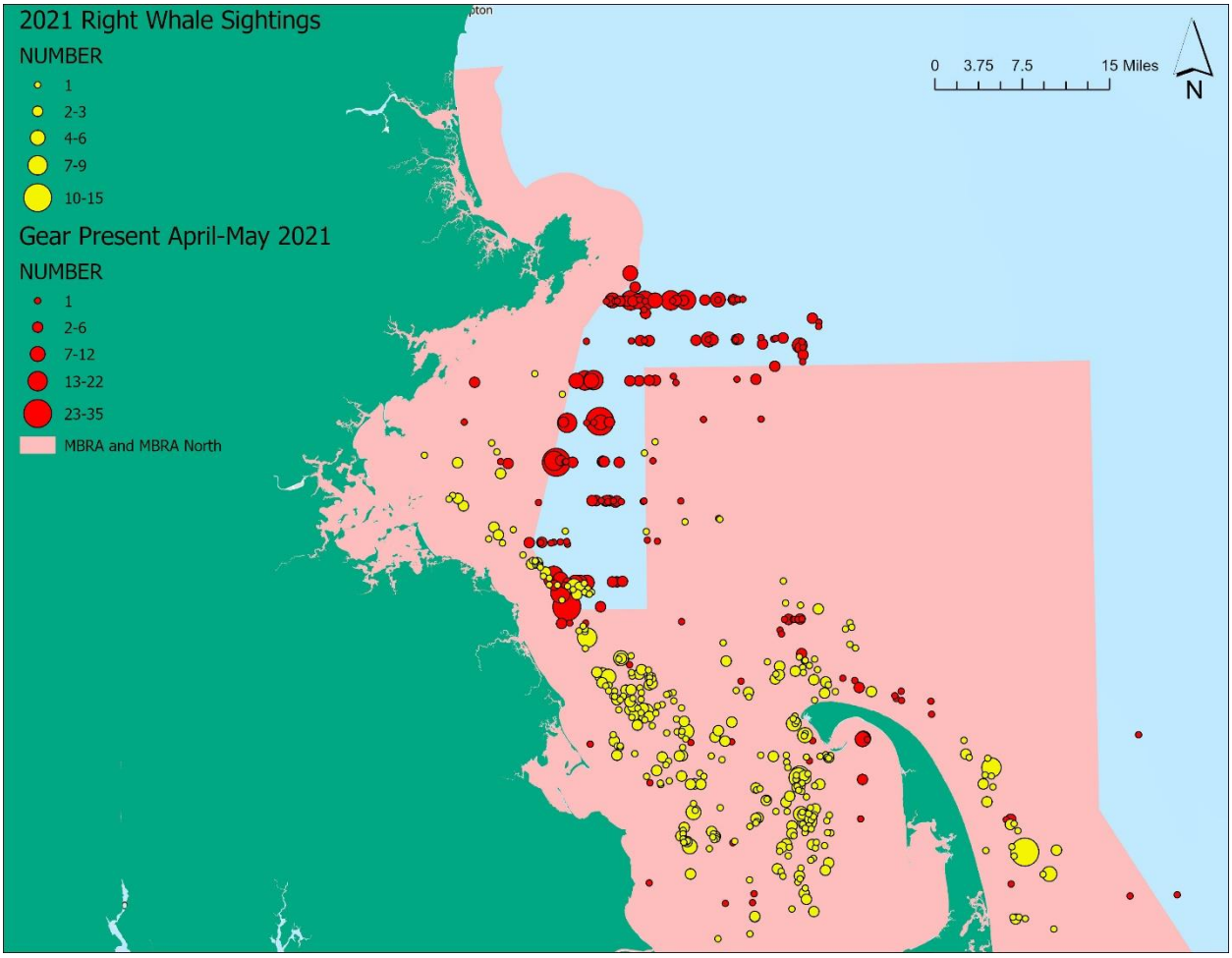
CC:

Bob Glen (robert.glenn@mass.gov)
Bennett Brooks (bbrooks@cbi.org)
Marisa Trego (marisa.trego@noaa.gov)

ATTACHMENTS: Maps provided by MADMF




2018 Right Whale Sightings
NUMBER
1
2-3
4-7
8-15
16-36
Gear Present on April 23, 2018
NUMBER
1-5
6-10
11-15
16-30
31-60
Massachusetts Restricted Area
State Waters
Newburyport
Salem
Massachusetts
0 3.75 7.5 15 Miles
N

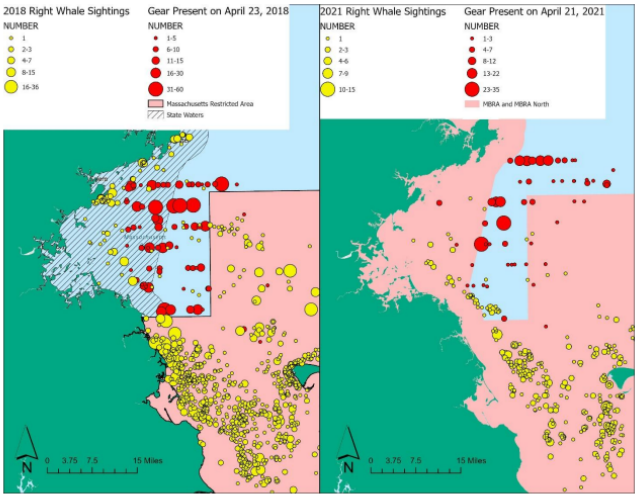

2021 Right Whale Sightings
NUMBER
1
2-3
4-6
7-9
10-15
Gear Present April-May 2021
NUMBER
1
2-6
7-12
13-22
23-35
MBRA and MBRA North
0 3.75 7.5 15 Miles
N

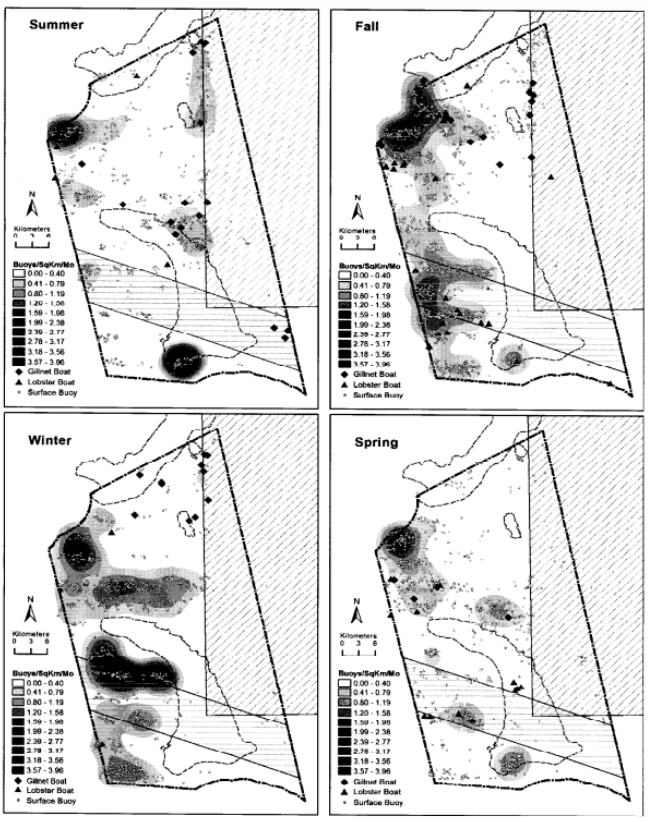
Dear ALWTRT Members,

I am supporting the concerns identified in the Asmutis/ Fuller letter to the ALWTRT dated January 5, 2022. Their concerns are supported by earlier work looking at gear and whales in the Stellwagen Bank National Marine Sancturay (SBNMS, Wiley et al. 2003, attached). I have provided the MADMS maps included in the Asmutis/Fuller letter and maps from Wiley et al. 2003 for comparison. While the SBNMS boundary is not included in the MADMF maps, it is clear that substantial gear has occurred in the area of concern during periods of right whale occupancy since at least the early 2000's (Wiley et al. 2003) and continues to this day (MADMS maps). Of greater importance might be a comparison of the seasonal movement of gear concentration on and off the southwest corner of the Stellwagen Bank. The extremly high summer concentration of gear on the southwest corner identifed in Wiley et al. 2003 is entirely absent during the winter months, with an area to the west exibiting high gear densities that were absent during the summer months. The accepted reason for this gear migration is not to increase lobster catch during this time, but to move gear to deeper, safer water to reduce winter storm damage, while avoiding the effort and difficulty of moving gear to limited land based storage areas (i.e., winter storage). The imporatnace of this is that, rather than moving gear to shore when faced with the existing closures, at least some fishermen can be expected to move gear to the nearest areas that remain open, (i.e., the "wedge" descibed in the Asmutid/Fuller letter), thereby increasing entanglement risk in that area during a time when decreased risk is the goal of MADMF, NMFS and ALWTRT. You will also notice that fishing effort is placed along the closure line on the Western Gulf Of Maine Closed Area. I also note that the MADMF maps show a decrease in gear throughout Massachusetts Bay from 2018 – 2021. This is a major contribution by Massachusetts lobster fishermen to the protection of right whales and should be applauded. I hope that this information helps in our understaning and decision-making.

Sincerely,

David Wiley, PhD
Research Ecologist
NOAA/Stellwagen Bank National Marine Sanctuary


2018 Right Whale Sightings
NUMBER
1
2-3
4-7
8-15
16-36
Gear Present on April 23, 2018
NUMBER
1-5
6-10
11-15
16-30
31-60
Massachusetts Restricted Area
State Waters
0 3.75 7.5 15 Miles
N
2021 Right Whale Sightings
NUMBER
1
2-3
4-6
7-9
10-15
Gear Present on April 21, 2021
NUMBER
1-3
4-7
8-12
13-22
23-35
MBRA and MBRA North
0 3.75 7.5 15 Miles
N


Summer
Fall
Winter
Spring
N
Kilometers
Buoys/SqKm/Mo
0.00 - 0.40
0.41 - 0.79
0.80 - 1.19
1.20 - 1.58
1.59 - 1.98
1.99 - 2.38
2.39 - 2.77
2.78 - 3.17
3.18 - 3.56
3.57 - 3.96
Gillnet Boat
Lobster Boat
Surface Buoy

PAPER

The Distribution and Density of Commercial Fisheries and Baleen Whales within the Stellwagen Bank National Marine Sanctuary: July 2001–June 2002

David N. Wiley, Just C. Moller and Kristin A. Zilinskas
Stellwagen Bank National Marine Sanctuary, Scituate, Massachusetts

David N. Wiley
International Wildlife Coalition, East Falmouth, Massachusetts

ABSTRACT

Research in a national marine sanctuary provides the ability to monitor, assess and understand changes in, and threats to, the area. In July 2001, the Stellwagen Bank National Marine Sanctuary undertook a year-long study to quantify and map patterns of human and marine mammal use. Data were collected during monthly standardized shipboard surveys that bisected the Sanctuary at 5 km (2.5 nm) intervals. We used a subset of those data and ArcView's Spatial Analyst program to conduct an analysis of the density and distribution of fixed gear (trap and gillnet) fisheries, mobile gear (otter trawl and scallop dredge) fisheries and baleen whales. We used this to develop a "user geography" of the Sanctuary based on patterns of use and identify high use areas that might pose the risk of environmental damage. We also used ArcView to develop an index of Relative Interaction Potential (RIP) to identify where baleen whales might become entangled in fishing gear; a known threat within the Sanctuary. The RIP identified a number of areas that stood out in terms of entanglement risk. Information from the study will allow managers to identify future changes in Sanctuary use and investigate current areas of intense use for potential harm.

INTRODUCTION

National Marine Sanctuaries (NMS) are ocean areas of special national significance whose protection and beneficial use require comprehensive management and planning. The primary goal of the NMS program is to protect the designated area's resources. However, multiple uses are allowed if such uses are consistent with the sanctuary's primary goal of resource protection. Because resource protection and resource use are often in conflict, considerable information is needed if legitimate planning and defensible management are to occur, and resources are to be protected in the face of exploitation.

One of the main suites of information needed for successful management and planning is the spatial and temporal distribution of various activities that take place within a sanctuary and the levels at which they occur. Such information can then be used as a baseline against which to measure future changes and to investigate the degree to which such uses might interact with sanctuary resources or other user groups. Unfortunately, few sanctuaries have such data to guide their decision-making. Most information available to managers is either collected at scales that make its application to sanctuary management questionable or is largely anecdotal. Because sanctuary decisions are often embedded in controversy, such information frequently creates, rather than informs, debate. If good decisions depend on good science, better and more rigorous information must be available to decision-makers (Lubchenco, 1995; Caughley and Gunne, 1996).

The productive waters encompassed by the Stellwagen Bank National Marine Sanctuary (SBNMS or Sanctuary) are home to an impressive array of marine life and are utilized by an equally impressive array of user groups. Public input has indicated high levels of concern over environmental issues such as the potential for habitat degradation by mobile fishing gear and the entanglement of baleen whales in fixed fishing gear. However, few data have been available to help guide Sanctuary management on such topics. In July of 2001, the SBNMS initiated a year-long study with the goal of determining the spatial and temporal distribution of human activity, marine mammals, and selected fish species. In this paper, we used a subset of those data to investigate the spatial and temporal densities of:

1. fixed gear fishing effort (i.e., gillnet and trap fisheries),
2. mobile gear fishing effort (i.e., otter trawl and scallop dredge fisheries), and
3. baleen whales; i.e., humpback (*Megaptera novaeangliae*), right (*Eubalaena glacialis*), fin (*Balaenoptera physalus*), and minke (*Balaenoptera acutorostrata*) whales.

We used those data to depict the "user geography" of the SBNMS and alert managers to areas where intense use or co-occurrence might signal potential harm to sanctuary resources.

METHODS

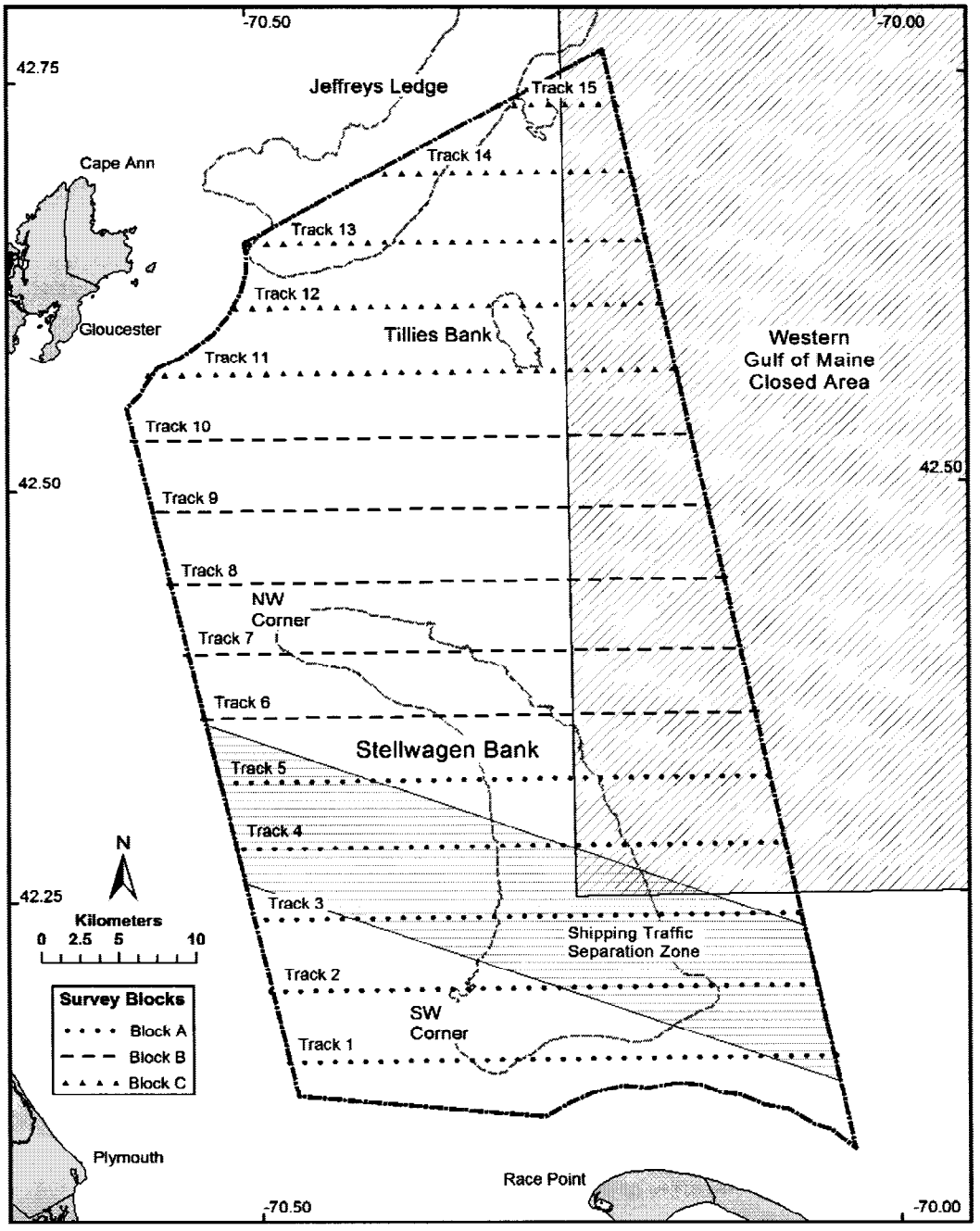
Study Area—The SBNMS (Figure 1) covers an area of 2,181 km^2 (842 mi^2) in the southwest Gulf of Maine. It is an offshore sanctuary, with its boundary being ~ 5.5 km (3 nm) north of Race Point (Provincetown), MA, ~ 5.5 km (3 nm) southeast of Cape Ann (Gloucester), MA and 46 km (25 nm) east of Boston, MA. The area's main bathymetric feature is Stellwagen Bank, a curved glacial moraine that is almost 37 km (20 nm) in length and over 11 km (6 nm) in

width at its widest point. Water depths over and around the bank range from 20 to 90 m (65 to 300 ft). To the north of the bank is deeper water (180 m or 600 ft) that rises to ~ 60 m (200 ft) where the Sanctuary border intersects Jeffreys Ledge. There are also numerous smaller bathymetric features. Within this area are seabed types ranging from muddy and sandy bottoms to extensive areas of gravel or small boulder fields (Valentine et al., 2001). The area is home to some of the largest aggregations of baleen whales along the United States' eastern seaboard (Anon., 1982) and is used extensively by commercial fisheries and recreational interests.

Data Field Collection

Survey Design—To determine the spatial and temporal densities of marine mammals and human activities within the SBNMS, we conducted monthly standardized shipboard surveys along 15 designated tracklines that bisected the Sanctuary in an east/west direction and ran approximately perpendicular to Stellwagen Bank (Figure 1). Track 1 was the southernmost

Figure 1. The Stellwagen Bank National Marine Sanctuary showing survey blocks and tracklines. Monthly survey of tracklines was conducted from July 2001 through June 2002.



line and track 15 was the most northern line. Because the SBNMS is irregularly shaped, tracklines were not of equal length. Track lengths were 37 km (20 nm) for line numbers 1–11, 27 km (14.5 nm) for line numbers 12 and 13, ~17km (9 nm) for line number 14, and 7 km (4 nm) for line number 15. Total track length was 485 km (262 nm). Tracklines were separated by 5 km (2.5 nm) and survey speed was 12–13 knots. Observations were limited to sea states of ~ Beaufort 4 or less.

Three days were required to complete each month's survey. Trackline coverage was not random. Tracks were grouped into 3 blocks (Figure 1): Block A; tracklines 1–5 (181 km or 97.5 nm of trackline), Block B; tracklines 6–10 (181 km or 97.5 nm of trackline), and Block C; tracklines 11–15 (114 km or 61.5 nm of trackline). Each block required one survey day to complete (including transit time). The order in which blocks were surveyed was determined by prevailing weather conditions and the previous month's survey pattern. Because of weather conditions, survey days were not consecutive, nor were all tracks surveyed in every month (see results).

Observation Platforms—Two observations platforms were used in the study: the *F/V Wavelength* and the *M/V AndyLynn*. The *F/V Wavelength* was a 10 m (32 ft) lobster style boat with an elevated (6 m) "tuna tower" from which observations were made. The *F/V Wavelength* was used for the July and August 2001 surveys. All other surveys were conducted from the *M/V AndyLynn*, a 20 m (65 ft) party fishing boat. Observations from the *M/V AndyLynn* were made from the upper bridge, which was 6 m above the water.

Sighting Categories—We grouped sightings into five major categories. These were: Marine Mammals, Fish, Commercial Fishing Vessels, Vessels (including commercial shipping), and Fixed Fishing Gear. Each category consisted of an assortment of identifiers likely to be encountered during surveys. For example, the Commercial Fishing Vessel category consisted of Stern Trawler[1], Side Trawler[2], Scallop Dredge, Gillnet Boat, Lobster Boat, Longline Boat, Unidentified, and Other. A vessel's identity was inferred from its observed deck configuration. To confirm identifications, we photographed vessels whenever possible. Differentiation was made between vessels transiting an area and those actively engaged in their trade at the time of observation. Marine mammal and fish identification was made from characteristic field markings.

Data Collection—Data were collected using line transect methodology (Burnham et al., 1980). The data collection team consisted of three people: two observers and a recorder/observer. Briefly, two observers each searched a 90° portion of a 180° field. The 180° field consisted of a semicircle extending from midship on the starboard side of the survey vessel, forward to midship on the port side of the survey vessel. When not recording, the recorder acted as a roving observer covering the full 180° arc. Observations were made with the unaided eye and with 7 x 50 power binoculars. Observer stations were rotated at the end of each trackline or at ~30 min intervals during adverse weather conditions (e.g. some winter surveys).

Sightings were recorded on hand–held computers using a data collection program similar to that described in Garrett-Logan and Smith (1997) and provided by the NOAA Fisheries[3]. At each sighting, the recorder documented its time (to the nearest second), identity, estimated radial angle from the ship's heading, estimated distance, number of objects in the sighting (high, low and best estimate), and behavior. For stationary or slow moving surface objects (e.g., fixed gear surface markers or slow moving vessels) radial angles were taken at right angles to the vessel's heading (90° or 270°). For ephemeral or fast moving objects (e.g., marine mammals or sport vessels) radial angles were recorded at the time of sighting. Distances were determined by visually estimating the distance to the sighted objects with the aid of range finding binoculars. Estimates to larger objects were aided by the use of radar, which also provided constant feedback for determining the accuracy of visual estimates to smaller objects that failed to appear on radar (e.g., surface buoys or marine mammals).

Data Processing and GIS Analyses

Determination of the latitude and longitude for sighted objects—The latitude and longitude of sighted objects were calculated using the bearing and range of the object from the ship's location. The ship's location, heading and speed were recorded at five-second intervals using a laptop computer containing "The Cap'n" software[4] interfaced with a Garmin GPS 48 Navigator. Synchronized time stamps from the hand-held computers (containing sightings) and the laptop (containing vessel latitude/longitude) were used to find the five-second-interval location closest to the time of sighting. This provided the ship's heading and location at the time of the sighting. Deviations by the ship away from the trackline's true east/west orientation were mathematically corrected for and a true bearing to the sighted object was calculated using the radial angle to the sighting. The latitude and longitude of the sighted object were then calculated using the ship's position and the range and corrected bearing to the object.

For analyses, we used a subset of the sighting categories and collapsed those we used into three broad grouping: (1) Baleen Whales, (2) Fixed Fishing Gear, and (3) Mobile Fishing Gear. The Baleen Whale category consisted of humpback, right, fin, and minke whales. The Fixed Fishing Gear category consisted of bullet buoys, high flyers, floatballs, and various combinations of the three (e.g., highflier with a floatball). For the Fixed Fishing Gear category, we also included the location of individual gillnet and lobster (trap fishing) boats. This was necessary because the use of a particular style of surface buoy is not necessarily unique to either the gillnet or trap fishery. The inclusion of these fishing vessels provided insight into which fishery the buoys were likely to belong. The Mobile Fishing Gear category included stern trawlers, side trawlers and scallop dredges. Stern trawlers with cable in the water, but nets on their net-reels were considered scallop dredges. Only vessels active in their trade at the time of observation were included in the study.

GIS Spatial and Temporal Density Analysis—To provide an indication of the relative abundance and distribution of the various categories, we grouped sightings into 12-month and seasonal time periods. Seasons were: summer; July, August and September, fall; October, November and December, winter; January, February and March, and spring; April, May and June. Within these periods, all tracklines were not equally surveyed. To correct for differences in effort, we partitioned sightings into strips of 2.5 km (1.25 nm) on either side of a trackline (the effective search area during a survey). For each time period, we divided each sighting within these strips by the number of times the trackline was surveyed, thereby calculating a sightings/month value for each object. We did not correct for differences in sighting probabilities relating to distance from the trackline or sea state. The resulting data were investigated using Geographic Information Systems (GIS) technology (ArcView 8.2) by converting them into a personal geodatabase format with feature classes created from the individual records. These were georeferenced to conform to the Massachusetts State Plane coordinate system (North American Datum, 1983, Lambert Conformal Conic projection) for compatibility with datasets from other sources.

ArcView's Spatial Analyst extension was used to create density surfaces that identified where sightings (e.g., fishing vessels or whales) were concentrated and provided a prediction of their distribution (ESRI, 2001). Density surfaces were created using the Kernel Density function. Values were calculated in square kilometers with an output raster cell size of 100 m^2 and a search radius of 5000 m. It is important to note that the resulting densities are greatly dependent on the search radius chosen. For example, larger search radii can link sightings over a larger area, but "dilute" heavy, localized concentrations. Smaller search radii can provide a more accurate quantification of localized densities, but reduce the analysis' ability to provide a broad understanding of patterns over a wider area. Our choice of a 5000 m search area was a compromise between these factors, with an emphasis on the goals of identifying the broader patterns of uses occurring within the Sanctuary and providing a baseline against which future changes could be measured.

Once the density areas were calculated, the range of density values was divided into ten equal interval classes. The relative large number of classes was selected in order to provide a better visualization of the data range and the areas of different use concentrations. For a category's seasonal maps, we used the season with the greatest range of densities as the basis for creating the classes for all other seasons. This allowed densities and patterns to be compared among seasons. However, as explained above, within each density surface are areas of higher and lower concentrations than reported in the accompanying class boundaries. For all maps, we provided the sightings data from which the density contours were calculated. In some cases a single sighting contained multiple objects. This was particularly common for surfaces buoys in the northwest portion of the Sanctuary and on Stellwagen Bank's southwest corner in the summer when gear aggregations were extremely dense.

GIS Interaction Potential Analysis—To investigate the potential for interaction between the Baleen Whale and Fixed Fishing Gear categories, we developed an index of Relative Interaction Potential (RIP). To derive the RIP, we created a matrix of five-minute grid cells that covered the SBNMS. The grid matrix was generated using the ArcInfo's *Generate* command and *Fishnet* option. Within each grid cell, we multiplied the total number of sighted objects within the two categories being investigated[5]. This resulted in a range of numbers for each grid cell that represented the potential for interaction. For example, if a grid cell had no whales (a zero value) and any number of fixed gear, the resulting value is zero or no probability of interaction. The same result would occur for any number of whales and no fixed gear. At the other extreme, if a grid cell had a large number of whales and a large number of fixed gear, a large index value would be calculated representing a much higher potential for interaction. To normalize the result, the index values were divided by the area within the grid cells.

For comparisons, we aggregated grid cell values into quartiles.

RIPs were calculated for the 12-month period and on a seasonal basis. For seasonal RIPs, we used the season with the greatest range of interaction potentials as the basis for creating the four classes upon which other seasons were based. This allowed RIPs to be compared among seasons. For greater visualization, we provided the sightings data from which the RIPs were calculated.

RESULTS

Survey Effort—For the twelve-month period July 2001–June 2002, a total of 5,700 km (3,078 nm) miles of trackline were available to be surveyed, of which 4,460 km (2,408 nm) miles (78%) were completed. Tracks 1–3 had the greatest coverage (92%) and tracks 11–14 had the least (58%) (Table 1). By month, survey coverage was greatest in July, October, April, and June (100%) and least in February (30%) (Table 1). For the entire survey area, the number of track-miles surveyed did not differ significantly by season (ANOVA F=2.86, P=0.104). However, considerably less trackline was covered during the winter months. Percent trackline coverage by season was: summer; 83%, fall; 87%, winter; 51%, and spring; 92%.

Sightings—The analyses is based on 6,526 sightings of 9, 991 objects (a sighting could contain multiple objects). The totals by category were: Fixed Gear; 4,963 sightings of 6,130 surface buoys, Gillnet Boats; 55 sightings of 56 boats, Lobster Boats; 100 sightings of 101 boats, Mobile Fishing Vessels; 187 sightings of 189 vessels, and Baleen Whales; 352 sightings of 414 animals.

Spatial and Temporal Density–Fixed gear fishing effort (gillnet and trap fisheries)

Twelve-month summary—Numerically, fixed fishing gear was the dominant human use of the SBNMS and it occurred throughout the Sanctuary (Figure 2). Density surfaces ranged from a high of 1.73–1.92 surface bouys/km^2/month around the southwest corner of Stellwagen Bank and the northwest section of the Sanctuary off Cape Ann, to lows of 0.0–0.19 surface bouys/km^2/month, primarily in the southeastern section of the Sanctuary. The dense areas coincided with the presence of trap fishing vessels, suggesting concentrations of fishing gear targeting lobster or, in some cases, crab.

In general, the density of fixed fishing gear was greatest in the western portions of the Sanctuary and diminished to the east. The presence of trap fishing vessels was also greatest in the western portions of the Sanctuary, suggesting that much of this activity was associated with the lobster/crab fishery. While the level of fixed fishing activity decreased to the east, substantial levels of use still occurred there. These levels were highest (~0.2–0.6 surface bouys/km^2/month) in an area northeast of Stellwagen Bank and along a line delineating the Western Gulf of Maine Closed Area[6] (WGMCA), an area closed to groundfishing

Table 1. Coverage of survey tracklines by month, season and year. Dark blocks signify surveyed tracklines and white blocks signify tracks that were not surveyed. Each month's survey consisted of 15 tracklines totalling 475km (256nm). Surveys occurred within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002.

		Track Line															
		Block 1					Block 2					Block 3					
Season	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Percent of Survey Area Completed by Month
Summer	July '01	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	100
	August	■	■	■	■	■	■	■	■	■	■	□	□	□	□	■	78
	September	■	■	■	■	■	■	■	■	■	□	□	□	□	□	■	70
Fall	October	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	100
	November	■	■	■	□	□	■	■	■	■	■	■	■	■	■	■	85
	December	■	■	■	■	■	□	□	□	■	■	■	■	■	■	■	77
Winter	January '02	□	□	□	■	■	■	■	■	■	□	□	□	□	□	□	38
	February	■	■	■	■	□	□	□	□	□	□	□	□	□	□	□	30
	March	■	■	■	□	□	■	■	■	■	■	■	■	■	■	■	85
Spring	April	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	100
	May	■	■	■	■	■	■	■	■	■	■	□	□	□	□	□	76
	June	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	100
Percent of Track Surveyed for the Year		92	92	92	83	83	75	83	83	83	83	58	58	58	58	75	

(e.g., Atlantic cod (*Gadhus morhua*)). These areas coincided with the presence of gillnet fishing vessels, indicating that this fishery occurred primarily in the eastern and northern portions of the Sanctuary. With the exception of the southwest corner of Stellwagen Bank, there was a tendency for fixed gear not to be associated with the shoal water of Stellwagen Bank itself.

Seasonal summary—There were substantial seasonal changes in the level and distribution of surface buoys indicating the presence/absence of fixed fishing gear (Figure 3). The densest aggregation occurred during the summer months around the southwest corner of Stellwagen Bank (3-4 surface bouys/km²/month). This aggregation persisted at reduced levels in the spring and fall (~1 surface

Figure 2. The density and distribution of surface buoys within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each point represents the sighting of one or more surface buoys. Surface buoys are indicators of fixed fishing gear (trap or gillnet)"sets" that can extend thousands of meters along the seafloor. Two surface buoys equals one set. Trap and gillnet sets cannot be unambiguously differentiated by surface buoys. Sightings of actively fishing lobster (trap) and gillnet vessel are provided as an aid to determining the type of gear in an area.

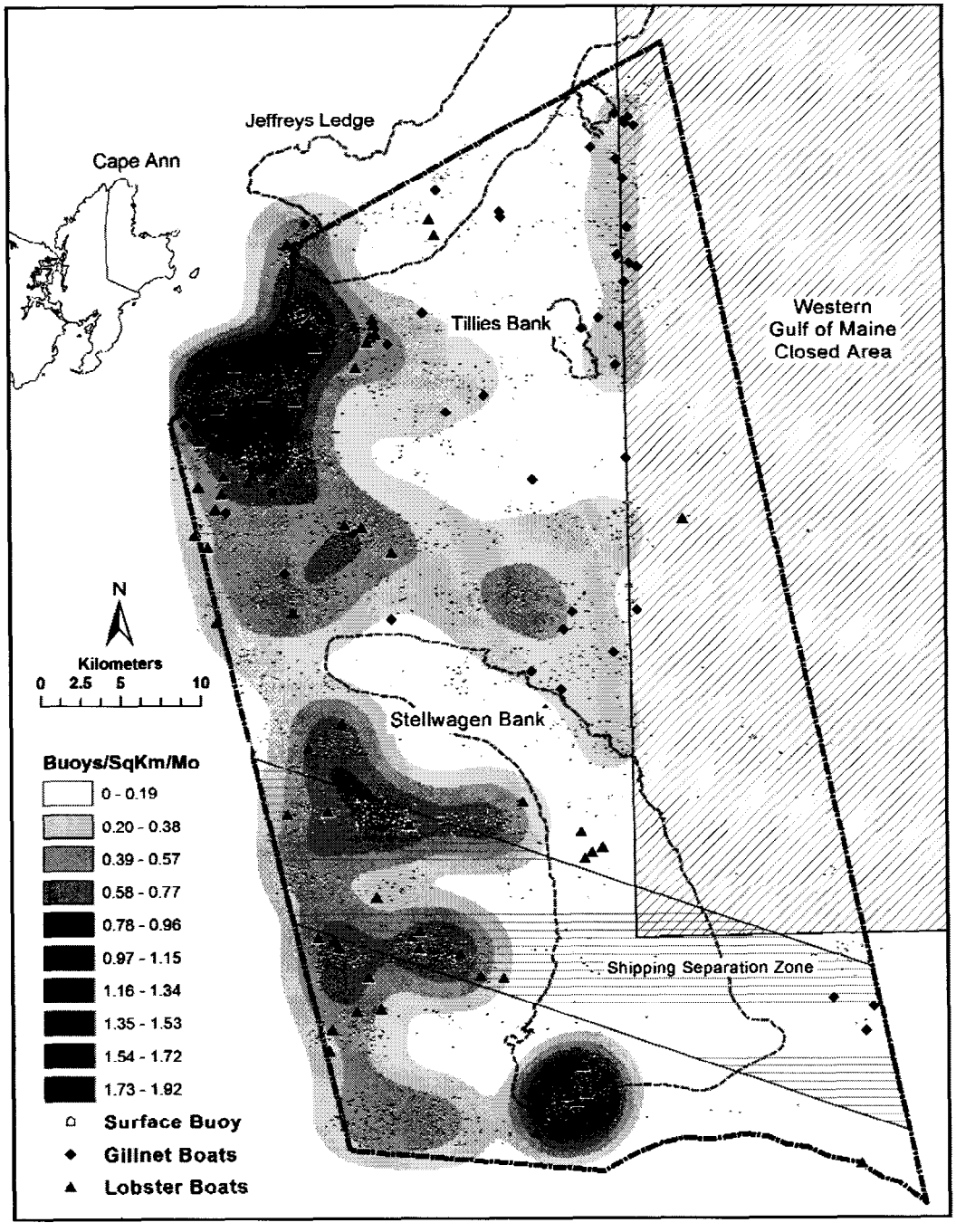
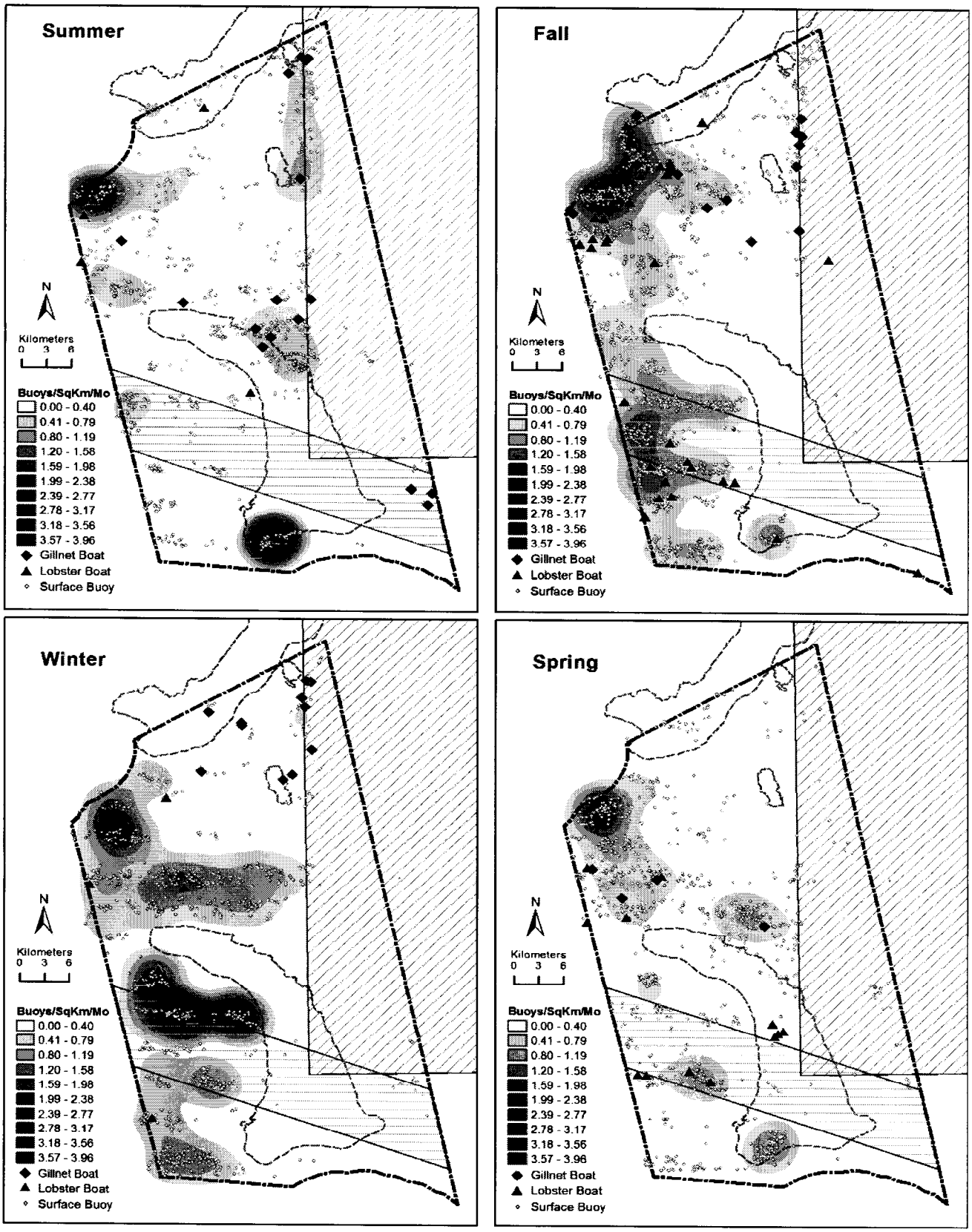


Figure 3. The seasonal density and distribution of surface buoys within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each point represents the sighting of one or more surface buoys. Surface buoys are indicators of fixed fishing gear (trap or gillnet)"sets" that can extend thousands of meters along the seafloor. Two surface buoys equals one set. Trap and gillnet sets cannot be unambiguously differentiated by surface buoys. Sightings of actively fishing lobster (trap) and gillnet vessel are provided as an aid to determining the type of gear in an area.

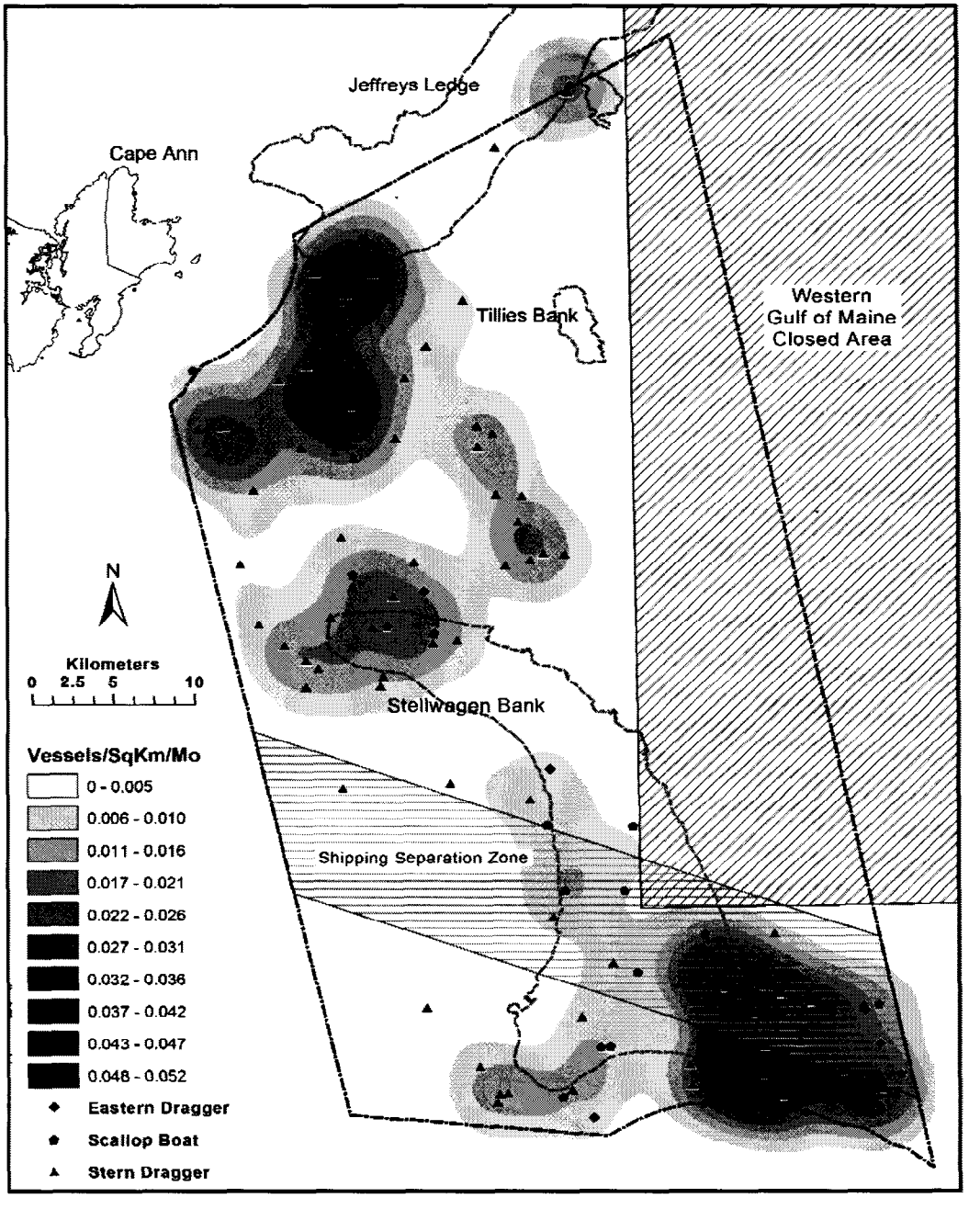


bouys/km²/month), but was absent during the winter months. Another dense seasonal aggregation occurred in the northwest section of the Sanctuary during the spring, winter and fall (~1–2 surface bouys/km²/month). A third concentration occurred during the winter in an area to the west of Stellwagen Bank. Excluding the high use area around the southwest corner of Stellwagen Bank, fixed gear was most abundant in the Sanctuary during the fall, winter and spring and was primarily associated with trap vessels.

Spatial and Temporal Density—Mobile fishing effort

Twelve-month summary—There were two major concentrations of mobile fishing vessels (Figure 4). The densest aggregation (0.048–0.052 vessels/km²/month) occurred in the southeast section of the Sanctuary. The primary vessels associated with that area were scallop dredges, although substantial numbers of stern and eastern trawlers also worked the area. A second aggregation occurred over a broad area covering

Figure 4. The density and distribution of mobile fishing vessels (stern dragger, eastern dragger and scallop dredge) within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each point represents the sighting of an active fishing vessel.



the Sanctuary's northwest quarter and consisted primarily of stern and eastern trawlers. Monthly densities in this region ranged up to 0.036 vessels/km²/month. With the exception of the heavily used portion in the southeast corner, mobile vessel's made less use of the Sanctuary's eastern section and the shallower area on top of Stellwagen Bank proper.

Seasonal Summary—The major use areas identified in the 12-month summary were retained on a seasonal basis (Figure 5). The southeast segment was used in all seasons, with scallop vessels most prevalent in winter and summer. Stern and eastern trawlers remained active in the northwest section, with a tendency to move further offshore in the spring.

Spatial and Temporal Density—Baleen Whales

Twelve-month summary—The highest use area for baleen whales was around the southwest corner of Stellwagen Bank (0.11–0.12 whale/km²/month), followed by the area around Jeffreys Ledge (~0.08–0.09 whale/km²/month) (Figure 6). Other areas of concentration occurred around the southeast and northwest corners of Stellwagen Bank (0.05–0.06 whale/km²/month and 0.02 -0.04 whale/km²/month, respectively).

Seasonal Summary—The greatest concentrations of baleen whales occurred during the summer months around the southwest corner of Stellwagen Bank (0.36–0.39 whale/km²/month) and Jeffreys Ledge (0.25–0.28 whale/km²/month) (Figure 7). Other high use areas by season were: fall; southeast corner of Stellwagen Bank (0.13–0.16 whale/km²/month), winter; a small area in the Sanctuary's northeast quarter (0.36–0.39 whale/km²/month)[7] and spring; Jeffreys Ledge (0.13–0.16 whale/km²/month/month).

Interaction Potential—Baleen Whales and Fixed Fishing Gear

Twelve-month summary–The highest potential for interaction between baleen whales and fixed fishing gear (top quartile 5-minute blocks) were the areas around the southwest and northwest corners of Stellwagen Bank (Figure 8). These areas consisted of six, 5-minute blocks around the Bank's southwest corner and three 5-minute blocks around the northwest corner. Second-level interaction areas were located in the northern portion of the Sanctuary along the southern border of Jeffreys Ledge (three 5-minute blocks),a one 5-minute block section in the southeast portion of the Sanctuary, and a five, 5-minute block area that was contiguous with the high RIP areas of the northwest and southwest corners of the Bank. The highest RIPs occurred around the southwest corner of the Bank.

Seasonal summary–The greatest areas of top ranked RIPs occurred during the spring and summer around the southwest and northwest corners of Stellwagen Bank, with each season possessing five top ranked index areas (RIP = 3.34–98.28) (Figure 9). The fall exhibited two top ranked index areas, one on western Jeffreys Ledge and one in the most southwestern portion of the Sanctuary. There were no top ranked RIP areas during the winter season. The southeastern section of the Sanctuary consistently exhibited the lowest RIPs in all seasons.

DISCUSSION

Fulfilling a sanctuary's dual mandate of multiple use and resource protection requires an understanding of how human activities are conducted, how those activities might impact the environment, and where and at what levels they occur. To that end, we provide a brief description of each fishery and its reported potential environmental impacts. We then use the survey results to describe patterns of use and identify areas that might be at risk of harm. We also used the RIP index to identify where baleen whales might be at the greatest risk of entanglement and suggest ways to mitigate such interactions.

We offer a number of caveats to this discussion. First, there is no known metric equating the density of fishing effort with environmental harm and the degree to which Sanctuary resources might be impacted, if at all, is unknown. Second, the reported fishing effort and distribution must be viewed with knowledge of the concurrent fisheries management regime, such as the patchwork of closures implemented by the New England Fisheries Management Council (NEFMC) to reduce groundfishing effort (Table 2) and the year-round Western Gulf of Maine Closed Area. Changes in fisheries management will undoubtedly change current fishing patterns. Finally, even long-term monitoring data are more powerful in explaining the past than predicting the future (Bondrup-Nielson and Herman, 1995). Our data provide a valuable snapshot of occurrences within the SBNMS from July 2001–June 2002. The degree to which they reflect previous or future occurrences is unknown.

DESCRIPTION OF FISHERY TYPES

Fixed Gear Fisheries

Trap Fishery—Trap fisheries employ a passive methodology in that traps sit on the seabed and

Figure 5. The seasonal density and distribution of mobile fishing vessels (stern dragger, eastern dragger and scallop dredge) within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each point represents the sighting of an active fishing vessel.

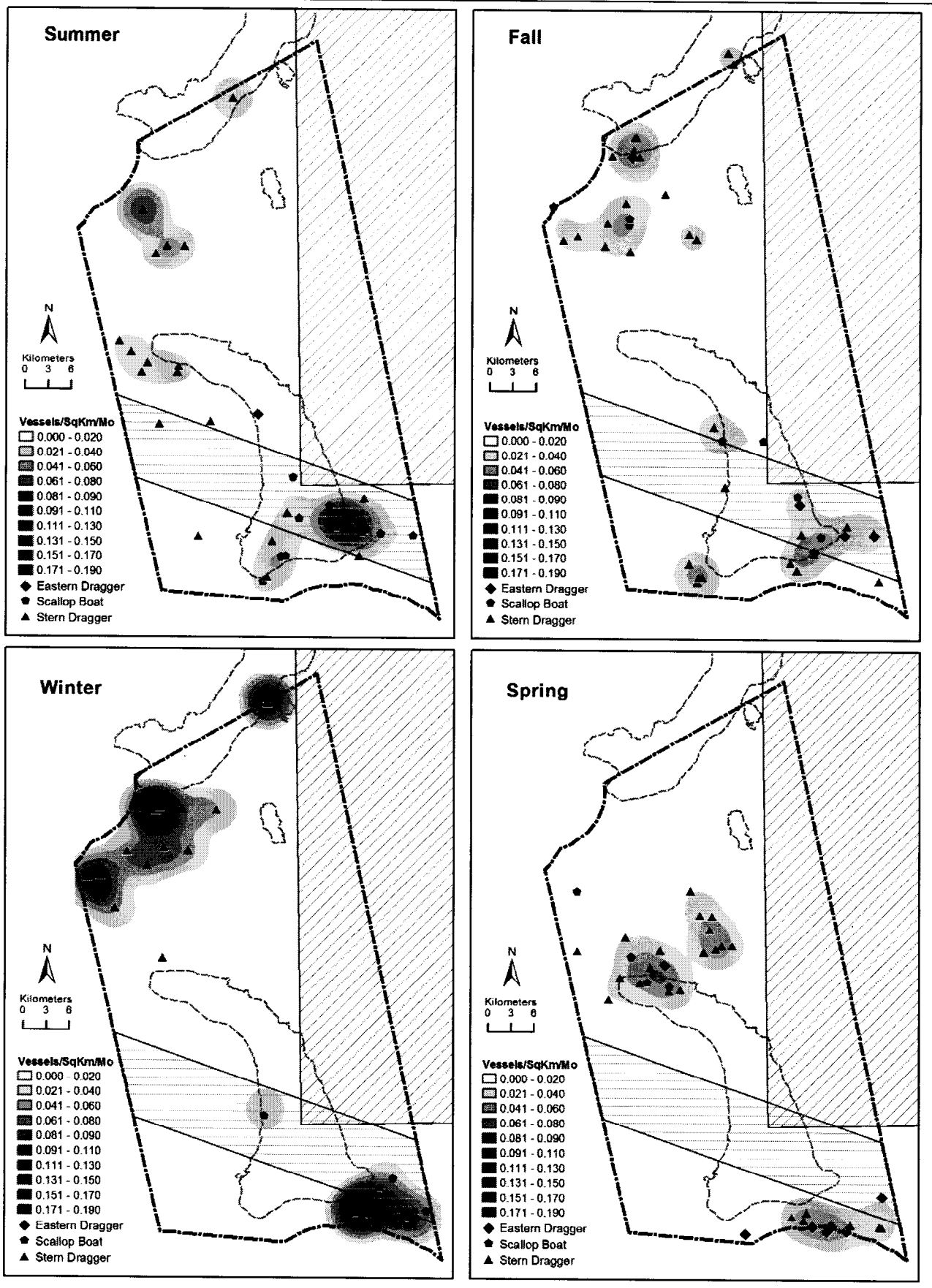
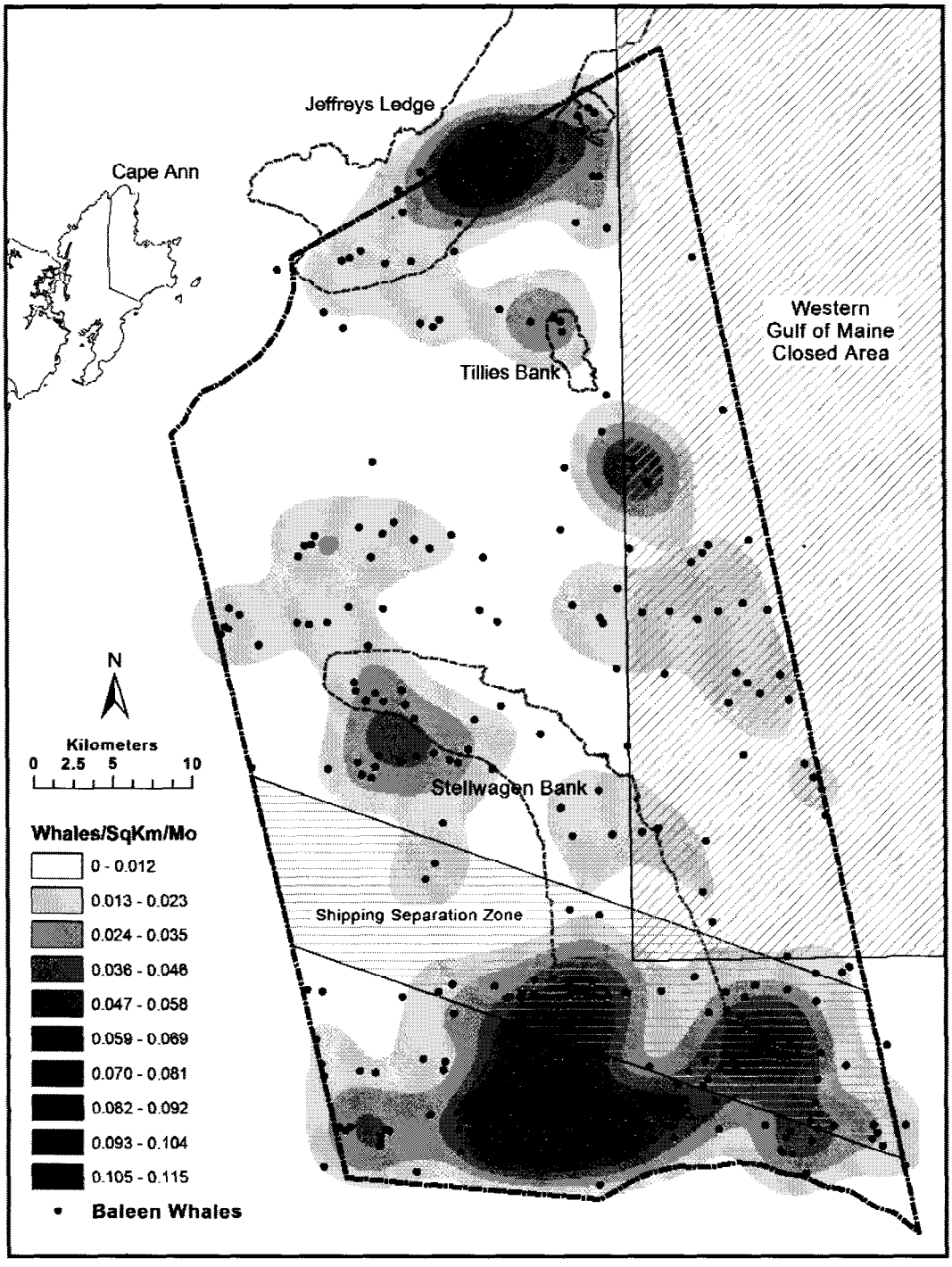


Figure 6. The density and distribution of baleen whales; i.e., humpback *(Megaptera novaeangliae)*, right *(Eubalaena glacialis)*, fin *(Balaenoptera physalus)*, and minke *(Balaenoptera acutorostrata)* whales, within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each point represents the sighting of one or more whales.



use bait (usually dead fish) to attract lobsters, and to a lesser extent crabs, to the traps. Traps are wire or wooden cages that typically measure 91 cm by 53 cm by 34 cm (36 in by 21 in by 13.5 in), although some can be larger. Traps are often fished in "trawls" consisting of a number of traps leading off a common "ground line". In the area around the SBNMS, trawls typically consist of ~ 25 traps spaced 30–55 m (100–180 ft) apart (W. Hoffman, Massachusetts Division of Marine Fisheries, Boston, MA, Pers. Comm.) Therefore a single trawl can be over 1,219 m (4,000 ft) in length. Ground lines along the length of the trawl characteristically consist of buoyant polypropylene line that can float more than 5 m (16 ft) above the bottom (McKiernan et al., 2002). On each end of a trawl, a "buoy line" runs from the gear to a

Figure 7. The seasonal density and distribution of baleen whales; i.e., humpback *(Megaptera novaeangliae)*, right *(Eubalaena glacialis)*, fin *(Balaenoptera physalus)*, and minke *(Balaenoptera acutorostrata)* whales, within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each point represents the sighting of one or more whales.

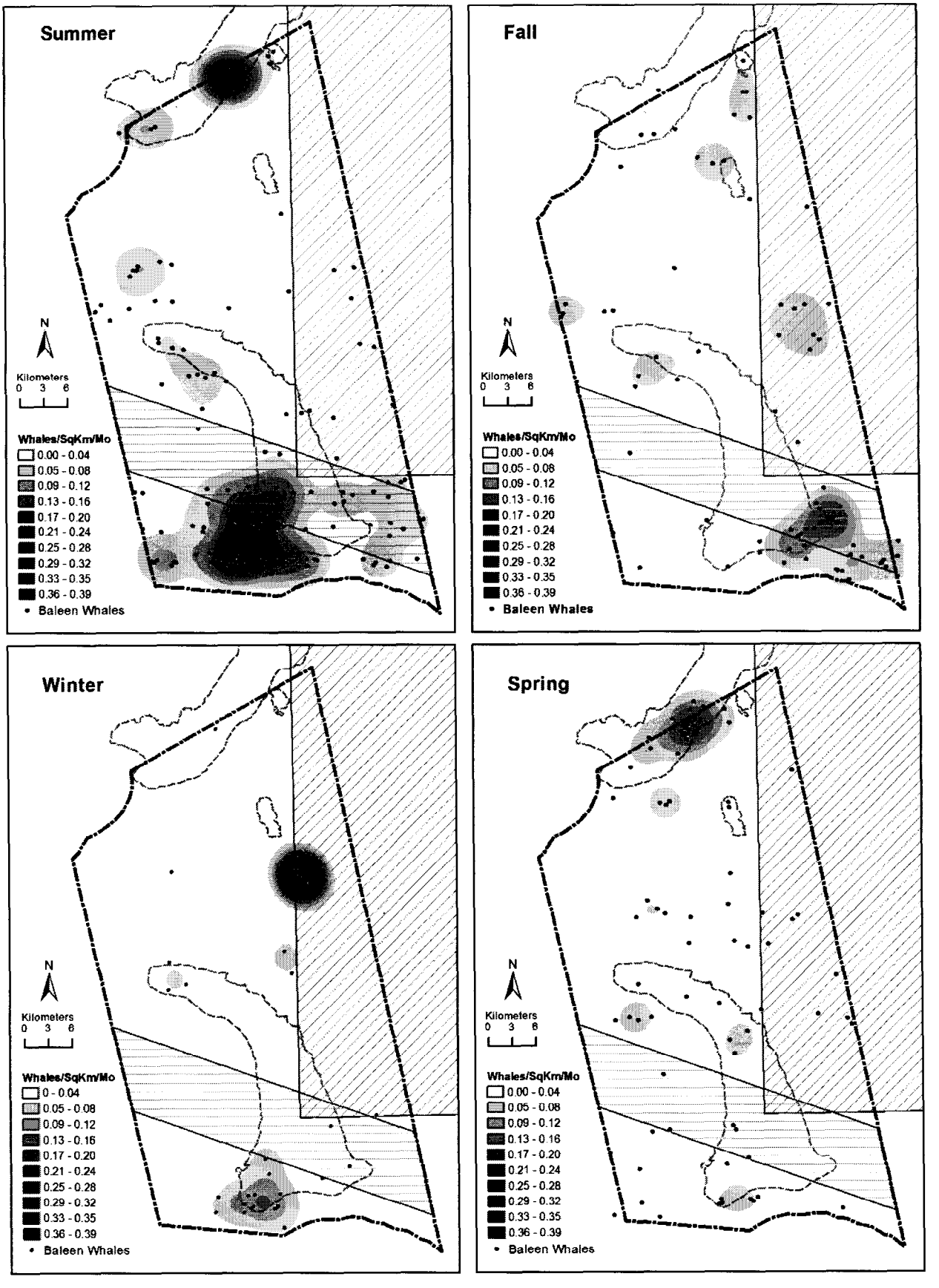
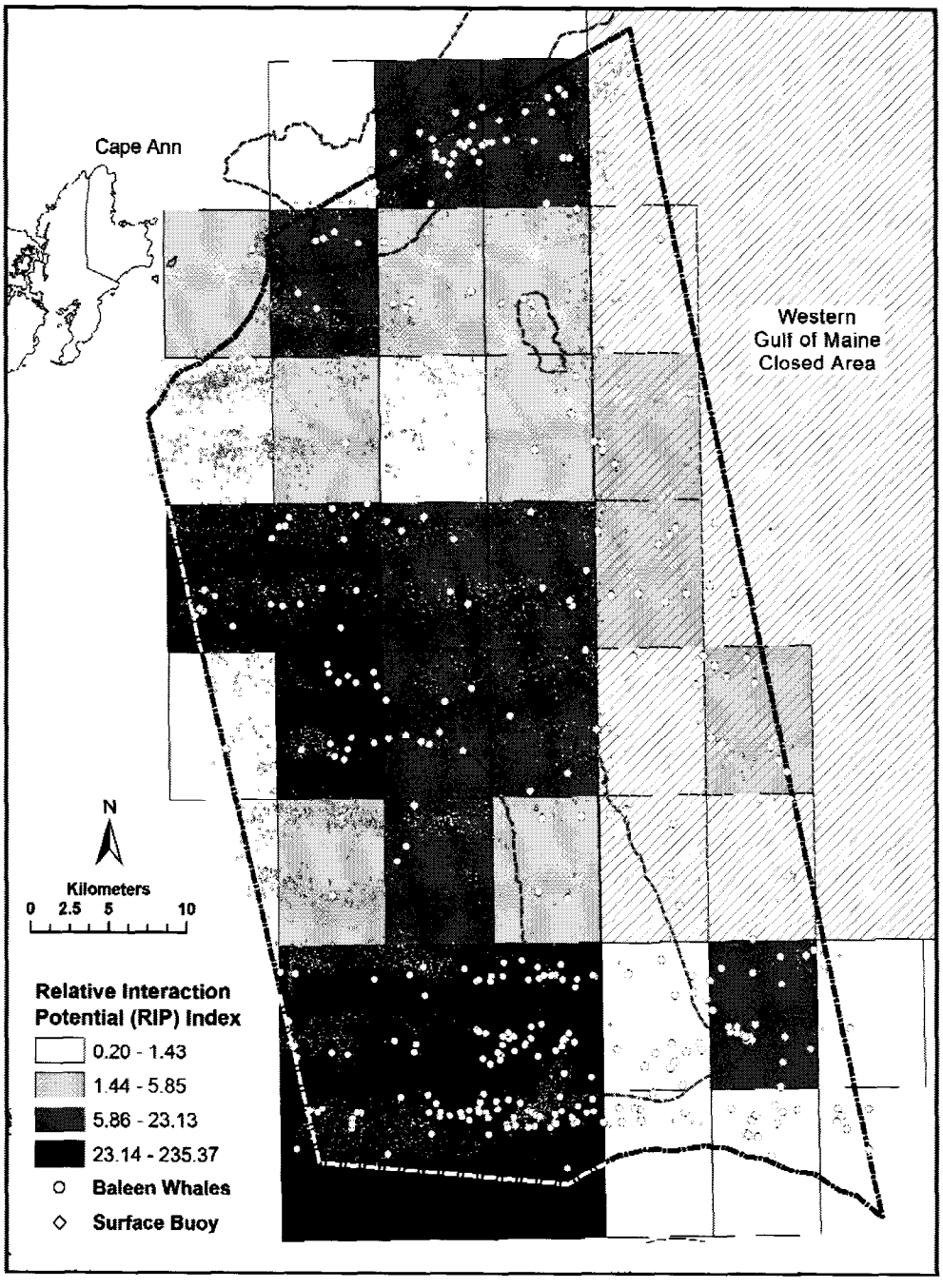


Figure 8. Relative Interaction Potential (RIP) index showing the potential for interaction between baleen whales and fixed fishing gear, by 5-minute square area. The index was calculated by multiplying the total number of fixed gear surface buoys within a 5-minute square by the total number of whales sighted in that square. Results were compared by quartile. Data were collected from July 2001 through June 2002.



buoy visible at the surface (i.e., the surface buoy). It is important to note that the surface buoy counts provided in our results represent unseen fishing gear on the seafloor. As described above, two surface buoys might indicate the presence of over 1,219 m (4000 ft) of lobster gear. Since 1990, the lobster fishery has ranked first in landed fish value for New England waters (Pol and Carr, 2000).

Environmental Issues of Trap Fisheries—Lobster/crab traps are a passive fishing gear that has minimal impact on the seabed. In addition, they pose minimal threat to small cetaceans such as porpoise and dolphins, or seabirds. The fishery also has a number of mechanisms that allow it to achieve substantial selectivity. For example, traps are fitted with an escape panel along a lower edge that allows

Figure 9. Seasonal Relative Interaction Potential (RIP) indexes showing the potential for interaction between baleen whales and fixed fishing gear, by 5-minute square area. The index was calculated by multiplying the total number of fixed gear surface buoys within a 5-minute square by the total number of whales sighted in that square. Class ranges were developed by taking the quartiles for the season with the greatest range in RIP values (summer) and applying them to all other seasons. Data were collected from July 2001 through June 2002.

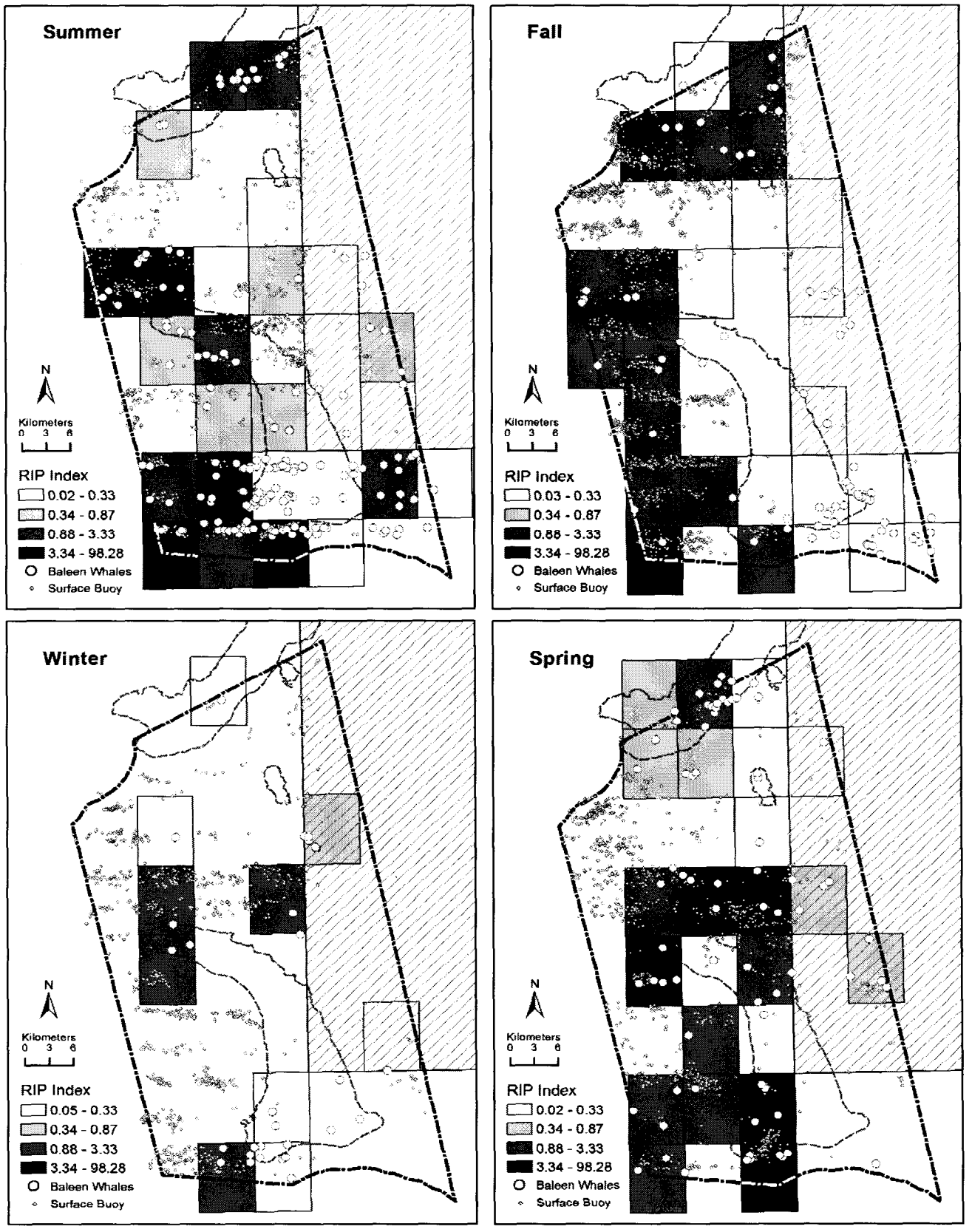


Table 2. Groundfish closures within the Stellwagen Bank National Marine Sanctuary by month. Closures were instituted by the New England Fishery Management Council to recovery depleted groundfish stocks.

Area	Closure Dates
Entire Sanctuary	1 – 30 April
North of 42° 30' 00"	1 – 31 May
South of 42° 30' 00"	1 October – 30 November 1 – 28 February 1 – 31 March

sub-legal size animals to pass through it. In addition, because lobsters are live captured, immatures or females brooding eggs can be returned to the water unharmed. Traps are also fitted with corrodible links which cause lost traps to fall apart, limiting the time spent as ghost fishing gear.

A drawback to the fishery is its interaction with baleen whales. Right, humpback, fin, and minke whales are all known to become entangled in the buoy lines running from traps to the surface or in the groundlines floating off the bottom between traps (Waring et al., 2001, Kenney and Hartley, 2001). This issue is most severe for the highly endangered right whale. Unless anthropogenic mortality in this species is reduced, it is projected to become extinct within ~ 200yrs (Caswell et al., 1999) and lobster gear has been identified as a major threat to the species (50CFR229.32). As a result, NOAA Fisheries has promulgated the Atlantic Large Whale Take Reduction Plan to reduce the incidental take of baleen whales in the lobster fishery, with a focus on right whale protection (50CFR229.32).

Distribution and Seasonality of Trap Fishing Gear—The trap fishery was focused on the western half of the Sanctuary. A dense aggregation of traps existed in the Sanctuary's most northwestern section (just off the coast of Cape Ann, MA) with areas of decreasing density radiating out from that hub. Trap fishing was the dominant commercial fishery in the southwestern portion of the Sanctuary, with a particularly dense area located on the southwest corner of Stellwagen Bank.

With the exception of the dense aggregation of traps located on the southwest corner of Stellwagen Bank, traps were at a Sanctuary minimum during the summer months. This is because lobsters, the fishery's main target, are concentrated in shallow, near-shore waters during that season. As lobsters move offshore in the fall, fishermen follow them into the deeper waters west of Stellwagen Bank. By winter, a substantial portion of the fishery is focused in that area and the water immediately west of the Sanctuary's western boarder. This concentration is due to the lack of lobster in the near-shore waters and because traps in shallow water (<~ 25 m or 80 ft) are vulnerable to destruction caused by winter storms (W. Adler, President, Massachusetts Lobstermen's Assoc. Marshfield, MA, pers. comm.). In springtime fishermen reverse the process, following lobster from the deeper waters of the Sanctuary back to near-shore waters.

The trap fishery that focused on the southwest corner of Stellwagen Bank was the exception to this trend. This fishery targeted crab and was at its peak during the summer months, when fishing densities were among the highest observed anywhere within the SBNMS. In the fall, this fishery shifted slightly west, as fishermen targeted the more profitable lobsters in the storm-safe deeper waters west of the Bank, and some numbers of them likely remained through the winter. In the spring, the disappearance of lobsters from deep water and a reduction in storm frequency and severity accompanied the re-establishment of the fishery on the Bank's southwest corner.

Potential areas of concern—Potential areas of concern for the trap fishery are covered under the section on Interaction Between Fixed Gear and Baleen Whales.

Gillnet Fishery—Gillnets are comprised of thin, transparent, monofilament webbing stretched between a buoyant "float line" running along the top on the net and a heavy "lead line" running along the bottom. Tension between the buoyant float line and the heavy lead line causes the webbing to rise from the seabed to a height of 2.5 to 3.6 m (8 to 12 ft). If flatfish (e.g., flounder) are targeted, the float line and lead line are tied together, limiting the height to ~ 1 m (3 ft). A single net is ~ 91 m (300 ft) long and nets are joined together into "strings". In the Gulf of Maine, net strings range between 458 m (1500 ft) and 2,292 m (7,500 ft) in length (Read, 1994). Each end of a string is marked on the surface with a buoy (usually a "high flyer") that is attached to the gear by a line also used for hauling. Strings of gillnets are often set in a zigzag or even circular pattern, with small weights along the lead line acting as pivot points. As with the trap fishery, it is important to note that an observation of two surface buoys can indicate the presence of hundreds or thousands of meters of netting on the seafloor below them. The landed value and ranking of New England's gillnet fleet has varied greatly since its resurgence in the 1970's. Pol and Carr (2000) ranked gillnetting fourth in landed value in 1997, the most recent year of analysis.

Environmental issues of the Gillnet Fishery—As a passive fishing gear, gillnets have mini-

mum impact upon the seabed. An additional positive attribute is that they can be size selective, allowing undersized fish to pass through the webbing uncaught (Hamley, 1975). However, gillnets are relatively unselective in terms of the species that become entrapped in them (see Perrin et al., 1994). For example, almost all marine mammals frequenting the SBNMS are vulnerable to incidental kill in gillnets (e.g., Kraus, 1990; Read, 1994; Wiley et al., 1995; Waring et al., 2001). Seabirds and marine turtles can also be incidentally caught during fishing operations.

Several attempts have been made to reduce the kill of non-target species in gillnets. This includes the use of acoustic devices to deter harbor porpoise (*Phocoena phocoena*) from nets during some portions of the year when porpoise are in the Sanctuary. This mitigation attempt has also raised concerns. If acoustic deterrents are aversive to harbor porpoise instead of simply alerting them to the presence of nets, they could act as a barrier to porpoise movement. As with the lobster fishery, the gillnet fishery is subject to the Atlantic Large Whale Take Reduction Plan to reduce the incidental take of baleen whales. Specific information on that plan can be found in 50CFR229.32.

Distribution and Seasonality of Gillnet Fishing Gear—Gillnetting was most prevalent in the northern and eastern portions of the Sanctuary, and was the dominant fishing activity in the Sanctuary's northeast quarter. The densest aggregation of gillnet activity occurred south of Jeffreys Ledge along a line formed by the Western Gulf of Maine Closed Area. A second concentration of gillnet activity occurred within a broad area along the northeast flank of Stellwagen Bank and another in the northwest section of the Sanctuary off Cape Ann. On a seasonal basis, fewer gillnet boats were observed in the spring than in other seasons.

Some gillnet vessels and unidentified fixed gear were observed in the Western Gulf of Maine Closed Area, mostly during the summer and fall. Unidentified fixed gear could indicate illegally fished gillnets or could belong to legally operating lobster or hagfish boats. The inability to differentiate between legal and illegal gear presents a substantial management problem within this section of the Sanctuary.

Potential areas of concern—If acoustic deterrent devices on gillnets act as a deterrent to harbor porpoise movements, the most likely area of impact would be along the northern boarder of the Western Gulf of Maine Closed Area, where a concentration of pingered gillnets could potentially impede porpoise movement in and out of the Sanctuary. The potential areas of concern involving gillnet interactions with baleen whales are covered under the section on Interaction Between Fixed Gear and Baleen Whales.

Mobile Gear Fisheries

Mobile gear fisheries consisted of otter trawls and scallop dredges. There was also a single observation of a hydraulic clam dredge operating in the west central part of the sanctuary. Because many of the sea floor impacts of these fisheries are similar their environmental issues will be discussed jointly.

Otter Trawl Fishery—Otter trawlers or "draggers" target primarily groundfish by towing a large conical net along the seabed (Von Brandt, 1984). The net opening is maintained by the action of a buoyant "headrope" (on the top) , a weighted "footrope" (on the bottom), and the spreading affect of heavy trawl "doors" (up to 450 kg or ~1,000 lbs) on either side of the net's mouth. The resistance of the doors moving through the water maintains a net opening width of 15 to 25 m (50–80 ft) (Carrothers, 1981).

Fish are captured by the forward motion of the net along the bottom, which causes fish to enter the net's mouth and collect in the anterior "codend". Fish capture is facilitated by the movement of the footrope along the bottom that disturbs bottom dwelling fish and forces them up into the path of net. The footrope can be modified with rollers or other devices that provide fishermen with access to rocky or uneven bottom (Carr and Milliken, 1998). From 1950 through 1990, trawlers ranked first in landed fish value for New England and second from 1990–1997 (Pol and Carr, 2000).

Scallop Dredge Fishery—A scallop dredge consists of a ~5 m (15 ft) wide rigid metal box trailing a bag of metal rings. The weight of the dredge (up to 700 kg or 1500 lbs) and the angle of the forward cutting bar force the dredge to dig a few centimeters (1-2 in) into the seabed. The forward motion of the cutting bar dislodges scallops from the bottom causing them to pass over the bar and collect in the trailing chain bag. Scallop vessels usually tow two dredges simultaneously at speeds under ~ 5 knots (Rango and McSherry, 2001). Scallop dredges are considered "dry" dredges in that they do not use water jets or suction in the capture process. From 1950–1997, scallop dredges ranked third and occasionally second (1950 and 1980) in landing values for New England's commercial fisheries (Pol and Carr, 2000).

Environmental Issues of Mobile Gear Fisheries—The issues of trawl and/or dredge impact on bottom habitat and benthic fauna, and the associated impact on marine biodiversi-

ty and the recruitment of commercial stocks, is hotly debated. Numerous authors have documented at least short-term impacts to the seabed and/or benthic fauna (see reviews in Jennings and Kaiser, 1998; Turner et al., 1999; and DeAlteris et al., 2000). In general, mobile gears were found to disrupt bottom substrate, suspend fine sediments and remove or damage large epifaunal invertebrates, often in only a single pass (Fresse et al., 1999). However, these impacts must also be measured against natural disturbances to the seabed caused by forces such as storm activity (DeAlteris et al., 1999) and the long-term environmental impact of mobile gear is not understood. An additional issue is the bycatch of non-target species or size classes during the fishing process.

Distribution and Seasonality of the Otter Trawl Fishery—The broadest and densest area of otter trawl activity occurred in the most northwest section of the Sanctuary, off the coast of Cape Ann, MA. Another focus of trawl activity was in the Sanctuary's most southeastern area off the tip of Cape Cod, MA. Smaller pockets of trawling occurred just south of the Stellwagen Bank's southwest corner and on Jeffreys Ledge along the northern border of the Sanctuary.

The distribution of otter trawl activity showed indications of distinct seasonality. The concentration of activity off Cape Ann persisted throughout the winter, summer and fall, but disappeared in the spring when almost all trawling was focused around the northwest corner of Stellwagen Bank and a second area just to the northeast of that area. These areas harbored little or no fishing in other seasons. Similarly, an area around the southeast corner of Stellwagen Bank was fished heavily in the spring, but was much reduced in the winter. The area just south of Stellwagen Bank's southwest corner was fished primarily in the fall and an area just south of Stellwagen Bank's northwest corner was fished primarily during the summer. No otter trawl activity was observed in the Western Gulf of Maine Closed Area.

Distribution and Seasonality of the Scallop Dredge Fishery—The scallop dredge fishery showed distinct geographic fidelity, being confined primarily to the southeastern portion of the Sanctuary. Based on vessel density, this locale exhibited greater use than any other area targeted by the mobile gear sector. A far lesser area of scallop dredge activity extended from that area in a broad swath across Stellwagen Bank and up the mid section of its western slope. Low levels of scallop dredge activity were observed in the northwest section of the Sanctuary and no scallop vessels were observed in the northeast section. No scallop dredge activity was observed in the Western Gulf of Maine Closed Area.

Seasonality in the scallop fishery was pronounced, with the greatest effort in the winter and the least in the spring. However, these patterns are complicated by the ability of stern and eastern rigged trawlers to be involved in the scallop fishery, but assigned to the trawling category.

Potential areas of concern—Based on levels of activity, the greatest areas of concern would be in the vicinity of the southeast corner of Stellwagen Bank, where scallop dredges and otter trawler occurred in relatively high numbers and the northwest section of the Sanctuary where relatively high levels of otter trawling occurred. However, if habitat impact is dependent on substrate type, lesser-used areas might be equally or more negatively impacted than those areas identified only through intensity of use.

Interactions between fixed gear and baleen whales -

Entanglement in fixed gear is an identified mortality threat for most species of baleen whales, and both gillnet and trap fisheries have been implicated (Waring et al., 2001). Since the creation of the SBNMS in 1990, numerous sightings of entangled whales have occurred within its border and whales have been observed becoming entangled in the Sanctuary (e.g., Weinrich, 1999).

The Relative Interaction Potential (RIP) index suggested that the most likely sites of whale entanglement would be Stellwagen Bank's southwest and northwest corners, followed by southern Jeffreys Ledge. The highest RIPs occurred in the summer around the southwest corner of Stellwagen Bank. The analysis' prediction was retroactively corroborated by the sighting of three entangled humpback whales on Stellwagen Bank's southwest corner in late July and August of 2001 (Center for Coastal Studies, Provincetown, MA, unpublished data). While entangled whales can tow fishing gear hundreds of miles, the occurrence of entangled whales within the highest RIP areas strengthens the possibility that at least some of the interactions occurred there. The high RIP values associated with the southwest and northwest corners of Stellwagen Bank and to a lesser extent southern Jeffreys Ledge are also areas where entangled whales are frequently reported, although this is complicated by the fact that the whale watching vessels reporting entanglements are also concentrated in those areas.

In summary RIPs were capable of identifying interaction "hot spots" and could provide managers with the opportunity to manage at scales smaller than the entire sanctuary. In terms

of whale entanglement, managers could could use RIPs to target specific areas for actions such as fishery closures, gear modifications, or intensive surveillance to facilitate rescue attempts. They can also be used as a valuable tool to facilitate dialogue and information exchange between interest groups seeking solution to the problem.

CONCLUSION

National Marine Sanctuaries are often in the difficult position of protecting resources while promoting a multiple use philosophy. This can only be accomplished through information that allows decision-makers to understand the abundance and distribution of Sanctuary resources, and the magnitude and distribution of potential interactors. The use of shipboard surveys and GIS analyses can quantify such information and provide important insights for management, such as the co-occurrence of vulnerable resources and potentially harmful human activities. However, it must be emphasized that there is no current metric equating levels of activity with harm. While we have chosen to use the results to explore environmental risk, they could also be used to identify areas where the Sanctuary plays an important economic role in the local community. The fact that zones of intense use can simultaneously be areas of elevated environmental risk and increased economic benefit represents a major challenge to Sanctuary management.

An additional benefit of mapping distributional data is the ability to gain a broader understanding of the Sanctuary by using it as a foundation for soliciting local knowledge. For example, discussions with local lobstermen led to an understanding of the impact that storm activity and water depth had on fishing patterns. Thus, data such as ours can be a tool for initiating important dialogue between the Sanctuary and the public, a concept that lies at the heart of the NMS program. While we have attempted a sample analysis and discussion of our data, we await the complex scrutiny, review and input of the many interested parties that make up the SBNMS community. In this way the explanatory power of our data will be maximized and a deeper understanding of the Sanctuary will evolve.

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REFERENCES

Anonymous. 1982. CeTAP: A characterization of marine mammals and turtles in the mid- and North Atlantic areas of the U.S. outer continental shelf. Final Report to the Cetacean and Turtle Assessment Program. Pages 450. University of Rhode Island.

Bondrup-Nielson. S. and Herman, T, B. 1995. Long-term monitoring of the environment: panacea or placebo! In: Ecosystem Monitoring and Protected Areas, eds. S. Bondrup-Nielson, T.B. Herman, J. Willison, and N.W. Munro, pp. 22–26. Wolfville: Science and Management of Protected Areas Association.

Burnham. K, P. Anderson. D, R. and Laake. J, L. 1980. Estimation of density from line transect sampling of biological populations. Wildlife Monographs 72: 1–202.

Carr. H,A. and Milliken, H, O. 1998. Conservation engineering: options to minimize fishing's impacts to the sea floor. In: eds. E. M. Dorsey and J. Perdersen, pp. 100–103. Effects of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation, Boston, MA.

Carrothers. P, J. 1981. Catch variability due to variations in groundfish otter trawl behavior. In: Bottom Trawl Surveys, eds. W. G. Doubleday and D. Rivard, pp. 2547–257. Canadian Special Publication of Fisheries and Aquatic Sciences.

Caswell. H. M. Fujiwara M. and Brault. S. 1999. Declining survival probability threatens the North Atlantic right whale. Proceedings of the National Academy of Science 96: 3308–3313.

Caughley. G. and. Gunne. A. 1996. Conservation Biology in Theory and Practice. Cambridge: Blackwell Science. 459 pp.

DeAlteris. J. L. Skrobe. L. and Lipsky. C. 1999. The significance of seabed disturbance by mobile fishing gear relative to natural processes: A case study in Narragansett Bay, Rhode Island. In: Fish Habitat: Essential Fish Habitat and Rehabilitation. ed L. Benaka, pp. 224–237. Bethesda: American Fisheries Society.

DeAlteris. J, T. Skrobe. L.G. and Castro. K.M. 2000. Effects of mobile bottom fishing gear on biodiversity and habitat in offshore New England waters. Northeastern Naturalist 7: 739–394.

ESRI. 2001. Using ArcGIS Spatial Analyst. Redlands, California: Environmental Systems Research Institute.

Freedman, B., Staicer. C. and Woodley. S. 1995. Ecological monitoring and research in greater ecological reserves: A conceptual framework. In: Ecosystem Monitoring and Protected Areas, eds. S. Bondrup-Nielson, T.B. Herman, J. Willison, and N.W. Munro, pp. 68–80. Wolfville:Science and Management of Protected Areas Association.

Freese. L. Auster. P. Heifetz. J. Heifetz. and Wing. B,L. 1999. Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. Marine Ecology Progress Series 182: 119–126.

Garret-Logan. N. and Smith.T. 1997. A hand-held, pen-based computer system for marine mammal surveys. Marine Mammal Science 13: 694-700.

Hamley. J, M. 1975. Review of gillnet selectivity. Journal of the Fisheries Research Board of Canada 32: 1943–1969.
Kraus. S, D. 1990. Rates and potential cause of mortality in North Atlantic right whales. Marine Mammal Science 6: 278–290.
Lubchenco. J. 1995. The role of science in formulating a biodiversity strategy. Bioscience 45: s-7–s-9.
McKiernan. D. Pol. M. and Malkoski. V. 2001. A study of the underwater profiles of lobster trawl groundlines. Massachusetts Division of Marine Fisheries, Boston, MA.
NMFS. 1999. Taking of marine mammals incidental to commercial fishing operations; Atlantic large whale take reduction plan regulations. Pages 7529–7556. NMFS, Washington, D.C.
Perrin. W. F. Donovan. G, P. and Barlow. J. eds. 1994. Gillnets and Cetaceans. Cambridge: International Whaling Commission. 629 pp.
Pol. M. and Carr. H, A. 2000. Overview of gear developments and trends in the New England commercial fishing industry. Northeastern Naturalist 7: 739–394.
Rago. P. and McSherry. M. 2001. Spatial distribution of fishing effort for sea scallops: 1998-2000. Conference on the Effects of Fishing Gear on Fish Habitat in the Northeastern U.S., October 23–25, 2001, Boston, MA.
Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the Northwest Atlantic. In: Pages 617 in Gillnets and Cetaceans, eds. W.F. Perrin, G. P. Donovan. and J. Barlow, pp. 133–148. Cambridge: International Whaling Commission.
Tuck. I. D. Hall. S. Robertson. M, R.Armstrong. E. and Basford. D.J. 1998. Effects of physical trawling disturbances in a previously unfished sheltered Scottish sea loch. Marine Ecology Progress Series 162: 227–242.
Turner. S, J. Thrush S, F. Hewitt. J, E. Cummings. V, J. and Funnell. G. 1999. Fishing impacts and the degradation or loss of habitat structure. Fisheries Management and Ecology 6: 401–420.
Valentine. P, C. et al. 2001. Sea Floor Topography and Backscatter Intensity Images of Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts: U.S. Geological Survey Open-File Report 00-410, U.S. Geological Survey, Reston, VA.
Von Brandt, A. 1984. Fish Catching Methods of the World. England: Fishing News Books Ltd. 418 pp.
Waring. G. Quintal. J. M. and Swartz. S. 2001. U.S. Atlantic and Gulf of Mexico stock assessments–2001. Pages 310. U.S. Dept. of Comm., NOAA, NMFS, Northeast Fisheries Science Center, Woods Hole, MA.
Weinrich. M. 1999. Behavior of a humpback whale (Megaptera novaeangliae) upon entanglement in a gillnet. Marine Mammal Science 15: 211–213.
Wiley. D, N. Asmutis. R. Pitchford. T. and Gannon. D. 1995. Stranding and mortality of humpback whales, Megaptera novaeangliae, in the mid-Atlantic and southeast regions of the United States. Fishery Bulletin 93: 196–205.

ENDNOTE

[1]Sometimes referred to as western-rigged trawlers.
[2]Sometimes referred to as eastern-rigged trawlers.
[3]Northeast Fisheries Science Center, Woods Hole, MA 02543
[4]Nautical Technologies Ltd. 217 Burleigh Road, Bangor, Maine 04401.
[5]Charles Mayo (Center for Coastal Studies, Provincetown, MA 02657) first proposed this method of determining risk for use by the Atlantic Large Whale Take Reduction Team (ALWTRT). The ALWTRT was tasked by the Department of Commerce with identifying ways to reduce the incidental kill of several species of baleen whales in fixed fishing gear.
[6]The Western Gulf of Maine Closed Area is a year-round ground fishing closure created by the New England Fishery Management Council to recover depleted stocks. Gillneting, otter trawling and scallop dredging are prohibited within the area.
[7]This area was based a concentration of right whales observed on a single survey in March 2002. Excluding those sightings, the highest winter concentration of baleen whales occurred on the southwest corner of Stellwagen Bank (0.13–0.16 whale/km^2).

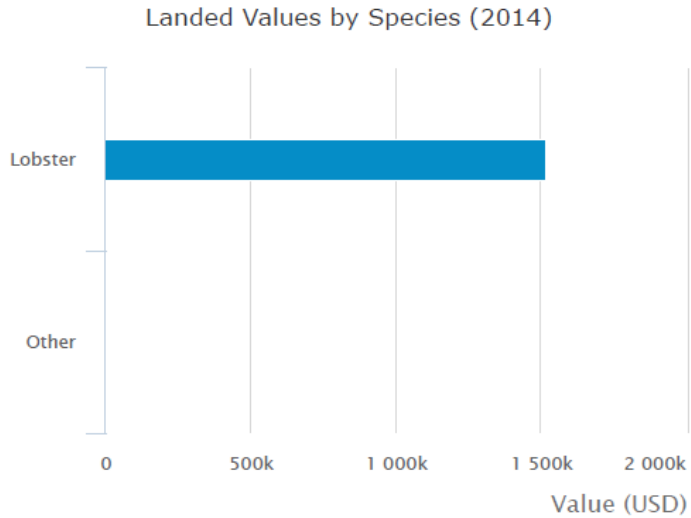
Chapter 3 Appendices
Appendix 3.1 Community Profiles

Rockport, MA

Where is Rockport located?

Rockport is a town with a population of 6,952 and classified by the census as falling within an urbanized area. Rural to urban is really a continuum. Increasing urbanization indicates that a community has more jobs overall, more kinds of jobs, and more services like hospitals, social workers and job training centers. However, increasing urbanization can also mean greater pressure to transform working waterfronts for alternative uses, such as hotels or tourist shops.

Involvement in Fisheries



What species are landed in Rockport?

The landings associated with a fishing community tell us what species are important to that community. The diversity of species caught also is indicative of a community's ability to adapt to changing environmental conditions (e.g. populations of specific fish stocks) or changes in fishing regulations that restrict access to resources.

*Groundfish includes cod, winter fl.,witch fl.,yellowtail fl., am.plaice, haddock, white hake,redfish, pollock.

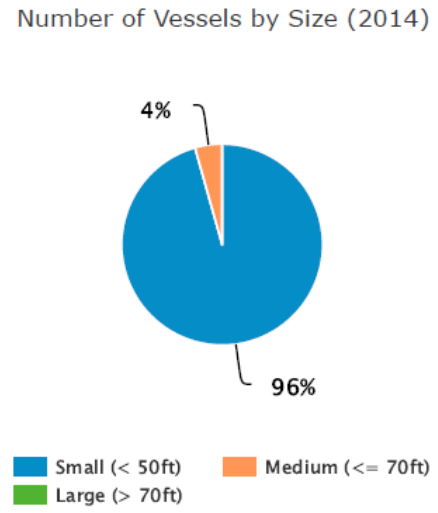
**Whiting includes red hake,ocean pout,black whiting,whiting.

What are the characteristics of the fishing vessels in Rockport?

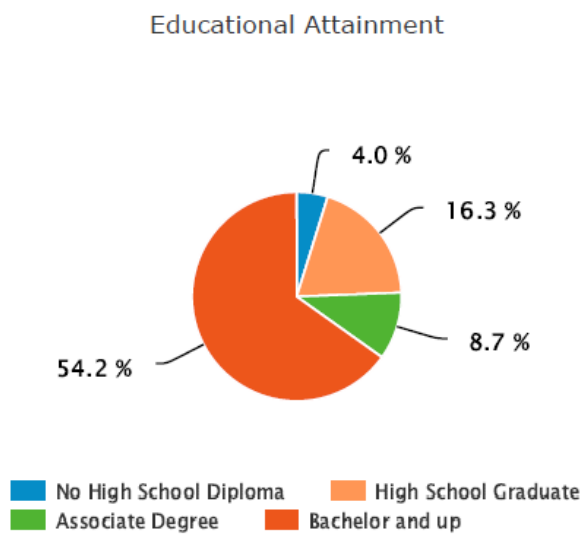
The number of fishing vessels in a given port provides a sense of the scale of fishing in that port. Where a large port may serve as the homeport for hundreds of vessels, a smaller one may only have a handful. The number of vessels also may provide a rough sense of the number of fishing-related jobs (e.g. crew positions, jobs in shoreside industries) available in a given location.

Size also matters. Larger vessels can travel farther offshore and stay out for longer periods more easily than smaller vessels. These differences also affect family life. Smaller dayboat fishermen tend to return home every day whereas fishermen on larger vessels may be away from home for weeks on long and distant fishing expeditions.

Apart from the lobster fleet, smaller boats also tend to catch a broader range of species where their larger counterparts are more specialized (e.g. limited access scallop boats and herring pair trawlers). All these characteristics help illuminate the potential impacts of regulatory changes on a given community.



Demographic Attributes

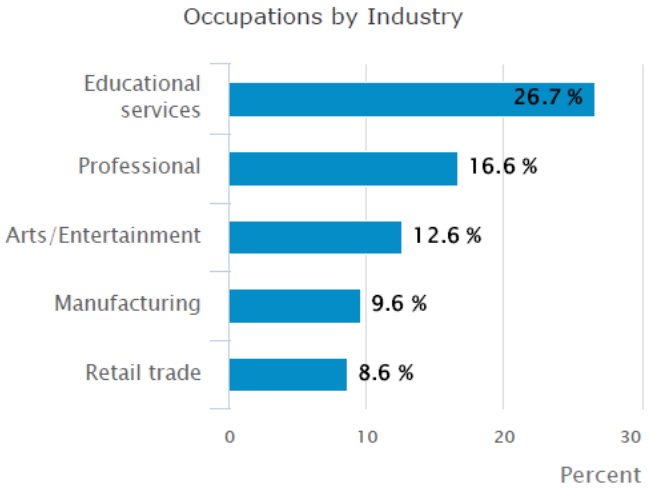


Educational Attainment

The level of educational attainment in a community is associated with issues important for community development, such as income and poverty levels, unemployment rates, and local participation in community activities.

How do people make a living in Rockport?

Just as the range of fish species harvested by town residents speaks to their ability to adapt to environmental change, the diversity in local occupations indicates the ability of a community to adapt to economic changes, including changes in the local fishing economy. Is there one predominant industry, for instance, or is there a range of economic opportunities? How many occupations are available that offer incomes similar to fishing or require skills and education common to the average fisherman? How many jobs are available that would provide a working environment that fishermen would be comfortable with?



Unemployment Rate: **5.2%**

National Rate: **7.9%***

The unemployment rate in a community is one indicator of the level of opportunity that may exist for fishermen who lose their jobs to find alternative ways of making a living. The unemployment rate may also indicate the desirability of fishing in the face of other opportunities.

*Source: U.S. Department of Labor, **Bureau of Labor Statistics**

Median Household Income: **$70,625.00**

National Average: **$51,914.00** (2011)

Individuals in Rockport living in poverty: **3.7%**

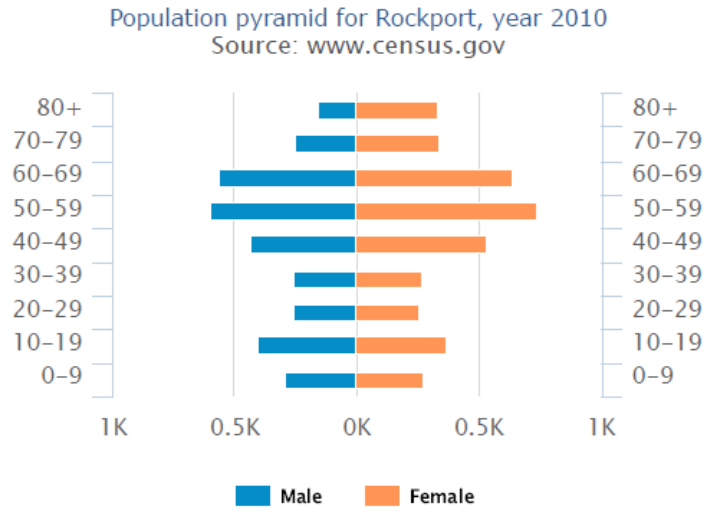
The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

Age structure of residents

Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process that may affect fishermen's access to the waterfront. In some remote coastal communities, people in their late teens or early twenties may leave to look for work or pursue an education outside of their community. A very large population of young people, on the other hand, may indicate the presence of universities or a military base.

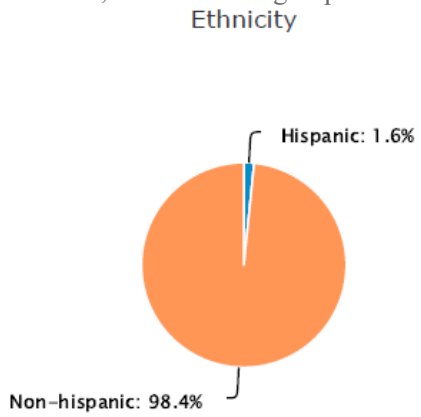
Median age: **51.2**

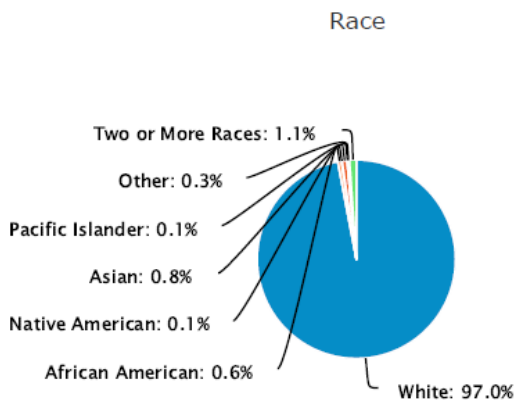
National median: **37.2**



Ethnicity and Race

These factors give a sense of the cultural context of the community, and the relationship of fishing families and groups to the community in which they live. Is this community racially and ethnically diverse? In the northeast region, ethnic diversity in coastal communities tends to be higher in the Mid Atlantic than in New England, though there are significant exceptions in some fishing ports. Moreover, certain ethnic groups have long been associated with fishing in various specific ports throughout the reg





Language and Marginalization

Fishing regulations can be complex. Documents are rarely translated from English into other languages. Lack of strong English language skills could affect participants' ability to engage effectively in the fisheries management process. While these numbers correspond to the overall community in Rockport they may indicate a population needing assistance in integrating their needs and concerns into the process.

Foreign Born: **3.9%**
National Average: **12.7%**

Speak English less than very well: **1.1%**
National Average: **8.7%**

Social Indicators

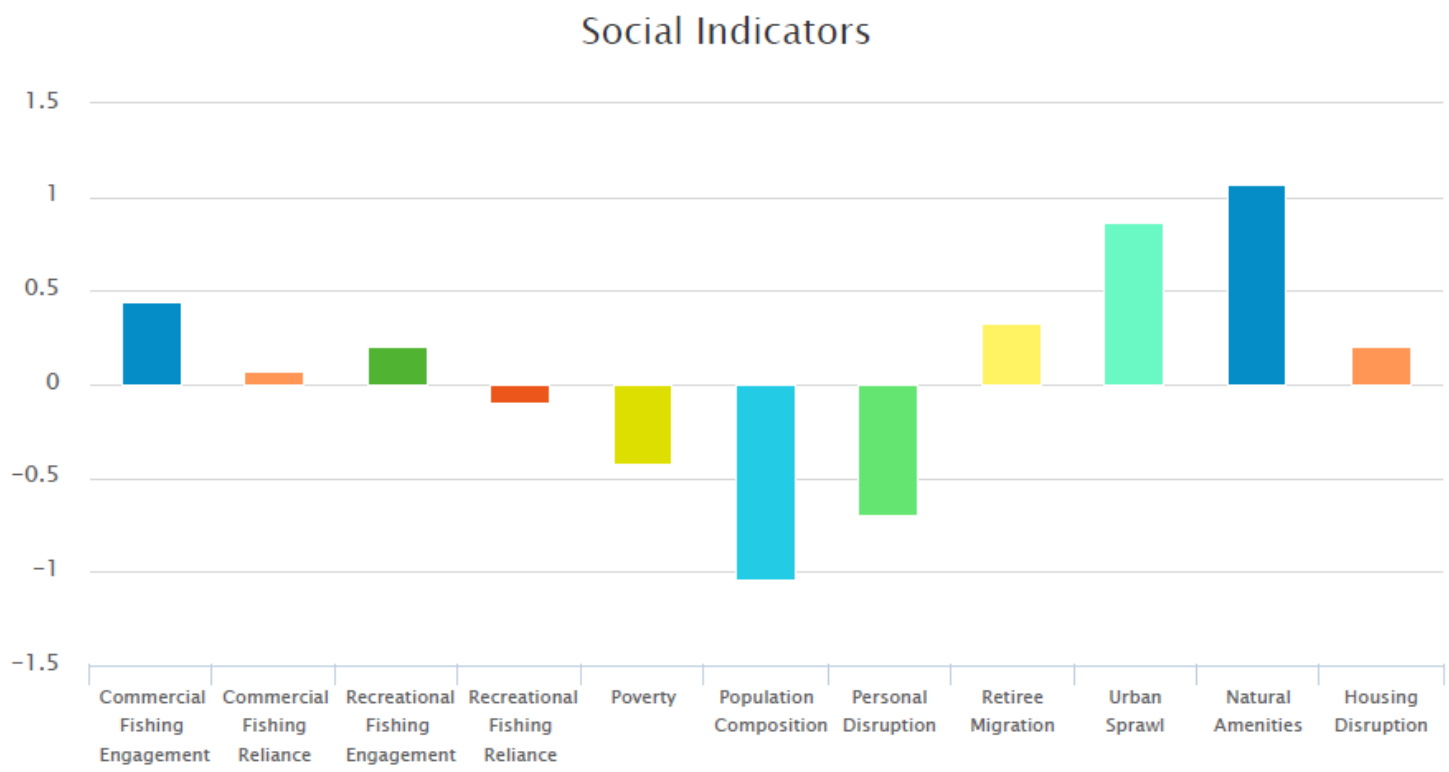
Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Rockport that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of interest and are used to evaluate community well-being in terms of social, economic and psychological welfare.

Fishing engagement and reliance indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities. The indices include: Commercial Engagement, Commercial Reliance, Recreational Engagement and Recreational Reliance.

Social vulnerability indices represent social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing. The indices include: Poverty, Population Composition, and Personal Disruption.

Gentrification Pressure indices characterize those factors that, over time may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure. The indices include: Retire Migration, Urban Sprawl, Natural Amenities and Housing Disruption.

The factor scores for each index are normalized so that zero is the mean. Therefore, a higher value implies more engagement or reliance upon fishing or higher social vulnerability or vulnerability to gentrification. Learn more about the social indicators for fishing communities.

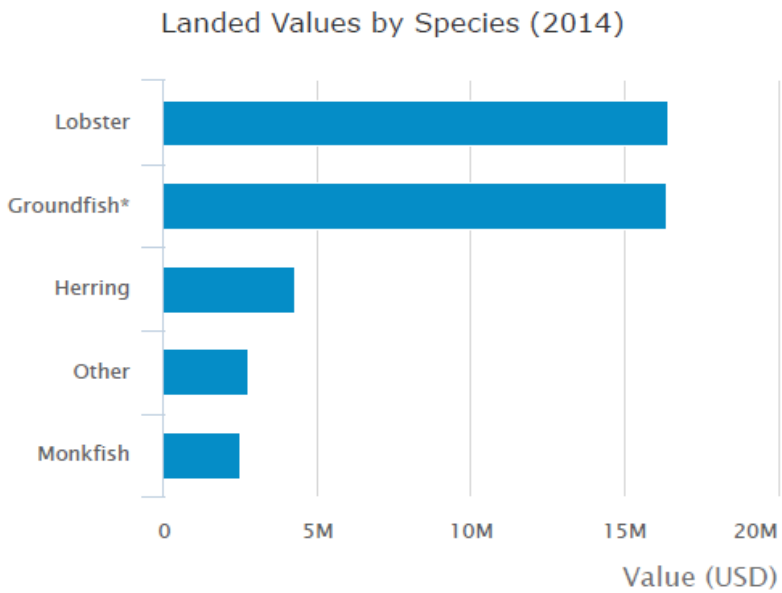

Social Indicators
1.5
1
0.5
0
−0.5
−1
−1.5
Commercial Fishing Engagement
Commercial Fishing Reliance
Recreational Fishing Engagement
Recreational Fishing Reliance
Poverty
Population Composition
Personal Disruption
Retiree Migration
Urban Sprawl
Natural Amenities
Housing Disruption

Gloucester, MA

Where is Gloucester located?

Gloucester is a town with a population of 28,789 and classified by the census as falling within an urbanized area. Rural to urban is really a continuum. Increasing urbanization indicates that a community has more jobs overall, more kinds of jobs, and more services like hospitals, social workers and job training centers. However, increasing urbanization can also mean greater pressure to transform working waterfronts for alternative uses, such as hotels or tourist shops.

Involvement in Fisheries



What species are landed in Gloucester?

The landings associated with a fishing community tell us what species are important to that community. The diversity of species caught also is indicative of a community's ability to adapt to changing environmental conditions (e.g. populations of specific fish stocks) or changes in fishing regulations that restrict access to resources.

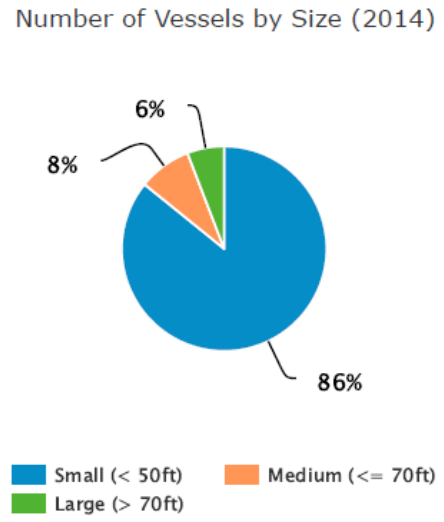
*Groundfish includes cod, winter fl.,witch fl.,yellowtail fl., am.plaice, haddock, white hake,redfish, pollock.

**Whiting includes red hake,ocean pout,black whiting,whiting.

What are the characteristics of the fishing vessels in Gloucester?

The number of fishing vessels in a given port provides a sense of the scale of fishing in that port. Where a large port may serve as the homeport for hundreds of vessels, a smaller one may only have a handful. The number of vessels also may provide a rough sense of the number of fishing-related jobs (e.g. crew positions, jobs in shoreside industries) available in a given location.

Size also matters. Larger vessels can travel farther offshore and stay out for longer periods more easily than smaller vessels. These differences also affect family life. Smaller dayboat fishermen tend to return home every day whereas fishermen on larger vessels may be away from home for weeks on long and distant fishing expeditions.

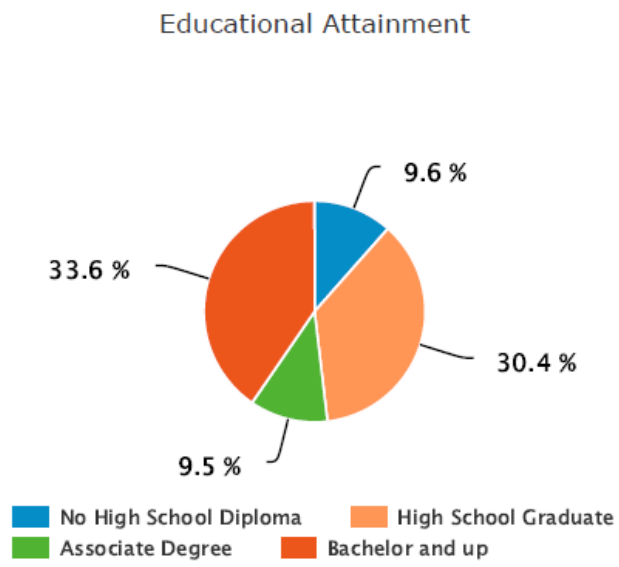


Apart from the lobster fleet, smaller boats also tend to catch a broader range of species where their larger counterparts are more specialized (e.g. limited access scallop boats and herring pair trawlers). All these characteristics help illuminate the potential impacts of regulatory changes on a given community.

Demographic Attributes

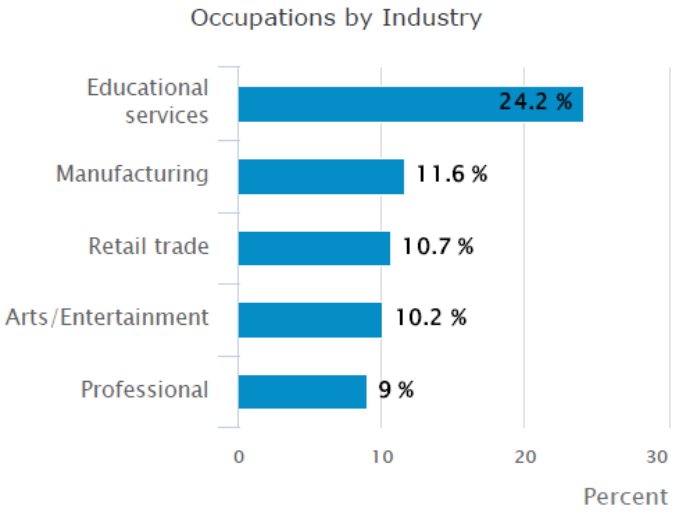
Educational Attainment

The level of educational attainment in a community is associated with issues important for community development, such as income and poverty levels, unemployment rates, and local participation in community activities.



How do people make a living in Gloucester?

Just as the range of fish species harvested by town residents speaks to their ability to adapt to environmental change, the diversity in local occupations indicates the ability of a community to adapt to economic changes, including changes in the local fishing economy. Is there one predominant industry, for instance, or is there a range of economic opportunities? How many occupations are available that offer incomes similar to fishing or require skills and education common to the average fisherman? How many jobs are available that would provide a working environment that fishermen would be comfortable with?



Unemployment Rate: **4%**

National Rate: **7.9%***

The unemployment rate in a community is one indicator of the level of opportunity that may exist for fishermen who lose their jobs to find alternative ways of making a living. The unemployment rate may also indicate the desirability of fishing in the face of other opportunities.

*Source: U.S. Department of Labor, **Bureau of Labor Statistics**

Median Household Income: **$60,506.00**

National Average: **$51,914.00** (2011)

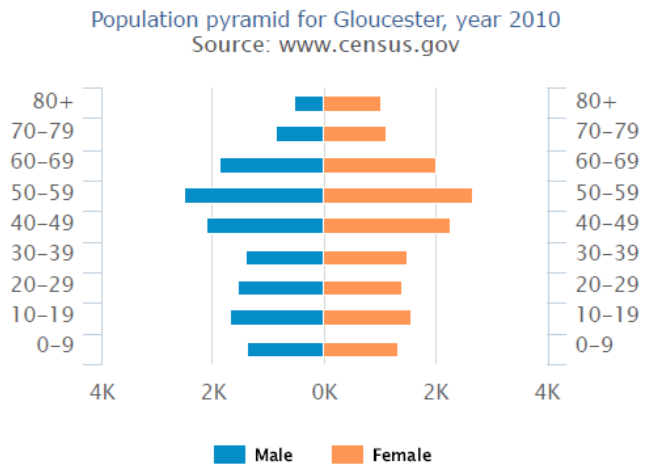
Individuals in Gloucester living in poverty: **7.8%**

The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

Age structure of residents

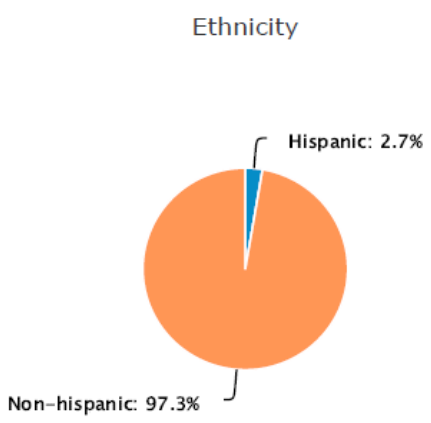
Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process that may affect fishermen's access to the waterfront. In some remote coastal communities, people in their late teens or early twenties may leave to look for work or pursue an education outside of their community. A very large population of young people, on the other hand, may indicate the presence of universities or a military base.

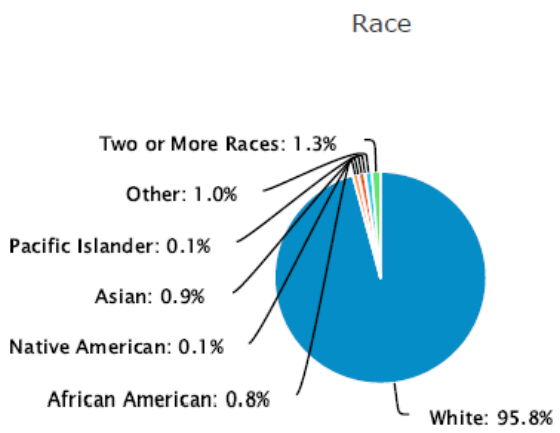
Median age: **46.4**
National median: **37.2**



Ethnicity and Race

These factors give a sense of the cultural context of the community, and the relationship of fishing families and groups to the community in which they live. Is this community racially and ethnically diverse? In the northeast region, ethnic diversity in coastal communities tends to be higher in the Mid Atlantic than in New England, though there are significant exceptions in some fishing ports. Moreover, certain ethnic groups have long been associated with fishing in various specific ports throughout the region.





Language and Marginalization

Fishing regulations can be complex. Documents are rarely translated from English into other languages. Lack of strong English language skills could affect participants' ability to engage effectively in the fisheries management process. While these numbers correspond to the overall community in Gloucester they may indicate a population needing assistance in integrating their needs and concerns into the process.

Foreign Born: **7%**
National Average: **12.7%**

Speak English less than very well: **4%**

National Average: **8.7%**

Social Indicators

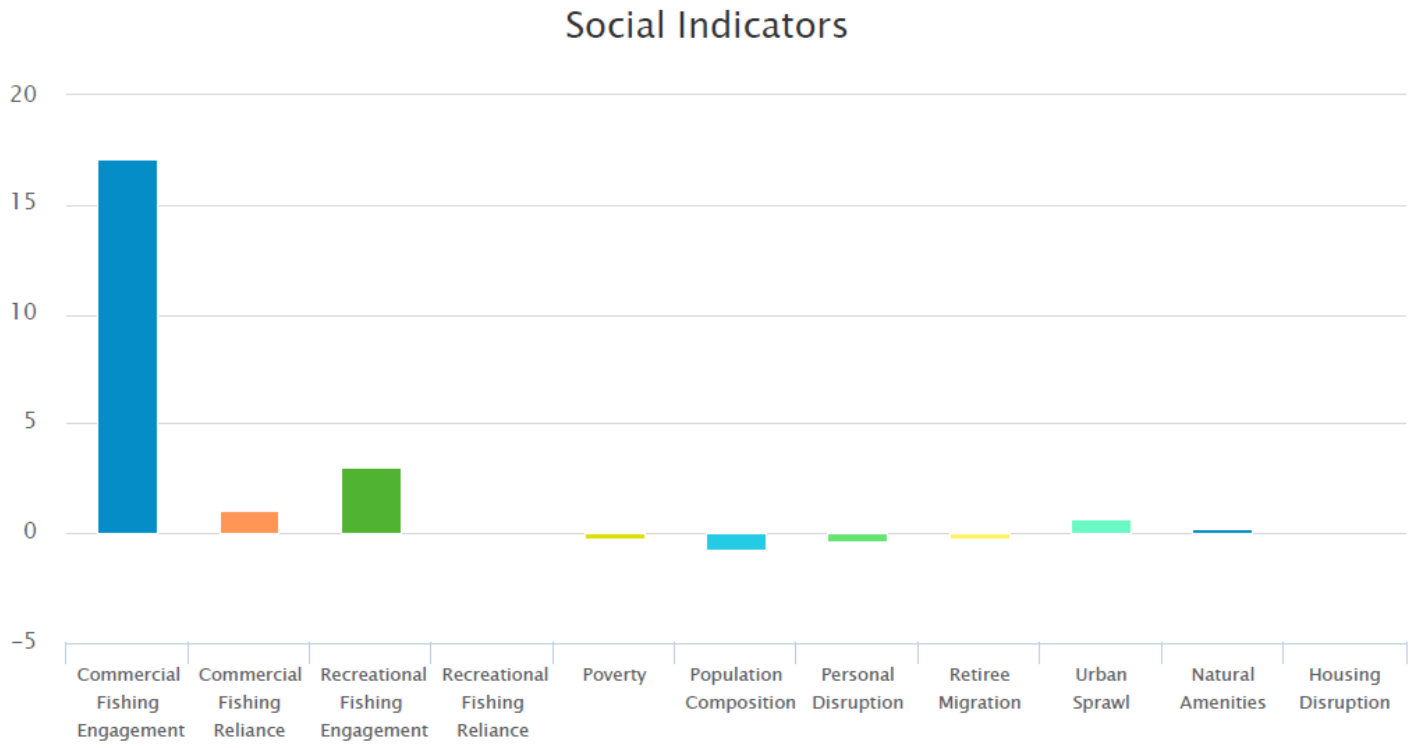
Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Gloucester that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of interest and are used to evaluate community well-being in terms of social, economic and psychological welfare.

Fishing engagement and reliance indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities. The indices include: Commercial Engagement, Commercial Reliance, Recreational Engagement and Recreational Reliance.

Social vulnerability indices represent social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing. The indices include: Poverty, Population Composition, and Personal Disruption.

Gentrification Pressure indices characterize those factors that, over time may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure. The indices include: Retire Migration, Urban Sprawl, Natural Amenities and Housing Disruption.

The factor scores for each index are normalized so that zero is the mean. Therefore, a higher value implies more engagement or reliance upon fishing or higher social vulnerability or vulnerability to gentrification. Learn more about the social indicators for fishing communities.


Social Indicators
20
15
10
5
0
−5
Commercial Fishing Engagement
Commercial Fishing Reliance
Recreational Fishing Engagement
Recreational Fishing Reliance
Poverty
Population Composition
Personal Disruption
Retiree Migration
Urban Sprawl
Natural Amenities
Housing Disruption

Boston, MA

Where is Boston located?

Boston is a town with a population of 617,594 and classified by the census as falling within an urbanized area. Rural to urban is really a continuum. Increasing urbanization indicates that a community has more jobs overall, more kinds of jobs, and more services like hospitals, social workers and job training centers. However, increasing urbanization can also mean greater pressure to transform working waterfronts for alternative uses, such as hotels or tourist shops.

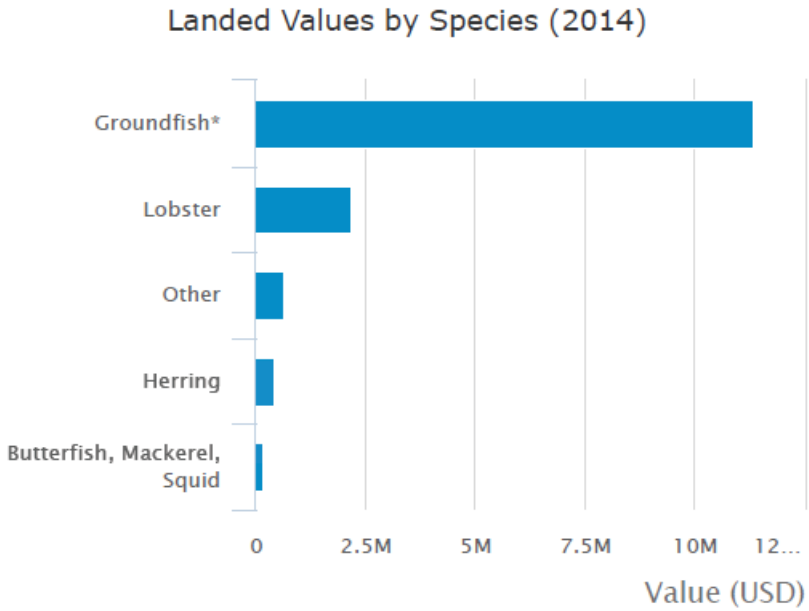
Involvement in Fisheries

What species are landed in Boston?

The landings associated with a fishing community tell us what species are important to that community. The diversity of species caught also is indicative of a community's ability to adapt to changing environmental conditions (e.g. populations of specific fish stocks) or changes in fishing regulations that restrict access to resources.

*Groundfish includes cod, winter fl.,witch fl.,yellowtail fl., am.plaice, haddock, white hake,redfish, pollock.

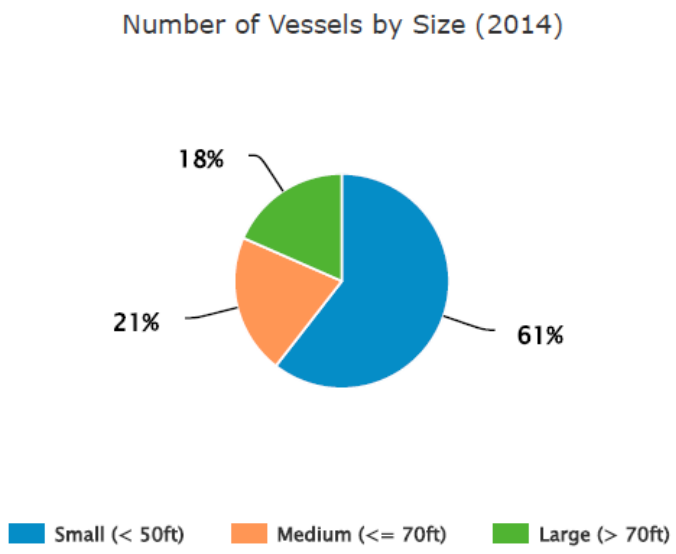
**Whiting includes red hake,ocean pout,black whiting,whiting.



What are the characteristics of the fishing vessels in Boston?

The number of fishing vessels in a given port provides a sense of the scale of fishing in that port. Where a large port may serve as the homeport for hundreds of vessels, a smaller one may only have a handful. The number of vessels also may provide a rough sense of the number of fishing-related jobs (e.g. crew positions, jobs in shoreside industries) available in a given location.

Size also matters. Larger vessels can travel farther offshore and stay out for longer periods more easily than smaller vessels. These differences also affect family life. Smaller dayboat fishermen tend to return home every day whereas fishermen on larger vessels may be away from home for weeks on long and distant fishing expeditions.

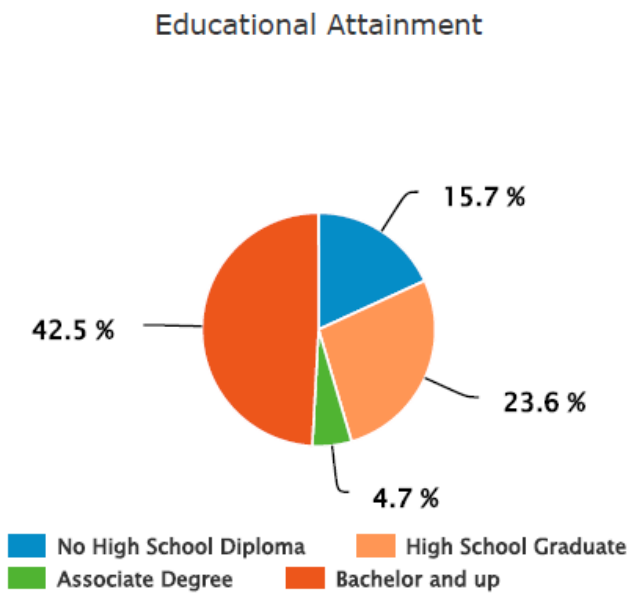


Apart from the lobster fleet, smaller boats also tend to catch a broader range of species where their larger counterparts are more specialized (e.g. limited access scallop boats and herring pair trawlers). All these characteristics help illuminate the potential impacts of regulatory changes on a given community.

Demographic Attributes

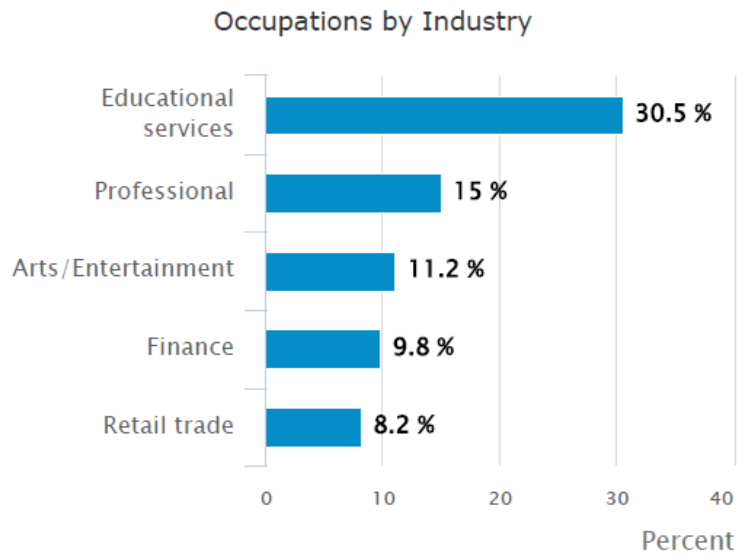
Educational Attainment

The level of educational attainment in a community is associated with issues important for community development, such as income and poverty levels, unemployment rates, and local participation in community activities.



How do people make a living in Boston?

Just as the range of fish species harvested by town residents speaks to their ability to adapt to environmental change, the diversity in local occupations indicates the ability of a community to adapt to economic changes, including changes in the local fishing economy. Is there one predominant industry, for instance, or is there a range of economic opportunities? How many occupations are available that offer incomes similar to fishing or require skills and education common to the average fisherman? How many jobs are available that would provide a working environment that fishermen would be comfortable with?



Unemployment Rate: **6.3%**

National Rate: **7.9%***

The unemployment rate in a community is one indicator of the level of opportunity that may exist for fishermen who lose their jobs to find alternative ways of making a living. The unemployment rate may also indicate the desirability of fishing in the face of other opportunities.

*Source: U.S. Department of Labor, **Bureau of Labor Statistics**

Median Household Income: **$50,684.00**

National Average: **$51,914.00** (2011)

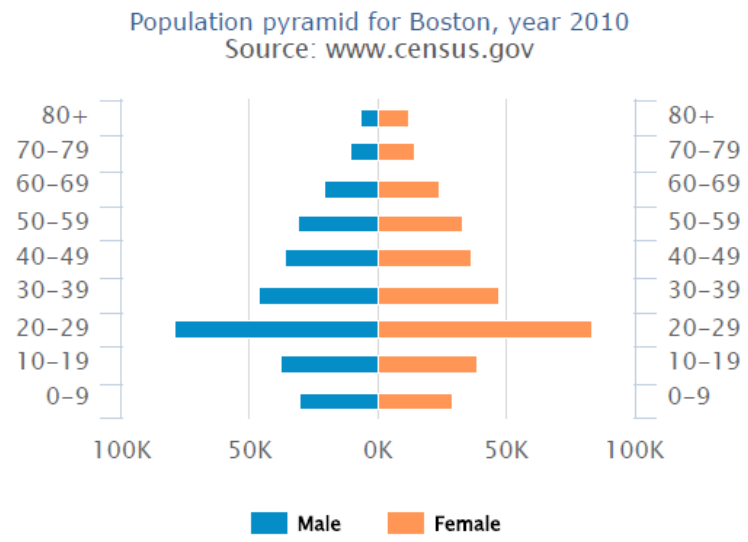
Individuals in Boston living in poverty: **21.2 %** The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

Age structure of residents

Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process that may affect fishermen's access to the waterfront. In some remote coastal communities, people in their late teens or early twenties may leave to look for work or pursue an education outside of their community. A very large population of young people, on the other hand, may indicate the presence of universities or a military base.

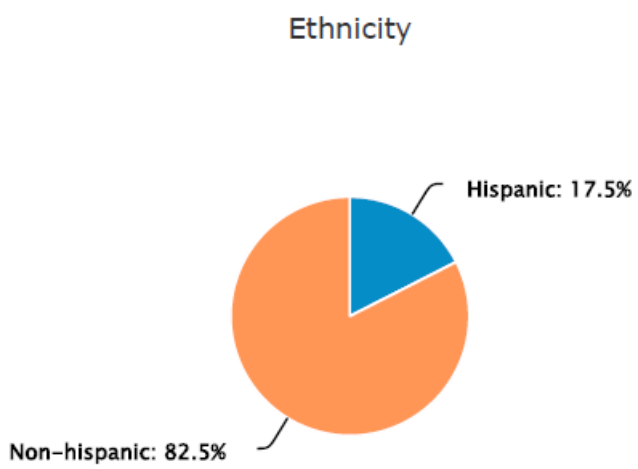
Median age: **30.8**

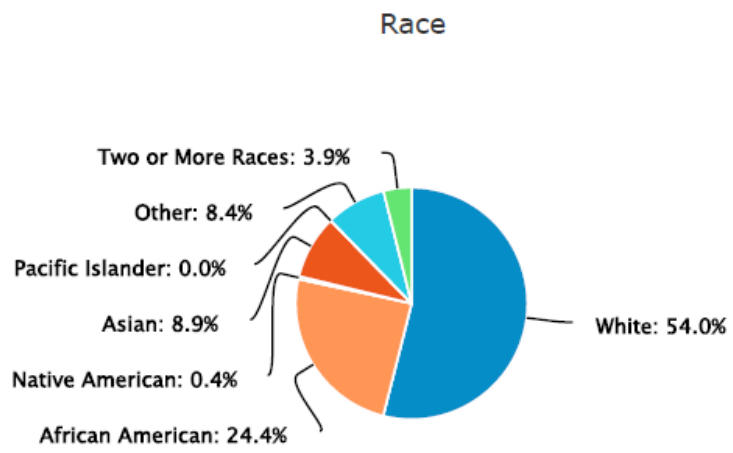
National median: **37.2**



Ethnicity and Race

These factors give a sense of the cultural context of the community, and the relationship of fishing families and groups to the community in which they live. Is this community racially and ethnically diverse? In the northeast region, ethnic diversity in coastal communities tends to be higher in the Mid Atlantic than in New England, though there are significant exceptions in some fishing ports. Moreover, certain ethnic groups have long been associated with fishing in various specific ports throughout the region.





Language and Marginalization

Fishing regulations can be complex. Documents are rarely translated from English into other languages. Lack of strong English language skills could affect participants' ability to engage effectively in the fisheries management process. While these numbers correspond to the overall community in Portsmouth they may indicate a population needing assistance in integrating their needs and concerns into the process.

Foreign Born: **27.2%**
National Average: **12.7%**
Speak English less than very well: **16.8%**
National Average: **8.7%**

Social Indicators

Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Portsmouth that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of interest and are used to evaluate community well-being in terms of social, economic and psychological welfare.
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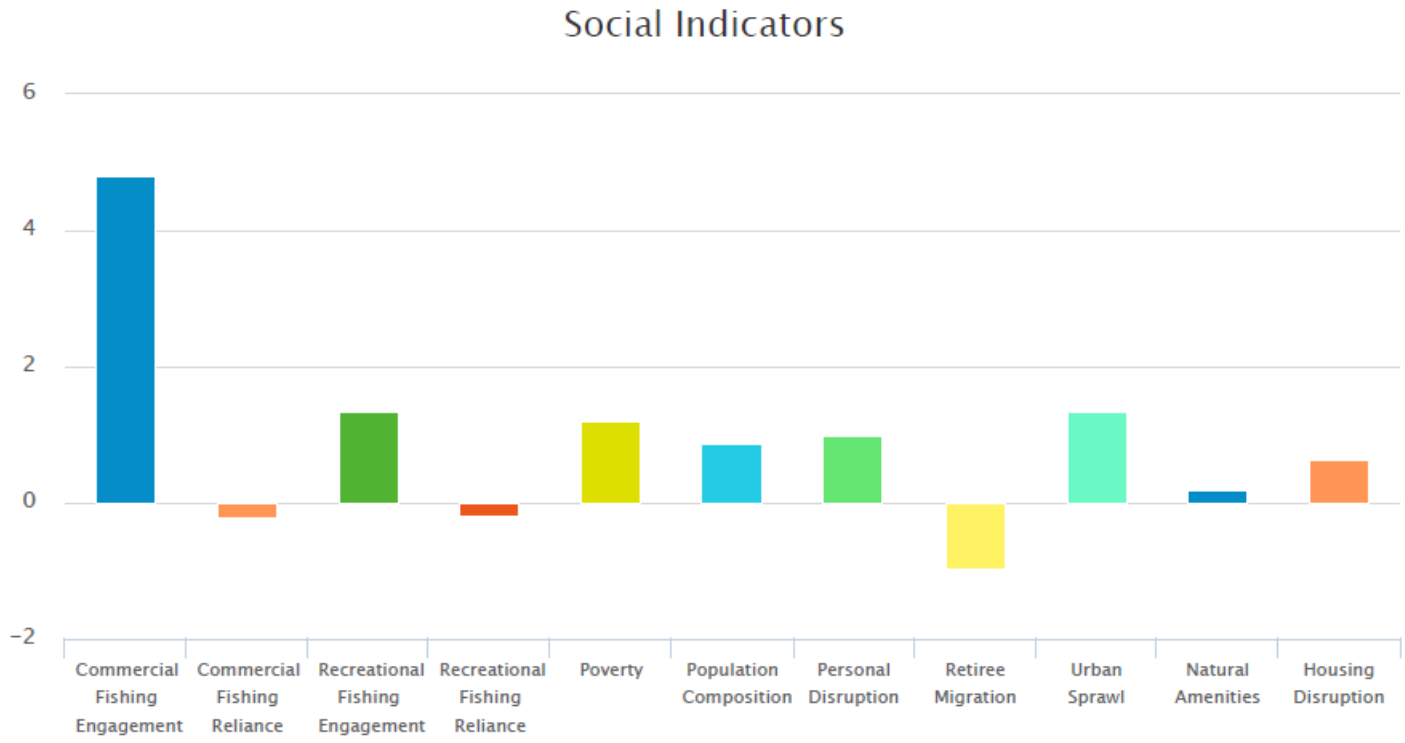
Gentrification Pressure indices characterize those factors that, over time may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure. The indices include: Retire Migration, Urban Sprawl, Natural Amenities and Housing Disruption.
The factor scores for each index are normalized so that zero is the mean. Therefore, a higher value implies more engagement or reliance upon fishing or higher social vulnerability or vulnerability to gentrification. Learn more about the social indicators for fishing communities.


Social Indicators
6
4
2
0
−2
Commercial Fishing Engagement
Commercial Fishing Reliance
Recreational Fishing Engagement
Recreational Fishing Reliance
Poverty
Population Composition
Personal Disruption
Retiree Migration
Urban Sprawl
Natural Amenities
Housing Disruption

Cohasset, MA

Where is Cohasset located?

Cohasset is a town with a population of 7,542 and classified by the census as falling within an urbanized area. Rural to urban is really a continuum. Increasing urbanization indicates that a community has more jobs overall, more kinds of jobs, and more services like hospitals, social workers and job training centers. However, increasing urbanization can also mean greater pressure to transform working waterfronts for alternative uses, such as hotels or tourist shops.

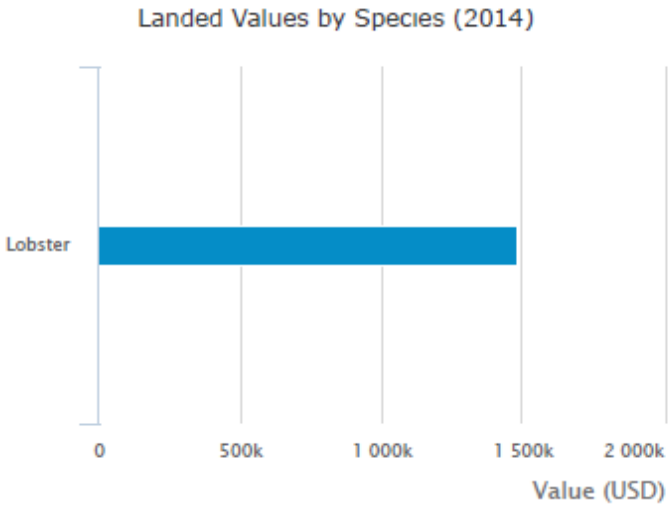
Involvement in Fisheries

What species are landed in Cohasset?

The landings associated with a fishing community tell us what species are important to that community. The diversity of species caught also is indicative of a community's ability to adapt to changing environmental conditions (e.g. populations of specific fish stocks) or changes in fishing regulations that restrict access to resources.

*Groundfish includes cod, winter fl.,witch fl.,yellowtail fl., am.plaice, haddock, white hake,redfish, pollock.

**Whiting includes red hake,ocean pout,black whiting,whiting.

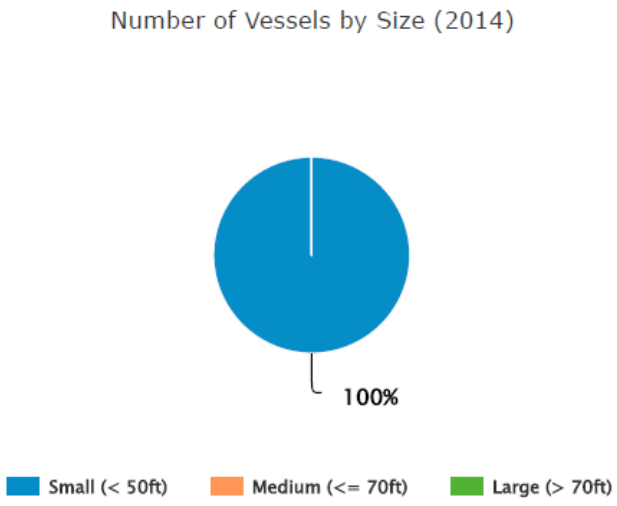


Number of Vessels by Size (2014)

What are the characteristics of the fishing vessels in Cohasset?

The number of fishing vessels in a given port provides a sense of the scale of fishing in that port. Where a large port may serve as the homeport for hundreds of vessels, a smaller one may only have a handful. The number of vessels also may provide a rough sense of the number of fishing-related jobs (e.g. crew positions, jobs in shoreside industries) available in a given location.

Size also matters. Larger vessels can travel farther offshore and stay out for longer periods more easily than smaller vessels. These differences also affect family life. Smaller dayboat fishermen tend to return home every day whereas fishermen on larger vessels may be away from home for weeks on long and distant fishing expeditions.



Apart from the lobster fleet, smaller boats also tend to catch a broader range of species where their larger counterparts are more specialized (e.g. limited access scallop boats and herring pair trawlers). All these characteristics help illuminate the potential impacts of regulatory changes on a given community.

Demographic Attributes

Educational Attainment

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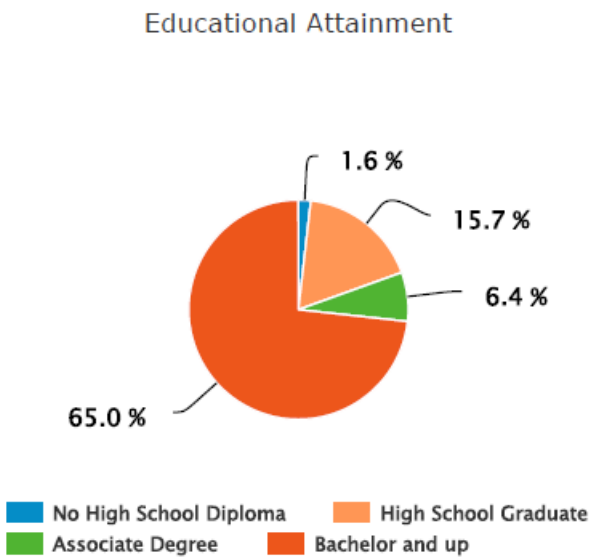
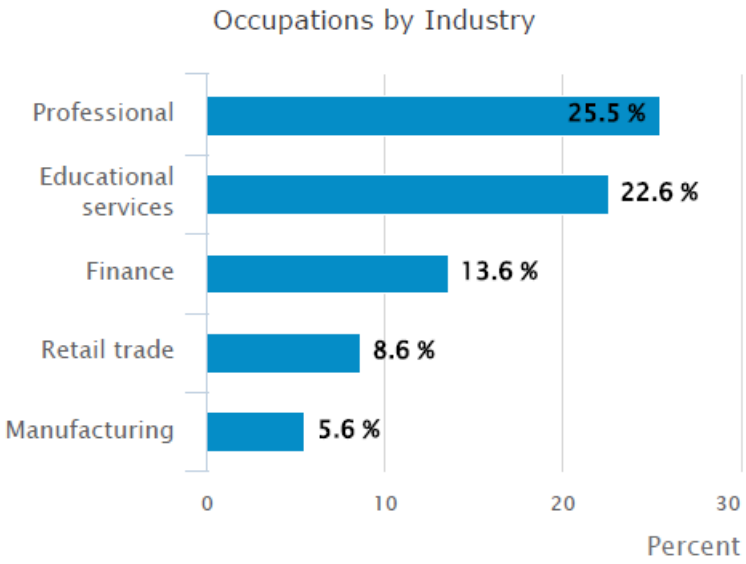


How do people make a living in Cohasset?

Just as the range of fish species harvested by town residents speaks to their ability to adapt to environmental change, the diversity in local occupations indicates the ability of a community to adapt to economic changes, including changes in the local fishing economy. Is there one predominant industry, for instance, or is there a range of economic opportunities? How many occupations are available that offer incomes similar to fishing or require skills and education common to the average fisherman? How many jobs are available that would provide a working environment that fishermen would be comfortable with?



Unemployment Rate: **3.1%**

National Rate: **7.9%***

The unemployment rate in a community is one indicator of the level of opportunity that may exist for fishermen who lose their jobs to find alternative ways of making a living. The unemployment rate may also indicate the desirability of fishing in the face of other opportunities.

*Source: U.S. Department of Labor, **Bureau of Labor Statistics**

Median Household Income: **$114,214.00**

National Average: **$51,914.00** (2011)

Individuals in Cohasset living in poverty: **1.2 %**

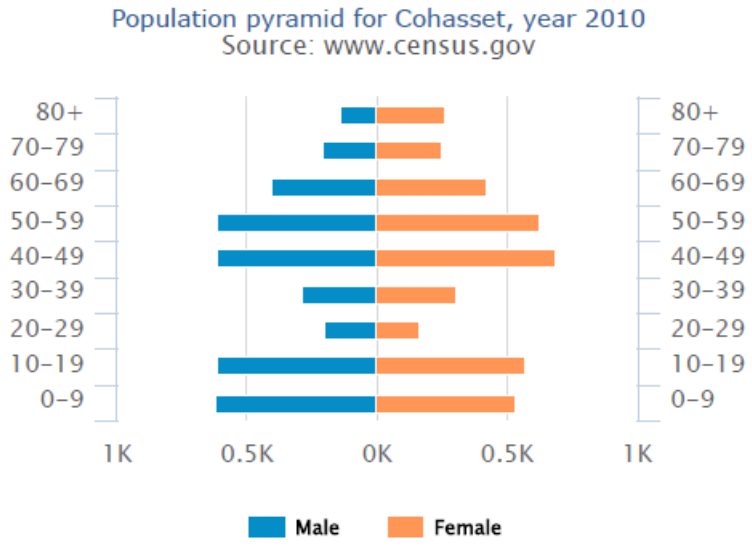
The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

Age structure of residents

Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process that may affect fishermen's access to the waterfront. In some remote coastal communities, people in their late teens or early twenties may leave to look for work or pursue an education outside of their community. A very large population of young people, on the other hand, may indicate the presence of universities or a military base.

Median age: **43.6**

National median: **37.2**



Ethnicity and Race

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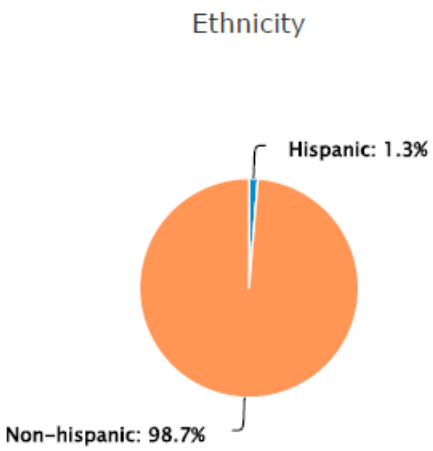

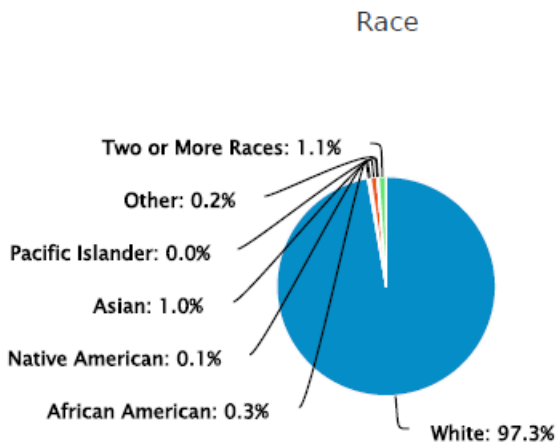

Language and Marginalization

Fishing regulations can be complex. Documents are rarely translated from English into other languages. Lack of strong English language skills could affect participants' ability to engage effectively in the fisheries management process. While these numbers correspond to the overall community in Cohasset they may indicate a population needing assistance in integrating their needs and concerns into the process.

Foreign Born: **3.9%**
National Average: **12.7%**

Speak English less than very well: **0.9%**
National Average: **8.7%**

Social Indicators

Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Portsmouth that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of interest and are used to evaluate community well-being in terms of social, economic and psychological welfare.
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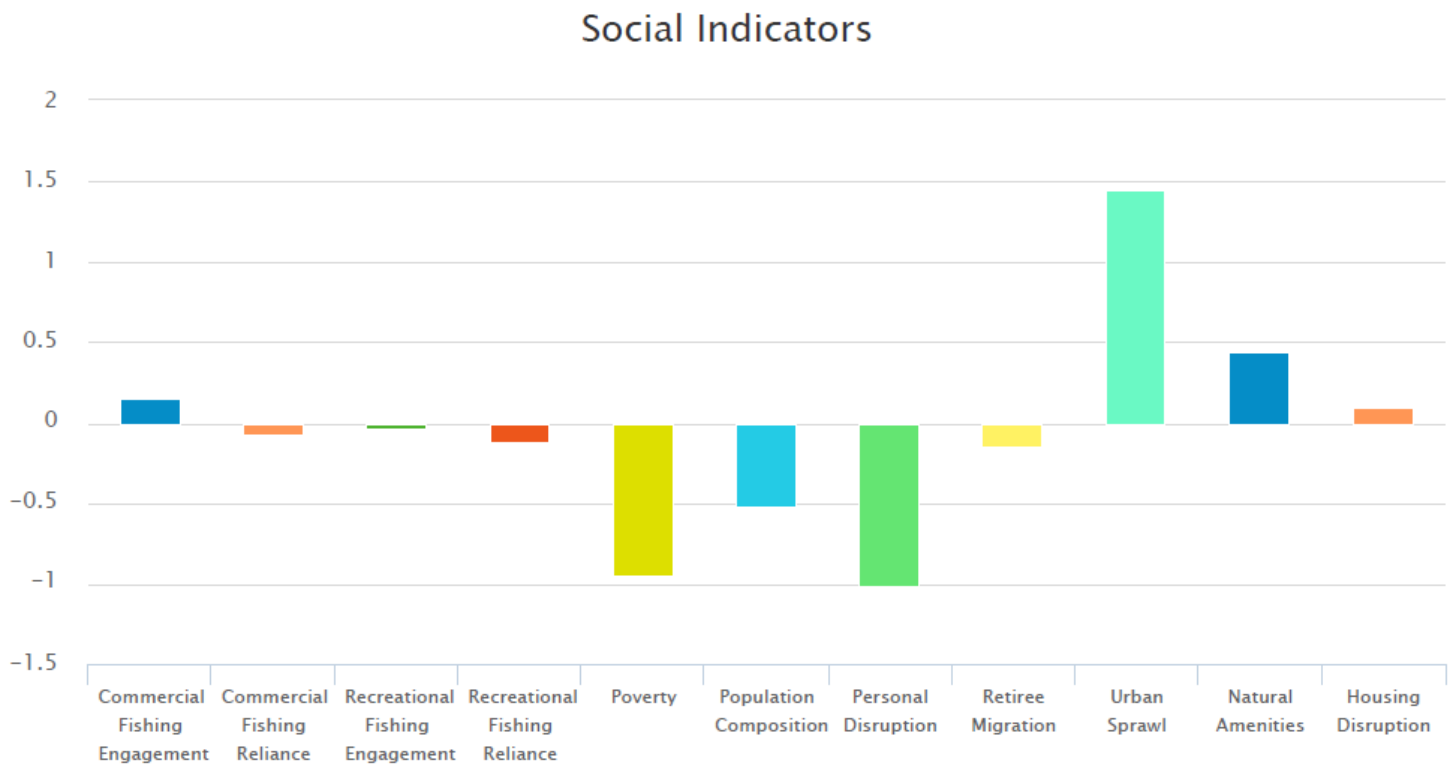
The factor scores for each index are normalized so that zero is the mean. Therefore, a higher value implies more engagement or reliance upon fishing or higher social vulnerability or vulnerability to gentrification. Learn more about the social indicators for fishing communities.

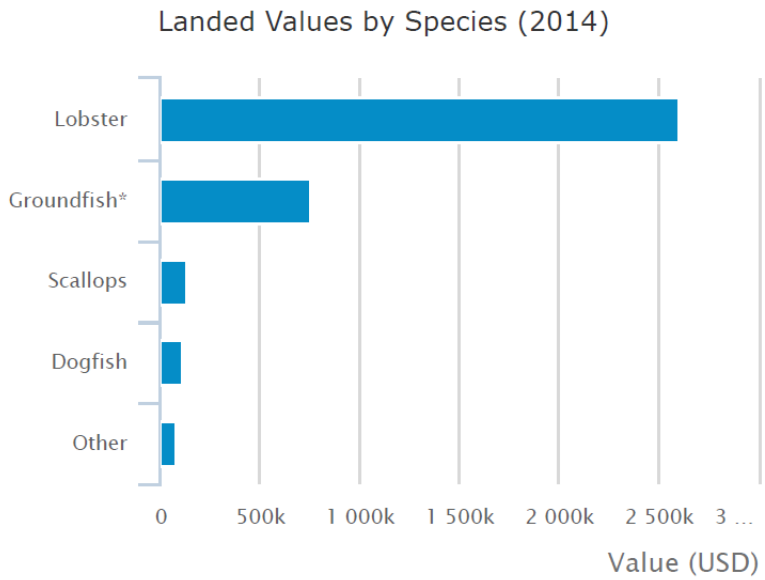

Social Indicators
2
1.5
1
0.5
0
-0.5
-1
-1.5
Commercial Fishing Engagement
Commercial Fishing Reliance
Recreational Fishing Engagement
Recreational Fishing Reliance
Poverty
Population Composition
Personal Disruption
Retiree Migration
Urban Sprawl
Natural Amenities
Housing Disruption

Scituate, MA

Where is Scituate located?

Scituate is a town with a population of 18,133 and classified by the census as falling within an urbanized area. Rural to urban is really a continuum. Increasing urbanization indicates that a community has more jobs overall, more kinds of jobs, and more services like hospitals, social workers and job training centers. However, increasing urbanization can also mean greater pressure to transform working waterfronts for alternative uses, such as hotels or tourist shops.

Involvement in Fisheries



What species are landed in Scituate?

The landings associated with a fishing community tell us what species are important to that community. The diversity of species caught also is indicative of a community's ability to adapt to changing environmental conditions (e.g. populations of specific fish stocks) or changes in fishing regulations that restrict access to resources.

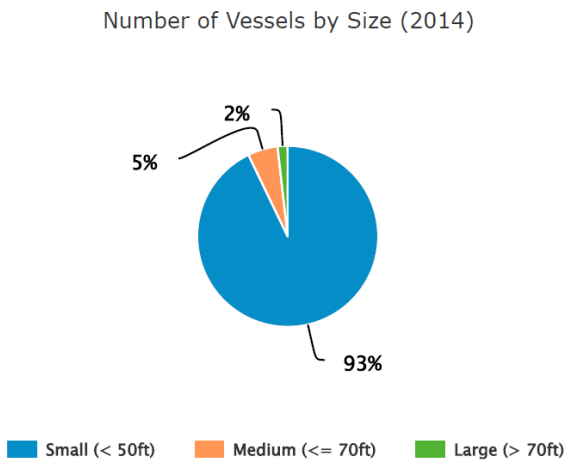
*Groundfish includes cod, winter fl.,witch fl.,yellowtail fl., am.plaice, haddock, white hake,redfish, pollock.

**Whiting includes red hake,ocean pout,black whiting,whiting.

What are the characteristics of the fishing vessels in Scituate?

The number of fishing vessels in a given port provides a sense of the scale of fishing in that port. Where a large port may serve as the homeport for hundreds of vessels, a smaller one may only have a handful. The number of vessels also may provide a rough sense of the number of fishing-related jobs (e.g. crew positions, jobs in shoreside industries) available in a given location.

Size also matters. Larger vessels can travel farther offshore and stay out for longer periods more easily than smaller vessels. These differences also affect family life. Smaller dayboat fishermen tend to return home every day whereas fishermen on larger vessels may be away from home for weeks on long and distant fishing expeditions.

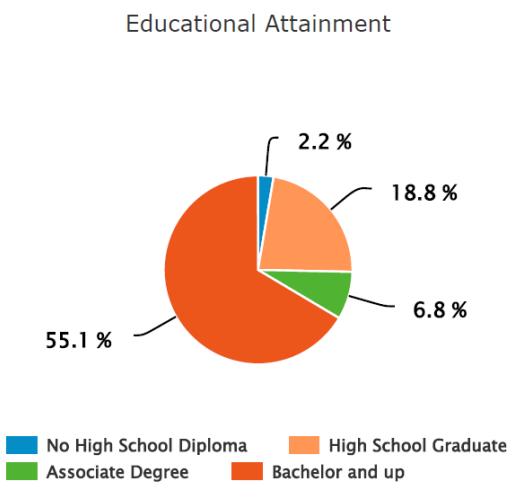


Apart from the lobster fleet, smaller boats also tend to catch a broader range of species where their larger counterparts are more specialized (e.g. limited access scallop boats and herring pair trawlers). All these characteristics help illuminate the potential impacts of regulatory changes on a given community.

Demographic Attributes

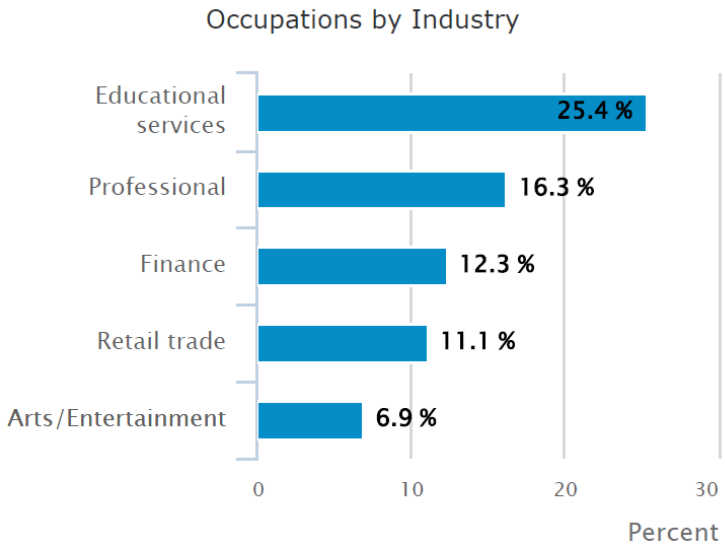
Educational Attainment

The level of educational attainment in a community is associated with issues important for community development, such as income and poverty levels, unemployment rates, and local participation in community activities.



How do people make a living in Scituate?

Just as the range of fish species harvested by town residents speaks to their ability to adapt to environmental change, the diversity in local occupations indicates the ability of a community to adapt to economic changes, including changes in the local fishing economy. Is there one predominant industry, for instance, or is there a range of economic opportunities? How many occupations are available that offer incomes similar to fishing or require skills and education common to the average fisherman? How many jobs are available that would provide a working environment that fishermen would be comfortable with?



Unemployment Rate: **4%**

National Rate: **7.9%***

The unemployment rate in a community is one indicator of the level of opportunity that may exist for fishermen who lose their jobs to find alternative ways of making a living. The unemployment rate may also indicate the desirability of fishing in the face of other opportunities.

*Source: U.S. Department of Labor, **Bureau of Labor Statistics**

Median Household Income: **$86,723.00**

National Average: **$51,914.00** (2011)

Individuals in Scituate living in poverty: **3.1%**

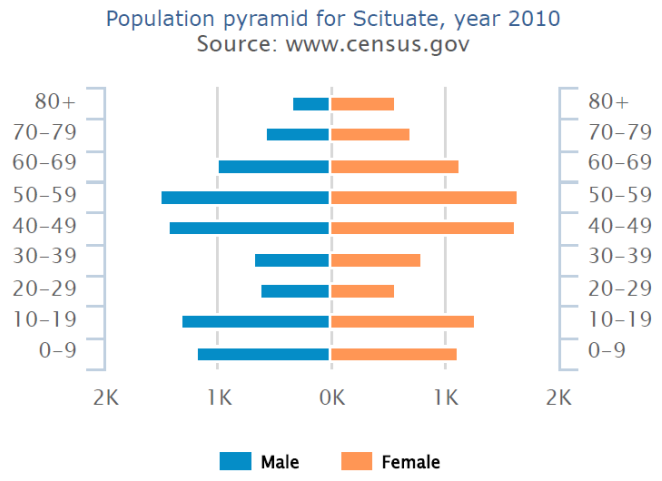
The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

Age structure of residents

Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process that may affect fishermen's access to the waterfront. In some remote coastal communities, people in their late teens or early twenties may leave to look for work or pursue an education outside of their community. A very large population of young people, on the other hand, may indicate the presence of universities or a military base.

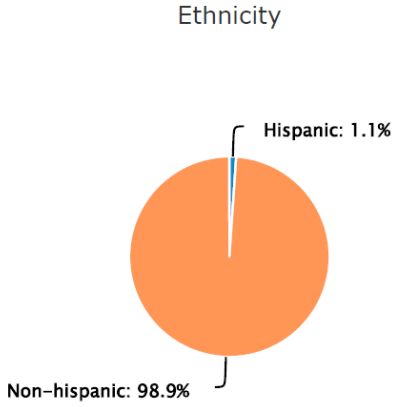
Median age: **45.1**

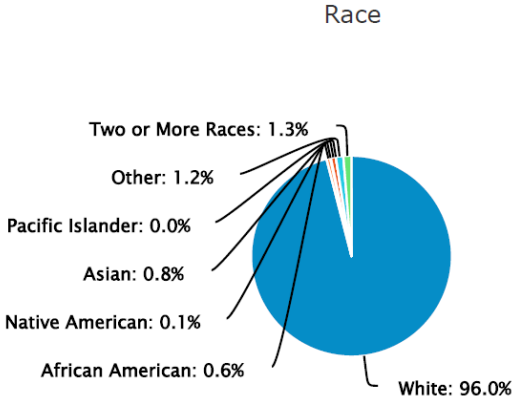
National median: **37.2**



Ethnicity and Race

These factors give a sense of the cultural context of the community, and the relationship of fishing families and groups to the community in which they live. Is this community racially and ethnically diverse? In the northeast region, ethnic diversity in coastal communities tends to be higher in the Mid Atlantic than in New England, though there are significant exceptions in some fishing ports. Moreover, certain ethnic groups have long been associated with fishing in various specific ports throughout the region.





Language and Marginalization

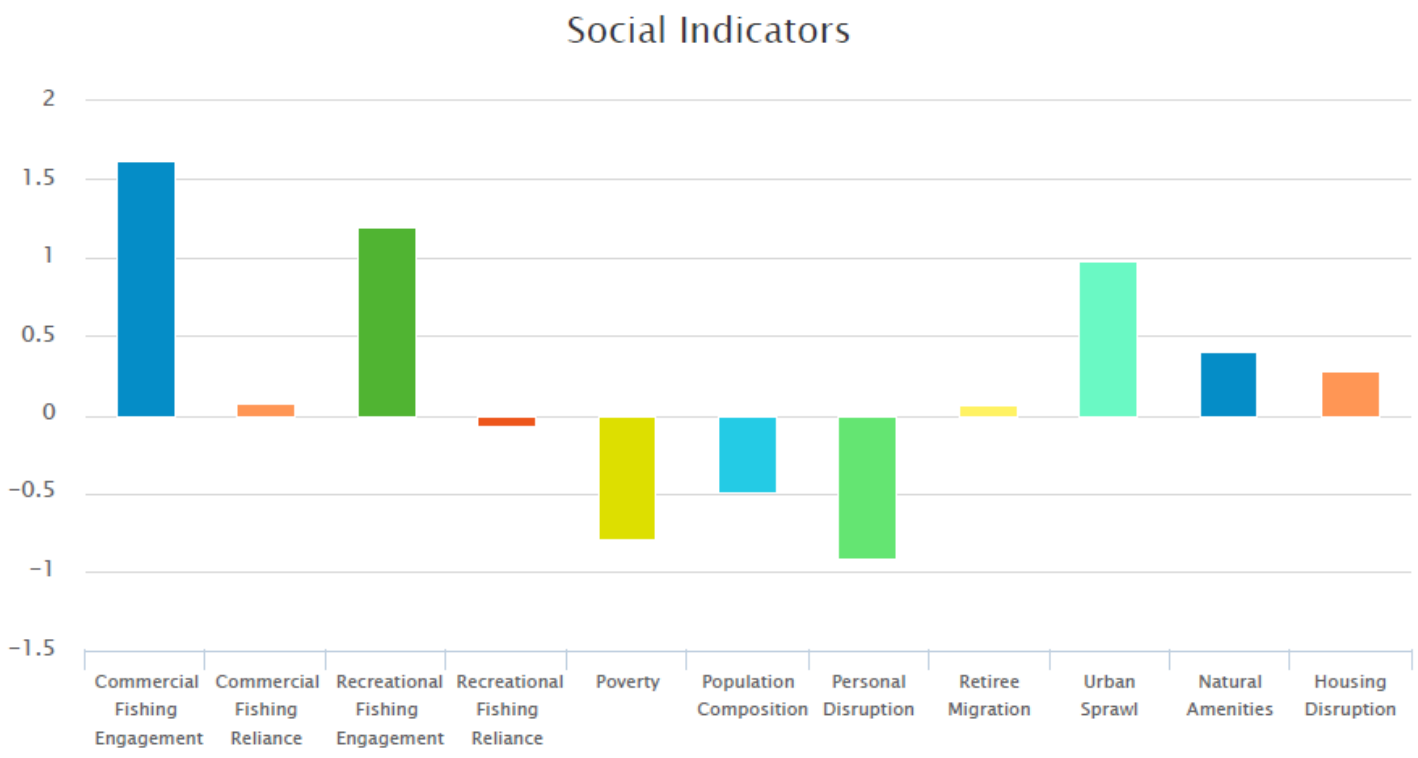
Fishing regulations can be complex. Documents are rarely translated from English into other languages. Lack of strong English language skills could affect participants' ability to engage effectively in the fisheries management process. While these numbers correspond to the overall community in Scituate they may indicate a population needing assistance in integrating their needs and concerns into the process.

Foreign Born: **4.6%**
National Average: **12.7%**

Speak English less than very well: **2%**
National Average: **8.7%**

Social Indicators

Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Portsmouth that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of interest and are used to evaluate community well-being in terms of social, economic and psychological welfare.
Fishing engagement and reliance indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities. The indices include: Commercial Engagement, Commercial Reliance, Recreational Engagement and Recreational Reliance.
Social vulnerability indices represent social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing. The indices include: Poverty, Population Composition, and Personal Disruption.
Gentrification Pressure indices characterize those factors that, over time may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure. The indices include: Retire Migration, Urban Sprawl, Natural Amenities and Housing Disruption.
The factor scores for each index are normalized so that zero is the mean. Therefore, a higher value implies more engagement or reliance upon fishing or higher social vulnerability or vulnerability to gentrification. Learn more about the social indicators for fishing communities.

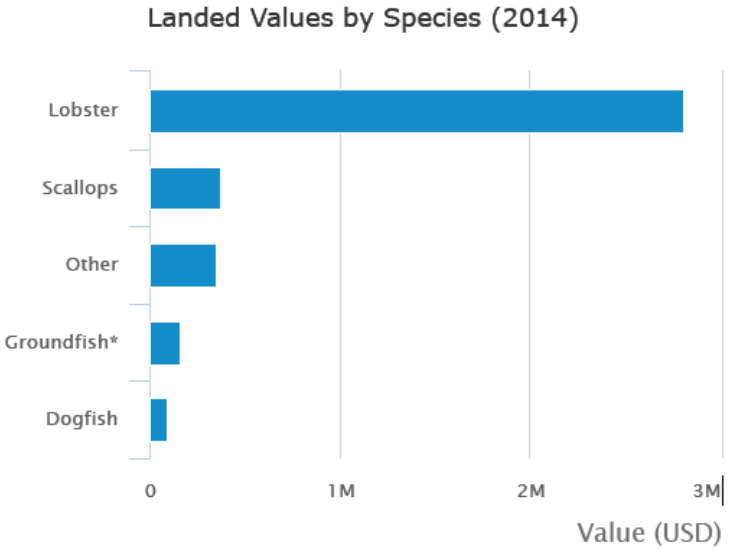

Social Indicators
2
1.5
1
0.5
0
−0.5
−1
−1.5
Commercial Fishing Engagement
Commercial Fishing Reliance
Recreational Fishing Engagement
Recreational Fishing Reliance
Poverty
Population Composition
Personal Disruption
Retiree Migration
Urban Sprawl
Natural Amenities
Housing Disruption

Plymouth, MA

Where is Plymouth located?

Scituate is a town with a population of 56,468 and classified by the census as falling within an urbanized area. Rural to urban is really a continuum. Increasing urbanization indicates that a community has more jobs overall, more kinds of jobs, and more services like hospitals, social workers and job training centers. However, increasing urbanization can also mean greater pressure to transform working waterfronts for alternative uses, such as hotels or tourist shops.

Involvement in Fisheries



What species are landed in Plymouth?

The landings associated with a fishing community tell us what species are important to that community. The diversity of species caught also is indicative of a community's ability to adapt to changing environmental conditions (e.g. populations of specific fish stocks) or changes in fishing regulations that restrict access to resources.

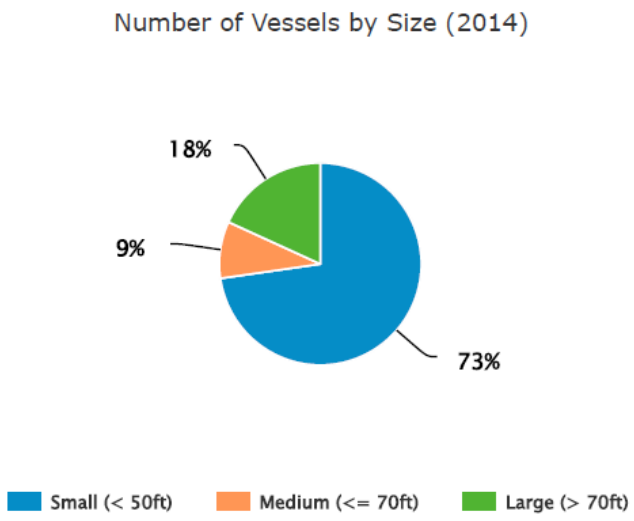
*Groundfish includes cod, winter fl.,witch fl.,yellowtail fl., am.plaice, haddock, white hake,redfish, pollock.

**Whiting includes red hake,ocean pout,black whiting,whiting.

What are the characteristics of the fishing vessels in Plymouth?

The number of fishing vessels in a given port provides a sense of the scale of fishing in that port. Where a large port may serve as the homeport for hundreds of vessels, a smaller one may only have a handful. The number of vessels also may provide a rough sense of the number of fishing-related jobs (e.g. crew positions, jobs in shoreside industries) available in a given location.

Size also matters. Larger vessels can travel farther offshore and stay out for longer periods more easily than smaller vessels. These differences also affect family life. Smaller dayboat fishermen tend to return home every day whereas fishermen on larger vessels may be away from home for weeks on long and distant fishing expeditions.



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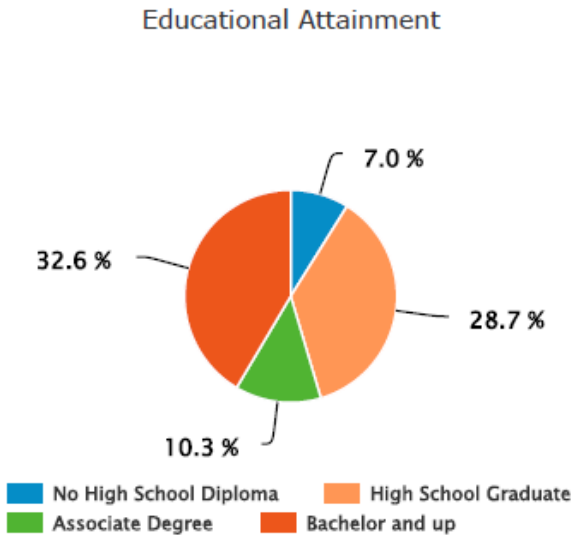
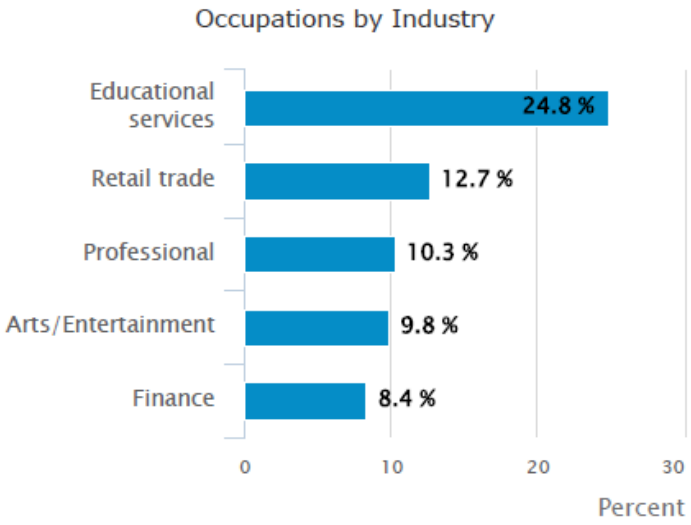


How do people make a living in Plymouth?

Just as the range of fish species harvested by town residents speaks to their ability to adapt to environmental change, the diversity in local occupations indicates the ability of a community to adapt to economic changes, including changes in the local fishing economy. Is there one predominant industry, for instance, or is there a range of economic opportunities? How many occupations are available that offer incomes similar to fishing or require skills and education common to the average fisherman? How many jobs are available that would provide a working environment that fishermen would be comfortable with?



Unemployment Rate: **5.8%**

National Rate: **7.9%***

The unemployment rate in a community is one indicator of the level of opportunity that may exist for fishermen who lose their jobs to find alternative ways of making a living. The unemployment rate may also indicate the desirability of fishing in the face of other opportunities.

*Source: U.S. Department of Labor, **Bureau of Labor Statistics**

Median Household Income: **$74,767.00**

National Average: **$51,914.00** (2011)

Individuals in Plymouth living in poverty: **6.5%**

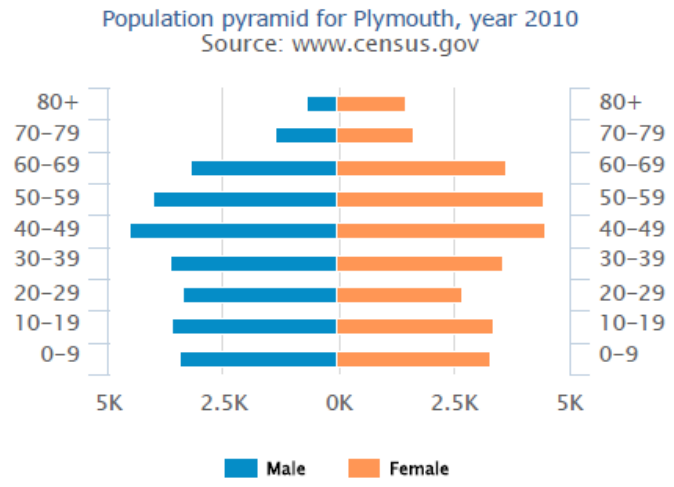
The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

Age structure of residents

Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process that may affect fishermen's access to the waterfront. In some remote coastal communities, people in their late teens or early twenties may leave to look for work or pursue an education outside of their community. A very large population of young people, on the other hand, may indicate the presence of universities or a military base.

Median age: **45.1**

National median: **37.2**



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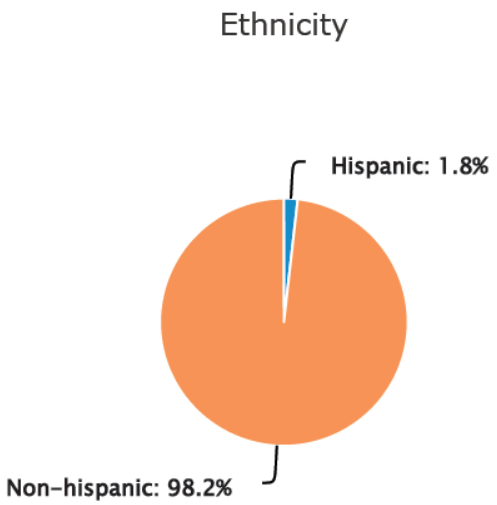

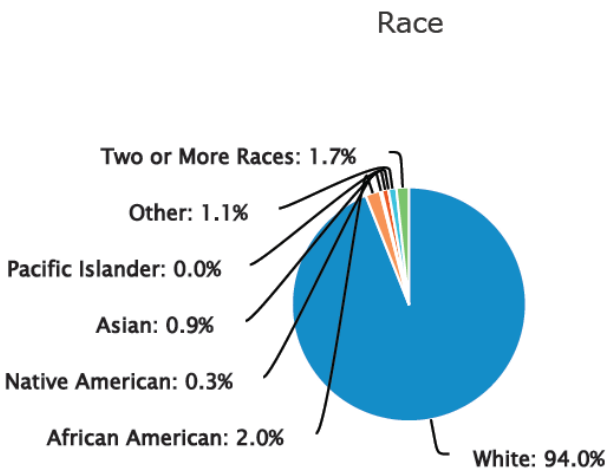

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Foreign Born: **4.8%**
National Average: **12.7%**

Speak English less than very well: **2.6%**
National Average: **8.7%**

Social Indicators

Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Portsmouth that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of interest and are used to evaluate community well-being in terms of social, economic and psychological welfare.
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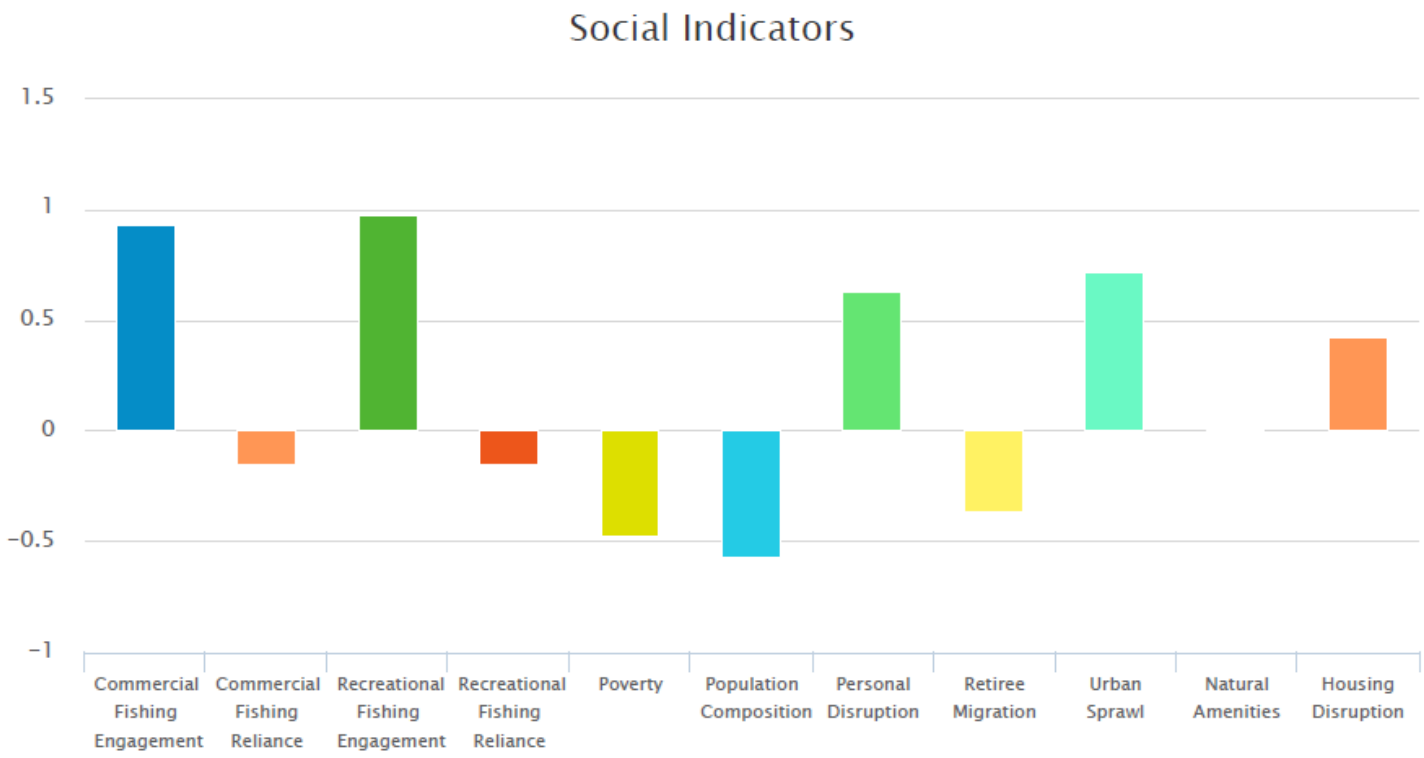
Social Indicators
1.5
1
0.5
0
−0.5
−1
Commercial Fishing Engagement
Commercial Fishing Reliance
Recreational Fishing Engagement
Recreational Fishing Reliance
Poverty
Population Composition
Personal Disruption
Retiree Migration
Urban Sprawl
Natural Amenities
Housing Disruption

Chapter 4 Appendices
Appendix 4.1 Decision Support Tool Model Runs

Appendix 4.1.1 Baseline Information

The baseline information on Lobster and Jonah crab fishing gear configuration, whale habitat density within Massachusetts Portion of Lobster Management Area 1. Information is referenced in Table 4.2 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 13:17:24
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1_Constraint.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												

Total Strings

	Variable	Month	Default	Scenario	Reduction
1	NumStrings	1	4,587	4,587	0 %
2	NumStrings	2	1,915	1,915	0 %
3	NumStrings	3	1,894	1,894	0 %
4	NumStrings	4	3,933	3,933	0 %
5	NumStrings	5	16,339	16,339	0 %
6	NumStrings	6	28,079	28,079	0 %
7	NumStrings	7	35,069	35,069	0 %
8	NumStrings	8	38,141	38,141	0 %
9	NumStrings	9	36,366	36,366	0 %
10	NumStrings	10	32,341	32,341	0 %
11	NumStrings	11	23,544	23,544	0 %
12	NumStrings	12	13,146	13,146	0 %
13	NumStrings	Total	235,354	235,354	0 %

Mean String Length (Gear per String)

	Variable	Month	Default	Scenario	Reduction
1	MeanStringLength	1	19.22	19.22	0 %
2	MeanStringLength	2	22.68	22.68	0 %
3	MeanStringLength	3	20.96	20.96	0 %
4	MeanStringLength	4	17.67	17.67	0 %
5	MeanStringLength	5	9.85	9.85	0 %
6	MeanStringLength	6	8.00	8.00	0 %
7	MeanStringLength	7	7.50	7.50	0 %
8	MeanStringLength	8	7.67	7.67	0 %
9	MeanStringLength	9	8.18	8.18	0 %
10	MeanStringLength	10	8.99	8.99	0 %
11	MeanStringLength	11	11.47	11.47	0 %
12	MeanStringLength	12	13.90	13.90	0 %

Total Vertical Lines

	Variable	Month	Default	Scenario	Reduction
1	NumVerticalLines	1	8,186	8,186	0 %
2	NumVerticalLines	2	3,760	3,760	0 %
3	NumVerticalLines	3	3,656	3,656	0 %
4	NumVerticalLines	4	7,002	7,002	0 %
5	NumVerticalLines	5	24,209	24,209	0 %
6	NumVerticalLines	6	39,710	39,710	0 %
7	NumVerticalLines	7	49,029	49,029	0 %
8	NumVerticalLines	8	52,784	52,784	0 %
9	NumVerticalLines	9	51,697	51,697	0 %
10	NumVerticalLines	10	47,123	47,123	0 %
11	NumVerticalLines	11	37,047	37,047	0 %
12	NumVerticalLines	12	21,847	21,847	0 %
13	NumVerticalLines	Total	346,050	346,050	0 %

Mean Rope Strength

	Variable	Month	Default	Scenario	Reduction
1	RopeStrength	1	3,320.274	3,320.274	0 %
2	RopeStrength	2	3,422.609	3,422.609	0 %
3	RopeStrength	3	3,314.396	3,314.396	0 %
4	RopeStrength	4	3,175.065	3,175.065	0 %
5	RopeStrength	5	2,701.114	2,701.114	0 %
6	RopeStrength	6	2,551.153	2,551.153	0 %
7	RopeStrength	7	2,504.212	2,504.212	0 %
8	RopeStrength	8	2,535.339	2,535.339	0 %
9	RopeStrength	9	2,562.631	2,562.631	0 %
10	RopeStrength	10	2,620.947	2,620.947	0 %
11	RopeStrength	11	2,778.522	2,778.522	0 %
12	RopeStrength	12	2,936.823	2,936.823	0 %
13	RopeStrength	Total	2,660.840	2,660.840	0 %

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	24.60	24.60	0 %
2	WhaleDensity	2	25.08	25.08	0 %
3	WhaleDensity	3	55.25	55.25	0 %
4	WhaleDensity	4	94.41	94.41	0 %
5	WhaleDensity	5	22.03	22.03	0 %
6	WhaleDensity	6	0.74	0.74	0 %
7	WhaleDensity	7	0.30	0.30	0 %
8	WhaleDensity	8	0.17	0.17	0 %
9	WhaleDensity	9	0.35	0.35	0 %
10	WhaleDensity	10	0.28	0.28	0 %
11	WhaleDensity	11	1.23	1.23	0 %
12	WhaleDensity	12	8.19	8.19	0 %
13	WhaleDensity	Total	232.64	232.64	0 %

The baseline information on Lobster and Jonah crab fishing gear configuration, whale habitat density within MRA Wedge, Alternative 2 proposed emergency closure area. Information is referenced in Table 4.2 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 14:21:39
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MRAgap2v2_Constraint.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
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26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					MRA_Gap_Area_North_v2									

Total Strings

	Variable	Month	Default	Scenario	Reduction
1	NumStrings	1	313	313	0 %
2	NumStrings	2	277	277	0 %
3	NumStrings	3	245	245	0 %
4	NumStrings	4	318	318	0 %
5	NumStrings	5	300	300	0 %
6	NumStrings	6	332	332	0 %
7	NumStrings	7	385	385	0 %
8	NumStrings	8	422	422	0 %
9	NumStrings	9	505	505	0 %
10	NumStrings	10	508	508	0 %
11	NumStrings	11	526	526	0 %
12	NumStrings	12	462	462	0 %
13	NumStrings	Total	4,592	4,592	0 %

Mean String Length (Gear per String)

	Variable	Month	Default	Scenario	Reduction
1	MeanStringLength	1	25.54	25.54	0 %
2	MeanStringLength	2	26.11	26.11	0 %
3	MeanStringLength	3	25.51	25.51	0 %
4	MeanStringLength	4	25.64	25.64	0 %
5	MeanStringLength	5	23.12	23.12	0 %
6	MeanStringLength	6	19.67	19.67	0 %
7	MeanStringLength	7	16.55	16.55	0 %
8	MeanStringLength	8	18.37	18.37	0 %
9	MeanStringLength	9	20.14	20.14	0 %
10	MeanStringLength	10	21.24	21.24	0 %
11	MeanStringLength	11	22.99	22.99	0 %
12	MeanStringLength	12	24.98	24.98	0 %

Total Vertical Lines

	Variable	Month	Default	Scenario	Reduction
1	NumVerticalLines	1	612	612	0 %
2	NumVerticalLines	2	551	551	0 %
3	NumVerticalLines	3	489	489	0 %
4	NumVerticalLines	4	626	626	0 %
5	NumVerticalLines	5	558	558	0 %
6	NumVerticalLines	6	582	582	0 %
7	NumVerticalLines	7	654	654	0 %
8	NumVerticalLines	8	730	730	0 %
9	NumVerticalLines	9	901	901	0 %
10	NumVerticalLines	10	922	922	0 %
11	NumVerticalLines	11	987	987	0 %
12	NumVerticalLines	12	883	883	0 %
13	NumVerticalLines	Total	8,495	8,495	0 %

Mean Rope Strength

	Variable	Month	Default	Scenario	Reduction
1	RopeStrength	1	3,669.901	3,669.901	0 %
2	RopeStrength	2	3,676.152	3,676.152	0 %
3	RopeStrength	3	3,617.501	3,617.501	0 %
4	RopeStrength	4	3,659.659	3,659.659	0 %
5	RopeStrength	5	3,590.650	3,590.650	0 %
6	RopeStrength	6	3,399.337	3,399.337	0 %
7	RopeStrength	7	3,157.077	3,157.077	0 %
8	RopeStrength	8	3,295.256	3,295.256	0 %
9	RopeStrength	9	3,401.723	3,401.723	0 %
10	RopeStrength	10	3,464.883	3,464.883	0 %
11	RopeStrength	11	3,548.555	3,548.555	0 %
12	RopeStrength	12	3,682.019	3,682.019	0 %
13	RopeStrength	Total	3,507.593	3,507.593	0 %

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	0.04	0.04	0 %
2	WhaleDensity	2	0.02	0.02	0 %
3	WhaleDensity	3	0.71	0.71	0 %
4	WhaleDensity	4	4.61	4.61	0 %
5	WhaleDensity	5	0.27	0.27	0 %
6	WhaleDensity	6	0.01	0.01	0 %
7	WhaleDensity	7	0.00	0.00	0 %
8	WhaleDensity	8	0.00	0.00	0 %
9	WhaleDensity	9	0.02	0.02	0 %
10	WhaleDensity	10	0.00	0.00	0 %
11	WhaleDensity	11	0.00	0.00	0 %
12	WhaleDensity	12	0.01	0.01	0 %
13	WhaleDensity	Total	5.69	5.69	0 %

The baseline information on Lobster and Jonah crab fishing gear configuration, whale habitat density within MRA Wedge North, Alternative 3 proposed emergency closure area. Information is referenced in Table 4.2 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 14:31:45
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MRAgap4v2_Constraint.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					MRA_Gap_Area_toNHborder_v2									

Total Strings

	Variable	Month	Default	Scenario	Reduction
1	NumStrings	1	1,190	1,190	0 %
2	NumStrings	2	1,093	1,093	0 %
3	NumStrings	3	989	989	0 %
4	NumStrings	4	1,142	1,142	0 %
5	NumStrings	5	845	845	0 %
6	NumStrings	6	880	880	0 %
7	NumStrings	7	881	881	0 %
8	NumStrings	8	1,076	1,076	0 %
9	NumStrings	9	1,363	1,363	0 %
10	NumStrings	10	1,462	1,462	0 %
11	NumStrings	11	1,563	1,563	0 %
12	NumStrings	12	1,470	1,470	0 %
13	NumStrings	Total	13,954	13,954	0 %

Mean String Length (Gear per String)

	Variable	Month	Default	Scenario	Reduction
1	MeanStringLength	1	26.97	26.97	0 %
2	MeanStringLength	2	26.68	26.68	0 %
3	MeanStringLength	3	25.61	25.61	0 %
4	MeanStringLength	4	26.85	26.85	0 %
5	MeanStringLength	5	26.69	26.69	0 %
6	MeanStringLength	6	24.24	24.24	0 %
7	MeanStringLength	7	21.73	21.73	0 %
8	MeanStringLength	8	23.48	23.48	0 %
9	MeanStringLength	9	24.58	24.58	0 %
10	MeanStringLength	10	25.43	25.43	0 %
11	MeanStringLength	11	26.57	26.57	0 %
12	MeanStringLength	12	27.48	27.48	0 %

Total Vertical Lines

	Variable	Month	Default	Scenario	Reduction
1	NumVerticalLines	1	2,366	2,366	0 %
2	NumVerticalLines	2	2,184	2,184	0 %
3	NumVerticalLines	3	1,977	1,977	0 %
4	NumVerticalLines	4	2,274	2,274	0 %
5	NumVerticalLines	5	1,645	1,645	0 %
6	NumVerticalLines	6	1,667	1,667	0 %
7	NumVerticalLines	7	1,632	1,632	0 %
8	NumVerticalLines	8	2,020	2,020	0 %
9	NumVerticalLines	9	2,601	2,601	0 %
10	NumVerticalLines	10	2,818	2,818	0 %
11	NumVerticalLines	11	3,056	3,056	0 %
12	NumVerticalLines	12	2,897	2,897	0 %
13	NumVerticalLines	Total	27,139	27,139	0 %

Mean Rope Strength

	Variable	Month	Default	Scenario	Reduction
1	RopeStrength	1	3,728.911	3,728.911	0 %
2	RopeStrength	2	3,692.518	3,692.518	0 %
3	RopeStrength	3	3,598.118	3,598.118	0 %
4	RopeStrength	4	3,716.268	3,716.268	0 %
5	RopeStrength	5	3,779.433	3,779.433	0 %
6	RopeStrength	6	3,625.181	3,625.181	0 %
7	RopeStrength	7	3,456.482	3,456.482	0 %
8	RopeStrength	8	3,577.238	3,577.238	0 %
9	RopeStrength	9	3,641.548	3,641.548	0 %
10	RopeStrength	10	3,687.516	3,687.516	0 %
11	RopeStrength	11	3,751.608	3,751.608	0 %
12	RopeStrength	12	3,803.858	3,803.858	0 %
13	RopeStrength	Total	3,682.295	3,682.295	0 %

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	3.32	3.32	0 %
2	WhaleDensity	2	2.70	2.70	0 %
3	WhaleDensity	3	1.34	1.34	0 %
4	WhaleDensity	4	6.33	6.33	0 %
5	WhaleDensity	5	1.80	1.80	0 %
6	WhaleDensity	6	0.37	0.37	0 %
7	WhaleDensity	7	0.15	0.15	0 %
8	WhaleDensity	8	0.07	0.07	0 %
9	WhaleDensity	9	0.19	0.19	0 %
10	WhaleDensity	10	1.06	1.06	0 %
11	WhaleDensity	11	2.56	2.56	0 %
12	WhaleDensity	12	1.87	1.87	0 %
13	WhaleDensity	Total	21.77	21.77	0 %

Gear reduction scenario in Massachusetts Restricted Area during February, March, and April. Management action is constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 13:54:06
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRA_100pGR_Feb,Mar,Apr.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.16	2.7 %
3	RelativeRisk_CoOccurrence	3	6.27	3.51	44 %
4	RelativeRisk_CoOccurrence	4	54.35	22.12	59.3 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	375.97	8.5 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	1.5 %
3	RelativeRisk_Threat	3	1.06	0.66	38 %
4	RelativeRisk_Threat	4	9.51	4.49	52.7 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	47.63	10.2 %

Gear reduction scenario in Massachusetts Restricted Area during February, March, and April.

Management action is constrained to the Northeast Region. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-01-31 12:06:39
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MRA_100pGR_Feb,Mar,Apr.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.72	0.1 %
3	RelativeRisk_CoOccurrence	3	26.60	23.83	10.4 %
4	RelativeRisk_CoOccurrence	4	89.76	57.53	35.9 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	884.31	3.8 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.04	0.1 %
3	RelativeRisk_Threat	3	6.63	6.23	6.1 %
4	RelativeRisk_Threat	4	16.96	11.95	29.6 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	130.67	4 %

Appendix 4.1.2 Alternative 2 Model Runs

April gear reduction scenario in MRA Wedge, Alternative 2 proposed emergency closure area. Management action is constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 16:29:44
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAgap2v2_100pGearReductionApril.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	GearReduction					MRA_Gap_Area_North_v2	4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.19	0 %
3	RelativeRisk_CoOccurrence	3	6.27	6.27	0 %
4	RelativeRisk_CoOccurrence	4	54.35	40.98	24.6 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	397.63	3.3 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	0 %
3	RelativeRisk_Threat	3	1.06	1.06	0 %
4	RelativeRisk_Threat	4	9.51	6.55	31.1 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	50.09	5.6 %

April closure scenario in MRA Wedge, Alternative 2 proposed emergency closure area. Management action is constrained to the Massachusetts portion of Lobster Management Area 1.

Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-22 19:48:20
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAgap2v2_ClosureApril.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	Closure					MRA_Gap_Area_North_v2	4								

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.19	0 %
3	RelativeRisk_CoOccurrence	3	6.27	6.27	0 %
4	RelativeRisk_CoOccurrence	4	54.35	42.33	22.1 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	398.97	2.9 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	0 %
3	RelativeRisk_Threat	3	1.06	1.06	0 %
4	RelativeRisk_Threat	4	9.51	6.82	28.2 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	50.37	5.1 %

April gear reduction scenario in MRA Wedge, Alternative 2 proposed emergency closure area. Management action is constrained to the Northeast Region. Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-23 15:26:23
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAgap2v2_100pGR_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	GearReduction					MRA_Gap_Area_North_v2	4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.77	0 %
3	RelativeRisk_CoOccurrence	3	26.60	26.60	0 %
4	RelativeRisk_CoOccurrence	4	89.76	76.39	14.9 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	905.99	1.5 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.05	0 %
3	RelativeRisk_Threat	3	6.63	6.63	0 %
4	RelativeRisk_Threat	4	16.96	14.00	17.4 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	133.14	2.2 %

April closure scenario in MRA Wedge, Alternative 2 proposed emergency closure area.

Management action is constrained to the Northeast Region. Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-23 19:41:58
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAgap2v2_Closure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	Closure					MRA_Gap_Area_North_v2	4								

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.77	0 %
3	RelativeRisk_CoOccurrence	3	26.60	26.60	0 %
4	RelativeRisk_CoOccurrence	4	89.76	77.69	13.4 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	907.29	1.3 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.05	0 %
3	RelativeRisk_Threat	3	6.63	6.63	0 %
4	RelativeRisk_Threat	4	16.96	14.24	16.1 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	133.38	2 %

April gear reduction scenario in MRA Wedge, Alternative 2 proposed emergency closure area,

and February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 16:52:42
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAandGap2v2_100pGearReductionApril.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							
3	GearReduction					MRA_Gap_Area_North_v2	4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.16	2.7 %
3	RelativeRisk_CoOccurrence	3	6.27	3.51	44 %
4	RelativeRisk_CoOccurrence	4	54.35	8.76	83.9 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	362.61	11.8 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	1.5 %
3	RelativeRisk_Threat	3	1.06	0.66	38 %
4	RelativeRisk_Threat	4	9.51	1.53	83.9 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	44.67	15.8 %

April closure scenario in MRA Wedge, Alternative 2 proposed emergency closure area, and

February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-22 21:26:30
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAandGap2v2_100pGRandClosure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	Closure					MRA_Gap_Area_North_v2	4								
3	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.16	2.7 %
3	RelativeRisk_CoOccurrence	3	6.27	3.51	44 %
4	RelativeRisk_CoOccurrence	4	54.35	10.11	81.4 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	363.96	11.4 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	1.5 %
3	RelativeRisk_Threat	3	1.06	0.66	38 %
4	RelativeRisk_Threat	4	9.51	1.81	81 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	44.95	15.3 %

April gear reduction scenario in MRA Wedge, Alternative 2 proposed emergency closure area, and February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Northeast Region. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-23 11:36:19
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAandGap2v2_100pGR_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	GearReduction					MRA_Gap_Area_North_v2	4	1							
3	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.72	0.1 %
3	RelativeRisk_CoOccurrence	3	26.60	23.83	10.4 %
4	RelativeRisk_CoOccurrence	4	89.76	44.16	50.8 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	870.95	5.3 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.04	0.1 %
3	RelativeRisk_Threat	3	6.63	6.23	6.1 %
4	RelativeRisk_Threat	4	16.96	8.99	47 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	127.71	6.2 %

April closure scenario in MRA Wedge, Alternative 2 proposed emergency closure area, and

February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Northeast Region. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-27 21:55:57
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAandGap2v2_100pGRandClosure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	Closure					MRA_Gap_Area_North_v2	4								
3	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.72	0.1 %
3	RelativeRisk_CoOccurrence	3	26.60	23.83	10.4 %
4	RelativeRisk_CoOccurrence	4	89.76	45.47	49.3 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	872.25	5.1 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.04	0.1 %
3	RelativeRisk_Threat	3	6.63	6.23	6.1 %
4	RelativeRisk_Threat	4	16.96	9.23	45.6 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	127.95	6 %

April gear reduction scenario in MRA Wedge, Alternative 2 proposed emergency closure area, and the 2021 Final Rule. Management actions are constrained to the Northeast Region. For reasons discussed in Section 2.1, not all management actions have been implemented as of March 2022. The mean risk and co-occurrence values of this scenario was subtracted from the baseline 2021 Final Rule risk and co-occurrence values (without the emergency closure) to quantity additional relative risk and co-occurrence reduction percentages for Alternative 2.

	ModelConfiguration
1	2022-02-24 19:22:53
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/FEIS_Preferred_Alternative_MRAgap2_100pGR_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	StringLength					Exempt_to_3_ME_ABFG			Min	2					
3	StringLength					Exempt_to_3_ME_CDE			Min	3					
4	StringLength					MaineZoneA_East			Min	20					
5	StringLength					MaineZoneA_West_3_6			Min	8					
6	StringLength					Three_to_6_ME_B			Exactly	5					
7	MaxGearWSingleLine					Three_to_6_ME_B									5
8	StringLength					Three_to_6_ME_CDEFG			Min	10					
9	StringLength					MaineZoneA_West_6_12			Min	15					
10	StringLength					Six_to_12_ME_B			Min	10					
11	StringLength					Six_to_12_ME_CG			Min	20					
12	StringLength					Six_to_12_ME_DEF			Min	10					
13	StringLength	A1	MA			6to12_A1_poly			Min	15					
14	StringLength	OCC				3nmi_to_12nmi			Min	15					
15	StringLength	A1				12nmi_to_EEZ_Boundary			Min	25					
16	StringLength	A2_3overlap							Min	40					
17	StringLength	A3				LMA3_Canyons_Simple			Min	35					
18	StringLength	A3				LMA3_NorthOfCanyons_Simple			Min	45					
19	StringLength					Georges_Basin_Restricted_Area			Min	50					
20	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							
21	GearReduction					MRA_Gap_Area_North_v2	4	1							
22	Closure					LMA1_Restricted_Area_FR	10,11,12,1								
23	Closure					South_Island_Restricted_Area	2,3,4								
24	GearReduction	A1	MA			Coast_to_3nmi_DST	2,3,4,5	1							
25	GearReduction	OCC	MA			Coast_to_3nmi_DST	5	1							
26	GearReduction	A3						0.12							
27	GearReduction	A2_3overlap						0.15							
28	GearReduction	A2						0.18							
29	MaxRopeStrength	A1	ME			Coast_to_3nmi_DST		0.3243			1700				
30	MaxRopeStrength					Three_to_12_ME_AwBCDE		0.181			1700				

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
31	MaxRopeStrength					Three_to_12_ME_AeFG		0.1015			1700				
32	MaxRopeStrength	A1	ME			12nmi_to_EEZ_Boundary		0.0472			1700				
33	MaxRopeStrength	A1	MA			Coast_to_3nmi_DST		0.5			1700				
34	MaxRopeStrength	OCC				Coast_to_3nmi_DST		0.5			1700				
35	MaxRopeStrength	A2				Coast_to_3nmi_DST		0.5			1700				
36	MaxRopeStrength	A1	MA			3nmi_to_12nmi		0.2933			1700				
37	MaxRopeStrength	OCC				3nmi_to_12nmi		0.3907			1700				
38	MaxRopeStrength	A2				3nmi_to_12nmi		0.5			1700				
39	MaxRopeStrength	A1	MA			12nmi_to_EEZ_Boundary		0.0786			1700				
40	MaxRopeStrength	A2				12nmi_to_EEZ_Boundary		0.5			1700				
41	MaxRopeStrength	OCC				12nmi_to_EEZ_Boundary		0.2049			1700				
42	MaxRopeStrength	A2_3overlap						0.4375			1700				
43	MaxRopeStrength	A3						0.375			1700				

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	55.84	37.5 %
2	RelativeRisk_CoOccurrence	2	34.77	24.35	30 %
3	RelativeRisk_CoOccurrence	3	26.60	16.92	36.4 %
4	RelativeRisk_CoOccurrence	4	89.76	27.82	69 %
5	RelativeRisk_CoOccurrence	5	315.51	24.82	92.1 %
6	RelativeRisk_CoOccurrence	6	19.10	13.37	30 %
7	RelativeRisk_CoOccurrence	7	10.16	6.92	31.8 %
8	RelativeRisk_CoOccurrence	8	24.98	21.38	14.4 %
9	RelativeRisk_CoOccurrence	9	81.84	68.58	16.2 %
10	RelativeRisk_CoOccurrence	10	60.48	36.88	39 %
11	RelativeRisk_CoOccurrence	11	72.50	38.12	47.4 %
12	RelativeRisk_CoOccurrence	12	94.32	72.18	23.5 %
13	RelativeRisk_CoOccurrence	Total	919.35	407.19	55.7 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	8.71	46.6 %
2	RelativeRisk_Threat	2	8.05	3.77	53.1 %
3	RelativeRisk_Threat	3	6.63	2.62	60.5 %
4	RelativeRisk_Threat	4	16.96	3.64	78.6 %
5	RelativeRisk_Threat	5	38.50	4.06	89.4 %
6	RelativeRisk_Threat	6	4.66	2.39	48.8 %
7	RelativeRisk_Threat	7	2.63	1.32	50 %
8	RelativeRisk_Threat	8	2.52	1.95	22.4 %
9	RelativeRisk_Threat	9	8.20	6.28	23.4 %
10	RelativeRisk_Threat	10	7.66	4.43	42.1 %
11	RelativeRisk_Threat	11	9.96	4.94	50.4 %
12	RelativeRisk_Threat	12	14.02	8.45	39.7 %
13	RelativeRisk_Threat	Total	136.10	52.57	61.4 %

April closure scenario in MRA Wedge, Alternative 2 proposed emergency closure area, and the 2021 Final Rule. Management actions are constrained to the Northeast Region. For reasons discussed in Section 2.1, not all management actions have been implemented as of March 2022. The mean risk and co-occurrence values of this scenario was subtracted from the baseline 2021 Final Rule risk and co-occurrence values (without the emergency closure) to quantity additional relative risk and co-occurrence reduction percentages for Alternative 2.

	ModelConfiguration
1	2022-02-25 15:18:35
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/FEIS_Preferred_Alternative_MRAgap2v2_Closure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	StringLength					Exempt_to_3_ME_ABFG			Min	2					
3	StringLength					Exempt_to_3_ME_CDE			Min	3					
4	StringLength					MaineZoneA_East			Min	20					
5	StringLength					MaineZoneA_West_3_6			Min	8					
6	StringLength					Three_to_6_ME_B			Exactly	5					
7	MaxGearWSingleLine					Three_to_6_ME_B									5
8	StringLength					Three_to_6_ME_CDEFG			Min	10					
9	StringLength					MaineZoneA_West_6_12			Min	15					
10	StringLength					Six_to_12_ME_B			Min	10					
11	StringLength					Six_to_12_ME_CG			Min	20					
12	StringLength					Six_to_12_ME_DEF			Min	10					
13	StringLength	A1	MA			6to12_A1_poly			Min	15					
14	StringLength	OCC				3nmi_to_12nmi			Min	15					
15	StringLength	A1				12nmi_to_EEZ_Boundary			Min	25					
16	StringLength	A2_3overlap							Min	40					
17	StringLength	A3				LMA3_Canyons_Simple			Min	35					
18	StringLength	A3				LMA3_NorthOfCanyons_Simple			Min	45					
19	StringLength					Georges_Basin_Restricted_Area			Min	50					
20	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							
21	Closure					MRA_Gap_Area_North_v2	4								
22	Closure					LMA1_Restricted_Area_FR	10,11,12,1								
23	Closure					South_Island_Restricted_Area	2,3,4								
24	GearReduction	A1	MA			Coast_to_3nmi_DST	2,3,4,5	1							
25	GearReduction	OCC	MA			Coast_to_3nmi_DST	5	1							
26	GearReduction	A3						0.12							
27	GearReduction	A2_3overlap						0.15							
28	GearReduction	A2						0.18							
29	MaxRopeStrength	A1	ME			Coast_to_3nmi_DST		0.3243			1700				
30	MaxRopeStrength					Three_to_12_ME_AwBCDE		0.181			1700				

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
31	MaxRopeStrength					Three_to_12_ME_AeFG		0.1015			1700				
32	MaxRopeStrength	A1	ME			12nmi_to_EEZ_Boundary		0.0472			1700				
33	MaxRopeStrength	A1	MA			Coast_to_3nmi_DST		0.5			1700				
34	MaxRopeStrength	OCC				Coast_to_3nmi_DST		0.5			1700				
35	MaxRopeStrength	A2				Coast_to_3nmi_DST		0.5			1700				
36	MaxRopeStrength	A1	MA			3nmi_to_12nmi		0.2933			1700				
37	MaxRopeStrength	OCC				3nmi_to_12nmi		0.3907			1700				
38	MaxRopeStrength	A2				3nmi_to_12nmi		0.5			1700				
39	MaxRopeStrength	A1	MA			12nmi_to_EEZ_Boundary		0.0786			1700				
40	MaxRopeStrength	A2				12nmi_to_EEZ_Boundary		0.5			1700				
41	MaxRopeStrength	OCC				12nmi_to_EEZ_Boundary		0.2049			1700				
42	MaxRopeStrength	A2_3overlap						0.4375			1700				
43	MaxRopeStrength	A3						0.375			1700				

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	55.84	37.5 %
2	RelativeRisk_CoOccurrence	2	34.77	24.35	30 %
3	RelativeRisk_CoOccurrence	3	26.60	16.92	36.4 %
4	RelativeRisk_CoOccurrence	4	89.76	28.43	68.3 %
5	RelativeRisk_CoOccurrence	5	315.51	24.82	92.1 %
6	RelativeRisk_CoOccurrence	6	19.10	13.37	30 %
7	RelativeRisk_CoOccurrence	7	10.16	6.92	31.8 %
8	RelativeRisk_CoOccurrence	8	24.98	21.38	14.4 %
9	RelativeRisk_CoOccurrence	9	81.84	68.58	16.2 %
10	RelativeRisk_CoOccurrence	10	60.48	36.88	39 %
11	RelativeRisk_CoOccurrence	11	72.50	38.12	47.4 %
12	RelativeRisk_CoOccurrence	12	94.32	72.18	23.5 %
13	RelativeRisk_CoOccurrence	Total	919.35	407.79	55.6 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	8.71	46.6 %
2	RelativeRisk_Threat	2	8.05	3.77	53.1 %
3	RelativeRisk_Threat	3	6.63	2.62	60.5 %
4	RelativeRisk_Threat	4	16.96	3.75	77.9 %
5	RelativeRisk_Threat	5	38.50	4.06	89.4 %
6	RelativeRisk_Threat	6	4.66	2.39	48.8 %
7	RelativeRisk_Threat	7	2.63	1.32	50 %
8	RelativeRisk_Threat	8	2.52	1.95	22.4 %
9	RelativeRisk_Threat	9	8.20	6.28	23.4 %
10	RelativeRisk_Threat	10	7.66	4.43	42.1 %
11	RelativeRisk_Threat	11	9.96	4.94	50.4 %
12	RelativeRisk_Threat	12	14.02	8.45	39.7 %
13	RelativeRisk_Threat	Total	136.10	52.69	61.3 %

Appendix 4.1.3 Alternative 3 Model Runs

April gear reduction scenario in MRA Wedge North, Alternative 3 proposed emergency closure area. Management action is constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 16:37:53
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAgap4v2_100pGearReductionApril.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	GearReduction					MRA_Gap_Area_toNHborder_v2	4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.19	0 %
3	RelativeRisk_CoOccurrence	3	6.27	6.27	0 %
4	RelativeRisk_CoOccurrence	4	54.35	39.33	27.6 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	395.97	3.7 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	0 %
3	RelativeRisk_Threat	3	1.06	1.06	0 %
4	RelativeRisk_Threat	4	9.51	6.13	35.5 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	49.67	6.4 %

April closure scenario in MRA Wedge North, Alternative 3 proposed emergency closure area. Management action is constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-22 20:51:08
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAgap4v2_ClosureApril.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	Closure					MRA_Gap_Area_toNHborder_v2	4								

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.19	0 %
3	RelativeRisk_CoOccurrence	3	6.27	6.27	0 %
4	RelativeRisk_CoOccurrence	4	54.35	40.61	25.3 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	397.26	3.3 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	0 %
3	RelativeRisk_Threat	3	1.06	1.06	0 %
4	RelativeRisk_Threat	4	9.51	6.41	32.6 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	49.95	5.8 %

April gear reduction scenario in MRA Wedge North, Alternative 3 proposed emergency closure area. Management action is constrained to the Northeast Region. Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-23 17:39:01
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAgap4v2_100pGR_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	GearReduction					MRA_Gap_Area_toNHborder_v2	4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.77	0 %
3	RelativeRisk_CoOccurrence	3	26.60	26.60	0 %
4	RelativeRisk_CoOccurrence	4	89.76	74.31	17.2 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	903.91	1.7 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.05	0 %
3	RelativeRisk_Threat	3	6.63	6.63	0 %
4	RelativeRisk_Threat	4	16.96	13.52	20.3 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	132.65	2.5 %

April closure scenario in MRA Wedge North, Alternative 3 proposed emergency closure area. Management action is constrained to the Northeast Region. Information is referenced in Table 4.3 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-25 20:34:34
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAgap4v2_Closure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	Closure					MRA_Gap_Area_toNHborder_v2	4								

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.77	0 %
3	RelativeRisk_CoOccurrence	3	26.60	26.60	0 %
4	RelativeRisk_CoOccurrence	4	89.76	77.03	14.2 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	906.63	1.4 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.05	0 %
3	RelativeRisk_Threat	3	6.63	6.63	0 %
4	RelativeRisk_Threat	4	16.96	13.90	18 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	133.04	2.2 %

April gear reduction scenario in MRA Wedge North, Alternative 3 proposed emergency closure area, and February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-16 17:06:34
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAandGap4v2_100pGearReductionApril.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							
3	GearReduction					MRA_Gap_Area_toNHborder_v2	4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.16	2.7 %
3	RelativeRisk_CoOccurrence	3	6.27	3.51	44 %
4	RelativeRisk_CoOccurrence	4	54.35	7.10	86.9 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	360.96	12.2 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	1.5 %
3	RelativeRisk_Threat	3	1.06	0.66	38 %
4	RelativeRisk_Threat	4	9.51	1.12	88.3 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	44.26	16.6 %

April closure scenario in MRA Wedge North, Alternative 3 proposed emergency closure area, and February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Massachusetts portion of Lobster Management Area 1. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-22 21:55:29
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/MA_LMA1Constraint_MRAandGap4v2_100pGRandClosure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial	A1	MA												
2	Closure					MRA_Gap_Area_toNHborder_v2	4								
3	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	15.89	15.89	0 %
2	RelativeRisk_CoOccurrence	2	1.19	1.16	2.7 %
3	RelativeRisk_CoOccurrence	3	6.27	3.51	44 %
4	RelativeRisk_CoOccurrence	4	54.35	8.40	84.5 %
5	RelativeRisk_CoOccurrence	5	281.04	281.04	0 %
6	RelativeRisk_CoOccurrence	6	0.98	0.98	0 %
7	RelativeRisk_CoOccurrence	7	0.24	0.24	0 %
8	RelativeRisk_CoOccurrence	8	0.33	0.33	0 %
9	RelativeRisk_CoOccurrence	9	2.42	2.42	0 %
10	RelativeRisk_CoOccurrence	10	0.29	0.29	0 %
11	RelativeRisk_CoOccurrence	11	1.26	1.26	0 %
12	RelativeRisk_CoOccurrence	12	46.73	46.73	0 %
13	RelativeRisk_CoOccurrence	Total	410.99	362.25	11.9 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2.87	2.87	0 %
2	RelativeRisk_Threat	2	0.30	0.30	1.5 %
3	RelativeRisk_Threat	3	1.06	0.66	38 %
4	RelativeRisk_Threat	4	9.51	1.40	85.3 %
5	RelativeRisk_Threat	5	32.16	32.16	0 %
6	RelativeRisk_Threat	6	0.17	0.17	0 %
7	RelativeRisk_Threat	7	0.05	0.05	0 %
8	RelativeRisk_Threat	8	0.05	0.05	0 %
9	RelativeRisk_Threat	9	0.34	0.34	0 %
10	RelativeRisk_Threat	10	0.08	0.08	0 %
11	RelativeRisk_Threat	11	0.35	0.35	0 %
12	RelativeRisk_Threat	12	6.13	6.13	0 %
13	RelativeRisk_Threat	Total	53.05	44.54	16 %

April gear reduction scenario in MRA Wedge North, Alternative 3 proposed emergency closure area, and February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Northeast Region. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-23 13:20:48
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAandGap4v2_100pGR_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	GearReduction					MRA_Gap_Area_toNHborder_v2	4	1							
3	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.72	0.1 %
3	RelativeRisk_CoOccurrence	3	26.60	23.83	10.4 %
4	RelativeRisk_CoOccurrence	4	89.76	42.08	53.1 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	868.86	5.5 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.04	0.1 %
3	RelativeRisk_Threat	3	6.63	6.23	6.1 %
4	RelativeRisk_Threat	4	16.96	8.51	49.9 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	127.23	6.5 %

April closure scenario in MRA Wedge North, Alternative 3 proposed emergency closure area, and February, March, April gear reduction scenario in Massachusetts Restricted Area. Management actions are constrained to the Northeast Region. Information is referenced in Table 4.4 of Section 4.2 of the Environmental Assessment.

	ModelConfiguration
1	2022-02-27 20:19:08
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/NEConstraint_MRAandGap4v2_100pGRandClosure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	Closure					MRA_Gap_Area_toNHborder_v2	4								
3	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	89.33	0 %
2	RelativeRisk_CoOccurrence	2	34.77	34.72	0.1 %
3	RelativeRisk_CoOccurrence	3	26.60	23.83	10.4 %
4	RelativeRisk_CoOccurrence	4	89.76	44.83	50.1 %
5	RelativeRisk_CoOccurrence	5	315.51	315.51	0 %
6	RelativeRisk_CoOccurrence	6	19.10	19.10	0 %
7	RelativeRisk_CoOccurrence	7	10.16	10.16	0 %
8	RelativeRisk_CoOccurrence	8	24.98	24.98	0 %
9	RelativeRisk_CoOccurrence	9	81.84	81.84	0 %
10	RelativeRisk_CoOccurrence	10	60.48	60.48	0 %
11	RelativeRisk_CoOccurrence	11	72.50	72.50	0 %
12	RelativeRisk_CoOccurrence	12	94.32	94.32	0 %
13	RelativeRisk_CoOccurrence	Total	919.35	871.61	5.2 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	16.30	0 %
2	RelativeRisk_Threat	2	8.05	8.04	0.1 %
3	RelativeRisk_Threat	3	6.63	6.23	6.1 %
4	RelativeRisk_Threat	4	16.96	8.89	47.6 %
5	RelativeRisk_Threat	5	38.50	38.50	0 %
6	RelativeRisk_Threat	6	4.66	4.66	0 %
7	RelativeRisk_Threat	7	2.63	2.63	0 %
8	RelativeRisk_Threat	8	2.52	2.52	0 %
9	RelativeRisk_Threat	9	8.20	8.20	0 %
10	RelativeRisk_Threat	10	7.66	7.66	0 %
11	RelativeRisk_Threat	11	9.96	9.96	0 %
12	RelativeRisk_Threat	12	14.02	14.02	0 %
13	RelativeRisk_Threat	Total	136.10	127.62	6.2 %

April gear reduction scenario in MRA Wedge North, Alternative 3 proposed emergency closure area, and the 2021 Final Rule. Management actions are constrained to the Northeast Region. For reasons discussed in Section 2.1, not all management actions have been implemented as of March 2022. The mean risk and co-occurrence values of this scenario was subtracted from the baseline 2021 Final Rule risk and co-occurrence values (without the emergency closure) to quantity additional relative risk and co-occurrence reduction percentages for Alternative 3.

	ModelConfiguration
1	2022-02-25 11:53:25
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/FEIS_Preferred_Alternative_MRAgap4v2_100pGR_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	StringLength					Exempt_to_3_ME_ABFG			Min	2					
3	StringLength					Exempt_to_3_ME_CDE			Min	3					
4	StringLength					MaineZoneA_East			Min	20					
5	StringLength					MaineZoneA_West_3_6			Min	8					
6	StringLength					Three_to_6_ME_B			Exactly	5					
7	MaxGearWSingleLine					Three_to_6_ME_B									5
8	StringLength					Three_to_6_ME_CDEFG			Min	10					
9	StringLength					MaineZoneA_West_6_12			Min	15					
10	StringLength					Six_to_12_ME_B			Min	10					
11	StringLength					Six_to_12_ME_CG			Min	20					
12	StringLength					Six_to_12_ME_DEF			Min	10					
13	StringLength	A1	MA			6to12_A1_poly			Min	15					
14	StringLength	OCC				3nmi_to_12nmi			Min	15					
15	StringLength	A1				12nmi_to_EEZ_Boundary			Min	25					
16	StringLength	A2_3overlap							Min	40					
17	StringLength	A3				LMA3_Canyons_Simple			Min	35					
18	StringLength	A3				LMA3_NorthOfCanyons_Simple			Min	45					
19	StringLength					Georges_Basin_Restricted_Area			Min	50					
20	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							
21	GearReduction					MRA_Gap_Area_toNHborder_v2	4	1							
22	Closure					LMA1_Restricted_Area_FR	10,11,12,1								
23	Closure					South_Island_Restricted_Area	2,3,4								
24	GearReduction	A1	MA			Coast_to_3nmi_DST	2,3,4,5	1							
25	GearReduction	OCC	MA			Coast_to_3nmi_DST	5	1							
26	GearReduction	A3						0.12							
27	GearReduction	A2_3overlap						0.15							
28	GearReduction	A2						0.18							
29	MaxRopeStrength	A1	ME			Coast_to_3nmi_DST		0.3243			1700				
30	MaxRopeStrength					Three_to_12_ME_AwBCDE		0.181			1700				

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
31	MaxRopeStrength					Three_to_12_ME_AeFG		0.1015			1700				
32	MaxRopeStrength	A1	ME			12nmi_to_EEZ_Boundary		0.0472			1700				
33	MaxRopeStrength	A1	MA			Coast_to_3nmi_DST		0.5			1700				
34	MaxRopeStrength	OCC				Coast_to_3nmi_DST		0.5			1700				
35	MaxRopeStrength	A2				Coast_to_3nmi_DST		0.5			1700				
36	MaxRopeStrength	A1	MA			3nmi_to_12nmi		0.2933			1700				
37	MaxRopeStrength	OCC				3nmi_to_12nmi		0.3907			1700				
38	MaxRopeStrength	A2				3nmi_to_12nmi		0.5			1700				
39	MaxRopeStrength	A1	MA			12nmi_to_EEZ_Boundary		0.0786			1700				
40	MaxRopeStrength	A2				12nmi_to_EEZ_Boundary		0.5			1700				
41	MaxRopeStrength	OCC				12nmi_to_EEZ_Boundary		0.2049			1700				
42	MaxRopeStrength	A2_3overlap						0.4375			1700				
43	MaxRopeStrength	A3						0.375			1700				

Final Relative Risk Scores – CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	89.33	55.84	37.5 %
2	RelativeRisk_CoOccurrence	2	34.77	24.35	30 %
3	RelativeRisk_CoOccurrence	3	26.60	16.92	36.4 %
4	RelativeRisk_CoOccurrence	4	89.76	25.85	71.2 %
5	RelativeRisk_CoOccurrence	5	315.51	24.82	92.1 %
6	RelativeRisk_CoOccurrence	6	19.10	13.37	30 %
7	RelativeRisk_CoOccurrence	7	10.16	6.92	31.8 %
8	RelativeRisk_CoOccurrence	8	24.98	21.38	14.4 %
9	RelativeRisk_CoOccurrence	9	81.84	68.58	16.2 %
10	RelativeRisk_CoOccurrence	10	60.48	36.88	39 %
11	RelativeRisk_CoOccurrence	11	72.50	38.12	47.4 %
12	RelativeRisk_CoOccurrence	12	94.32	72.18	23.5 %
13	RelativeRisk_CoOccurrence	Total	919.35	405.21	55.9 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	16.30	8.71	46.6 %
2	RelativeRisk_Threat	2	8.05	3.77	53.1 %
3	RelativeRisk_Threat	3	6.63	2.62	60.5 %
4	RelativeRisk_Threat	4	16.96	3.23	81 %
5	RelativeRisk_Threat	5	38.50	4.06	89.4 %
6	RelativeRisk_Threat	6	4.66	2.39	48.8 %
7	RelativeRisk_Threat	7	2.63	1.32	50 %
8	RelativeRisk_Threat	8	2.52	1.95	22.4 %
9	RelativeRisk_Threat	9	8.20	6.28	23.4 %
10	RelativeRisk_Threat	10	7.66	4.43	42.1 %
11	RelativeRisk_Threat	11	9.96	4.94	50.4 %
12	RelativeRisk_Threat	12	14.02	8.45	39.7 %
13	RelativeRisk_Threat	Total	136.10	52.16	61.7 %

April closure scenario in MRA Wedge North, Alternative 3 proposed emergency closure area, and the 2021 Final Rule. Management actions are constrained to the Northeast Region. For reasons discussed in Section 2.1, not all management actions have been implemented as of March 2022. The mean risk and co-occurrence values of this scenario was subtracted from the baseline 2021 Final Rule risk and co-occurrence values (without the emergency closure) to quantity additional relative risk and co-occurrence reduction percentages for Alternative 3.

	ModelConfiguration
1	2022-02-25 22:33:19
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DecisionSupportTool_V3.1.0.R
4	Input Spreadsheet: CrystalsSubfolder/FEIS_Preferred_Alternative_MRAgap4v2_Closure_April.csv
5	MapRefDomain: MapRef_HR_Lobster_V3.0.0.Rdata
6	GearMap: GearMap_Lobster_V3.0.0.Rdata
7	StringLengthModel: IncludedInGearMap
8	Rope Strength Model: LineStrengthModel_V2.1_60TrapThreshold.Rdata
9	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
10	Whale Model: Duke_RightWhaleModel_v11_1018.Rdata
11	
12	Comment:
13	CoOccurrence: FALSE
14	Run Test Scenario: TRUE
15	AggregateStrings= TRUE
16	HighResolution= TRUE
17	RelocationCostExp: 1
18	ExpressRedistribution: TRUE
19	Update Endline Strengths: FALSE
20	RopeStrengthResolution: 500
21	
22	PrintTables= TRUE
23	PrintDefaultMaps= TRUE
24	PrintScenarioMaps= TRUE
25	PrintRedistributionMaps= TRUE
26	PrintMapsInHighResolution= TRUE
27	WriteMapSources= TRUE
28	WriteOutputCsv= TRUE
29	WriteDetailedOutput= TRUE
30	PrintSummary= TRUE
31	ArchiveInputSpreadsheet: FALSE

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
1	Constraint_Spatial					NE_TrapPot_2020FEIS									
2	StringLength					Exempt_to_3_ME_ABFG			Min	2					
3	StringLength					Exempt_to_3_ME_CDE			Min	3					
4	StringLength					MaineZoneA_East			Min	20					
5	StringLength					MaineZoneA_West_3_6			Min	8					
6	StringLength					Three_to_6_ME_B			Exactly	5					
7	MaxGearWSingleLine					Three_to_6_ME_B									5
8	StringLength					Three_to_6_ME_CDEFG			Min	10					
9	StringLength					MaineZoneA_West_6_12			Min	15					
10	StringLength					Six_to_12_ME_B			Min	10					
11	StringLength					Six_to_12_ME_CG			Min	20					
12	StringLength					Six_to_12_ME_DEF			Min	10					
13	StringLength	A1	MA			6to12_A1_poly			Min	15					
14	StringLength	OCC				3nmi_to_12nmi			Min	15					
15	StringLength	A1				12nmi_to_EEZ_Boundary			Min	25					
16	StringLength	A2_3overlap							Min	40					
17	StringLength	A3				LMA3_Canyons_Simple			Min	35					
18	StringLength	A3				LMA3_NorthOfCanyons_Simple			Min	45					
19	StringLength					Georges_Basin_Restricted_Area			Min	50					
20	GearReduction					Mass_Restricted_Area_State_Expansion	2,3,4	1							
21	Closure					MRA_Gap_Area_toNHborder_v2	4								
22	Closure					LMA1_Restricted_Area_FR	10,11,12,1								
23	Closure					South_Island_Restricted_Area	2,3,4								
24	GearReduction	A1	MA			Coast_to_3nmi_DST	2,3,4,5	1							
25	GearReduction	OCC	MA			Coast_to_3nmi_DST	5	1							
26	GearReduction	A3						0.12							
27	GearReduction	A2_3overlap						0.15							
28	GearReduction	A2						0.18							
29	MaxRopeStrength	A1	ME			Coast_to_3nmi_DST		0.3243			1700				
30	MaxRopeStrength					Three_to_12_ME_AwBCDE		0.181			1700				

Input Scenario Spreadsheet

	Action	LMA	State	StatArea	Fishery	Shapefile	Months	Percentage	StringRegulation	StringLen	MaxRopeStrength	BuoylineDevice	RopelessDevice	GearCap	MaxGearSnglLn
31	MaxRopeStrength					Three_to_12_ME_AeFG		0.1015			1700				
32	MaxRopeStrength	A1	ME			12nmi_to_EEZ_Boundary		0.0472			1700				
33	MaxRopeStrength	A1	MA			Coast_to_3nmi_DST		0.5			1700				
34	MaxRopeStrength	OCC				Coast_to_3nmi_DST		0.5			1700				
35	MaxRopeStrength	A2				Coast_to_3nmi_DST		0.5			1700				
36	MaxRopeStrength	A1	MA			3nmi_to_12nmi		0.2933			1700				
37	MaxRopeStrength	OCC				3nmi_to_12nmi		0.3907			1700				
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7	RelativeRisk_CoOccurrence	7	10.16	6.92	31.8 %
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FINDING OF NO SIGNIFICANT IMPACT

Under the National Environmental Policy Act

2022 Emergency Final Rule to Reduce Right Whale Interactions
with Lobster and Jonah Crab Trap/Pot Gear
March 31, 2022

I. Purpose of Finding of No Significant Impact (FONSI): The National Environmental Policy Act (NEPA) requires the preparation of an Environmental Impact Statement (EIS) for any proposal for a major federal action significantly affecting the quality of the human environment. 42 U.S.C. § 4332(C). The Council on Environmental Quality (CEQ) Regulations direct agencies to prepare a Finding of No Significant Impact (FONSI) when an action not otherwise excluded will not have a significant impact on the human environment. 40 CFR §§ 1500.4(b), 1500.5(b), & 1501.6. To evaluate whether a significant impact on the human environment is likely, the CEQ regulations direct agencies to analyze the potentially affected environment and the degree of the effects of the proposed action. 40 CFR § 1501.3(b). In doing so, agencies should consider the geographic extent of the affected area (i.e., national, regional, or local), the resources located in the affected area (40 CFR § 1501.3(b)(1)), and whether the project is considered minor or small-scale (NAO 216-6A CM, Appendix A-2). In considering the degree of effect on these resources, agencies should examine, as appropriate, short- and long-term effects, beneficial and adverse effects, and effects on public health and safety, as well as effects that would violate laws for the protection of the environment (40 CFR § 1501.3(b)(2)(i)-(iv); NAO 216-6A CM Appendix A-2 - A-3), and the magnitude of the effect (e.g., negligible, slight, moderate, high). CEQ identifies specific criteria for consideration. 40 CFR § 1501.3(b)(2)(i)-(iv). Each criterion is discussed below with respect to the proposed action and considered individually as well as in combination with the others.

In preparing this FONSI, we reviewed the **Environmental Assessment (EA) of a 2022 Emergency Rule to Reduce Right Whale Interactions with Lobster and Jonah Crab Trap/Pot Gear** which evaluates the affected area, the scale and geographic extent of the proposed action, and the degree of effects on those resources (including the duration of impact, and whether the impacts were adverse and/or beneficial and their magnitude). The EA is hereby incorporated by reference. 40 CFR § 1501.6(b).

II. Approach to Analysis:
The proposed action is not considered to meaningfully contribute to a significant impact based on the scale of impact. The alternatives for this emergency closure of the waters between state and federal portions of the Massachusetts Restricted Area (MRA) from April 1 to April 30, 2022 is expected to have minimal impacts on their own because the emergency closure area is small relative to the entire MRA,minimal economic impacts are expected, and any indirect effects are likely beneficial for the environment. The emergency closure would be of limited duration (i.e., will be in place for the month of April) further reducing impact.

The proposed action will not meaningfully contribute to significant impacts to specific resources. The Atlantic Large Whale Take Reduction Plan (Plan) was developed pursuant to section 118(f) of the MMPA to reduce the level of mortality and serious injury of large whales as a result of trap/pot and gillnet commercial fishing gear. Modifications to the Plan are designed to meet

established management goals and objectives. The expected impacts of the proposed action on the Valued Ecosystem Components (VECs) and associated analyses are described in Chapter 4 of the EA.

The Preferred Alternative for the Emergency Rule is expected to have impacts ranging from slight negative to moderate negative on protected species due to the continuation of fishing activity outside of the closure period (Section 4.2.3). The Preferred Alternative is expected to have impacts ranging from slight negative to negligible on habitat (Section 4.3.2) and slight negative impacts on human communities (Section 4.4.3). None of these conclusions, when considered together, are expected to result in any overall significant impact.

The proposed action is not connected to other actions that have caused or may cause effects to the resources in the affected area. Thus, there is no potential for the effects of the proposed action to add to the effects of other projects, such that the effects taken together could be significant, as described in the Cumulative Effects Analysis in Section 4.5.

III. Geographic Extent and Scale of the Proposed Action:
The proposed action establishes an emergency closure off the Atlantic coast to close the gap between the previous Massachusetts Restricted Area and the expanded restricted area which includes Massachusetts State waters, and therefore local in its geographic extent. The area proposed to be closed to the lobster and Jonah crab trap/pot fishery in the Preferred Alternative is approximately 200 square miles (518 square kilometers) and begins in federal waters east of Cape Ann, is bounded landward by the Massachusetts state waters, east until it intersects with the MRA, and runs north until it intersects the state water boundary. The resources present throughout this region with the potential to be impacted by the Emergency Rule are described in Chapter 3 of the EA. The proposed action and its impacts focus on a small area for the month of April. Due to being very narrow in time and geographic extent, the environmental effects for the VECs concerned in this action, focus on a very specific area. These effects are not expected to result in substantial changes to any VECs or specific geographic areas.

IV. Degree of Effect:

A. *The potential for the proposed action to threaten a violation of Federal, state, or local law or requirements imposed for environmental protection.*

The Emergency Rule is not expected to violate federal, state, or local environmental laws. In particular, the Emergency Rule is in compliance with the Marine Mammal Protection Act (MMPA) and the Endangered Species Act. The purpose of the Emergency Rule is to continue managing Northeast lobster and Jonah crab trap/pot fisheries according to MMPA requirements through modification of the Plan. The MMPA requires the implementation of measures, through a take reduction plan, to reduce the mortality and serious injury of marine mammals in U.S. commercial fisheries to levels that are below each stock's PBR.

B. *The degree to which the proposed action is expected to affect public health or safety.*

The Emergency Rule is not expected to significantly affect public health and safety. This action

does not modify current requirements in a way that would impact the potential safety of small vessel operators. Fishers were notified a month ahead of time to allow ample time to remove gear from the closure. This impact is not considered significant because we expect that this action will either prevent fishing during this time in this area or allow fishing to continue according to current practices, rather than fish in an unsafe manner. Refer to Section 4.4 for a description of the social impacts of the proposed action.

C. *The degree to which the proposed actions is expected to affect a sensitive biological resource, including:*
    a. *Federal threatened or endangered species and critical habitat;*

Impacts to protected resources including endangered species from the proposed action are discussed in Section 4.2 of the EA. Subsection 4.2.3 identifies expected moderate to slight negative impacts to ESA-listed species from the alternatives proposed for the Emergency Rule. Specifically, this determination has been made because co-occurrence of ESA-listed species of large whales with buoy lines and associated entanglement risk will likely decline minimally to substantially, depending on the whale species. While entanglement risk is not completely eliminated, the action does significantly reduce risk in the action area for marine mammals. Overall, we consider the Emergency Rule Preferred Alternative to have moderate to slight negative impacts on ESA-listed large whales but is not expected to cause new effects to listed species or critical habitat that were not already considered in the previous ESA Section 7 consultations.

    b. *stocks of marine mammals as defined in the Marine Mammal Protection Act;*

The Atlantic Large Whale Take Reduction Plan (Plan) was developed pursuant to section 118(f) of the Marine Mammal Protection Act to reduce the level of mortality and serious injury of large whales as a result of trap/pot and gillnet commercial fishing gear. In alignment with federal obligations under the Plan, the proposed action is not expected to adversely affect stocks of marine mammals (Section 4.2). Specifically, this determination has been made because the co-occurrence of MMPA-protected large whales with buoy lines and associated entanglement risk is expected to decrease. While entanglement risk is not completely eliminated, the action does reduce risk in the action area for marine mammals. Based on all of this information, this action is not expected to adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act.

    c. *essential fish habitat identified under the Magnuson–Stevens Fishery Conservation and Management Act;*

The proposed action is not expected to cause substantial damage to EFH as defined under the MSA and identified in the American lobster and Jonah crab FMP. The directed commercial fishery for American lobster and Jonah crab is primarily prosecuted with trap/pot gear as described in Section 4.3. Because gear will be removed from areas where the habitat is currently disturbed, the Preferred Alternative is expected to reduce the impact of lobster and Jonah crab fishing on the habitat VEC. Operational trap/pot gear is not considered to cause long-term benthic impacts, but the removal of traps may decrease benthic community disturbance, protect local community structure, and may increase local lobster and/or Jonah crab abundance (Uhrin

2016). The impacts of this action's alternatives are all expected to be negligible to slight negative.

d. bird species protected under the Migratory Bird Treaty Act;

Information about seabird interactions with trap/pot gear is limited. However, there is no known evidence of substantial impacts to bird species, including those protected under the Migratory Bird Treaty Act, from the American lobster and Jonah crab fishery in the past. The Preferred Alternative will remove gear from the closure areas and, as a result, this action would only reduce risks to these species.

e. national marine sanctuaries or monuments;

The Stellwagen Bank National Marine Sanctuary and Northeast Canyons and Seamounts Marine National Monument occur within the broad management areas of the Plan, however they are not within the area considered for the emergency closure. As a result, the Emergency Rule is not expected to have any substantial effects on national marine sanctuaries or monuments.

f. vulnerable marine or coastal ecosystems, including, but not limited to, shallow or deep coral ecosystems;

The Preferred Alternative is not expected to have significant impacts on the natural or physical environment, including vulnerable marine or coastal ecosystems. The Preferred Alternative will remove gear from the emergency closure area and is not likely to result in a significant redistribution of gear and any gear that is relocated is not expected to be moved to areas not already heavily impacted by commercial fishing. No additional trap/pot fishing will take place near the continental slope/shelf break where deep sea corals may be found in and around the submarine canyons. The Preferred Alternative is not expected to alter American lobster or Jonah crab fishing patterns relative to this protected area or in any other manner that would lead to adverse impacts on deep sea coral or other vulnerable marine or coastal ecosystems.

g. biodiversity or ecosystem functioning (e.g., benthic productivity, predator-prey relationships, etc.)

The impacts of the Emergency Rule on biodiversity and ecosystem functioning have not been assessed; however, the impacts to components of the ecosystem (i.e., protected species, habitat) have been considered. The proposed action is not expected to have a substantial impact on biodiversity and ecosystem function within the affected area. Additionally, the proposed action is not expected to substantially alter fishing methods or activities or fishing effort or the spatial and/or temporal distribution of current fishing effort outside of the emergency closure area.

D. The degree to which the proposed action is reasonably expected to affect a cultural resource: properties listed or eligible for listing on the National Register of Historic Places; archeological resources (including underwater resources); and resources important to traditional cultural and religious tribal practice.

The Emergency Rule is not likely to affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or cause loss or destruction of significant scientific, cultural, or historical resources. Although there are shipwrecks present in areas where fishing occurs, including some registered on the National Register of Historic Places, vessels try to avoid fishing too close to wrecks due to the possible loss or hang ups of fishing gear. Therefore, it is not likely that the Emergency Rule would adversely affect the historic resources.

E. *The degree to which the proposed action has the potential to have a disproportionately high and adverse effect on the health or the environment of minority or low-income communities, compared to the impacts on other communities (EO 12898).*

The proposed action is not expected to have a disproportionately high and adverse effect on the health or the environment of minority or low-income communities, compared to the impacts on other communities. As described in Section 3.3 and 4.4.2 while some communities expected to be affected by this proposed amendment may have social vulnerabilities that exceed the environmental justice (EJ) thresholds and, therefore, may constitute areas of concern, significant EJ issues are not expected to arise as a result of this proposed amendment. It is anticipated that the impacts from the proposed regulations may impact minorities or the poor, but not through discriminatory application of these regulations. However, it should be noted that some communities are not able to be analyzed as census data are not available to create the indices. There are no known claims for customary usage or subsistence consumption of American lobster or Jonah crab by any population including tribes or indigenous groups.

F. *The degree to which the proposed action is likely to result in effects that contribute to the introduction, continued existence, or spread of noxious weeds or nonnative invasive species known to occur in the area or actions that may promote the introduction, growth, or expansion of the range of the species.*

The Emergency Rule would not result in the introduction or spread of non-indigenous species. The Emergency Rule will not result in U.S. vessels leaving regional waters, or result in foreign vessels operating in U.S. waters.

G. *The potential for the proposed action to cause an effect to any other physical or biological resources where the impact is considered substantial in magnitude (e.g., irreversible loss of coastal resources such as marshland or seagrass) or over which there is substantial uncertainty or scientific disagreement.*]

The proposed action is not expected to cause a substantial effect to any other physical or biological resource, nor is there substantial uncertainty or scientific disagreement on the impacts of the proposed actions. As described in Chapter 4, it is not anticipated that there is potential for the proposed actions to cause an effect to any other physical or biological resource where the impact is considered substantial because the proposed actions are not expected to change the way the American lobster and Jonah crab fisheries are prosecuted.

V. Other Actions Including Connected Actions:

There are no other connected actions (40 CFR § 1501.9(e)(1)). Any other future actions within the Plan would be developed, analyzed, and implemented independently of the proposed action. The Cumulative Effects Analysis in Section 4.5 of the EA discusses other beneficial and adverse actions that are occurring or reasonably certain to occur, and that affect the same resources as the Proposed Action. This section of the EA demonstrates that the effects of these collective actions, for each resource analyzed, do not result in synergistically significant impacts, either positive or negative.

VI. Mitigation and Monitoring:

NMFS does not anticipate any high or significant impact from the Proposed Action. Therefore, NMFS is not adopting any mitigation measures.

DETERMINATION

The CEQ NEPA regulations, 40 CFR § 1501.6, direct an agency to prepare a FONSI when the agency, based on the EA for the proposed action, determines not to prepare an EIS because the action will not have significant effects. In view of the information presented in this document and the analysis contained in the supporting EA prepared for a 2022 Emergency Rule to Reduce Right Whale Interactions with Lobster and Jonah Crab Trap/Pot Gear, it is hereby determined that the 2022 Emergency Final Rule will not significantly impact the quality of the human environment. The 2022 Emergency Final Rule is hereby incorporated by reference. In addition, all beneficial and adverse impacts of the proposed action, as well as mitigation measures, have been evaluated to reach the conclusion of no significant impacts. Accordingly, preparation of an EIS for this action is not necessary.

_____ _____March 31, 2022_____

Regional Administrator Date
GARFO, NMFS, NOAA

REGULATORY IMPACT REVIEW OF: 2022 EMERGENCY FINAL RULE TO REDUCE RIGHT WHALE INTERACTIONS WITH LOBSTER AND JONAH CRAB TRAP/POT GEAR

1. Basis for and purpose of the Rule

The Atlantic Large Whale Take Reduction Plan (Plan) was developed pursuant to section 118(f) of the Marine Mammal Protection Act (MMPA), to reduce the level of mortality and serious injury of large whales as a result of trap/pot and gillnet commercial fishing gear. After the 1994 amendments to the MMPA, National Marine Fisheries Service (NMFS) created the Atlantic Large Whale Take Reduction Team in 1996 and developed the first Plan which published its implementing regulations on July 22, 1997 (62 FR 39157). The Team consists of stakeholders representing state and federal government agencies, fishing industry, conservation organizations, and researchers. For a more detailed management history of the Plan and management of fishery interactions, please see the Final Environmental Impact Statement (FEIS) accompanying the 2021 amendment to the Plan (NMFS 2021).

One measure included in the 2021 Final Rule (86 FR 51970, September 17, 2021) has left a critical gap in protection where North Atlantic right whales (Eubalaena glacialis, hereafter referred to as right whale) distribution information identifies a high risk of overlap between right whales and buoy lines. Right whale monthly distribution data identifies risk in unrestricted waters encapsulated on three sides by the expanded Massachusetts Restricted Area (MRA) during the month of April. The 2021 expansion of the geographic extent of the MRA under the Plan to include Massachusetts state waters north to the New Hampshire border (Figure 1) mirrors the Massachusetts State 2021 modification of the state water closure (322 CMR 12.04(2)).

Outside of the boundaries of the MRA, approximately 200 square miles (518 square kilometers) of federal waters remain open to lobster and Jonah crab trap/pot fishing between state and federal waters of the closure, creating a wedge where 2021 data indicates that trap/pot gear is concentrated during the month of April (Figure1 and Figure 2). During aerial surveys in April 2021, the Center for Coastal Studies (CCS) observed right whales and aggregated fishing gear within the wedge. Fishermen that used this area in April are likely to be using the remaining open waters to fish trap/pot gear and also could be staging their gear in preparation for the opening of the federal waters portion of the MRA on May 1. The high gear density observed in this area outside of the MRA has created an area of high risk of entanglement by right whales.

A key component of the Phase 1 Final Rule implemented a maximum breaking strength of 1,700 pounds (771 kg) in buoy lines for trap/pot fisheries in the affected area. However, weak insertion requirements that reduce risk of serious entanglements included in the 2021 Final Rule are not yet required in federal waters until May 1, 2022. Given the dense concentration of high-strength buoy lines in an area with persistent right whale presence, this wedge area presents an imminent entanglement threat as whales move in and out of their feeding grounds.

The purpose of the Emergency Rule is to reduce the acute risk of right whales to entanglement with lobster and Jonah crab trap/pot fisheries in waters adjacent to the existing MRA where there is high overlap between right whale aggregations and strong buoy lines. There is an urgent need to prevent any mortality or serious injury of right whales in the U.S. commercial fisheries because any take is above the Potential Biological Removal (PBR) for this population. Implementing an emergency restriction to fishing with buoy lines in this area will address a critical gap in entanglement risk where there is a particularly high chance of entanglement in 2022 that was not addressed in recent modifications to the Plan while long term measures are being developed.

Figure 1: The Massachusetts Restricted Area expansion (hatched area in green) of the original closure area (solid blue) was closed by Massachusetts State in Spring of 2021 and mirrored in the Atlantic Large Whale Take Reduction Plan in Fall of 2021. Massachusetts state regulations prohibit trap/pot fishing in any waters under the jurisdiction of the Commonwealth from February 1 through May 15 (322 CMR 12.04(2)).

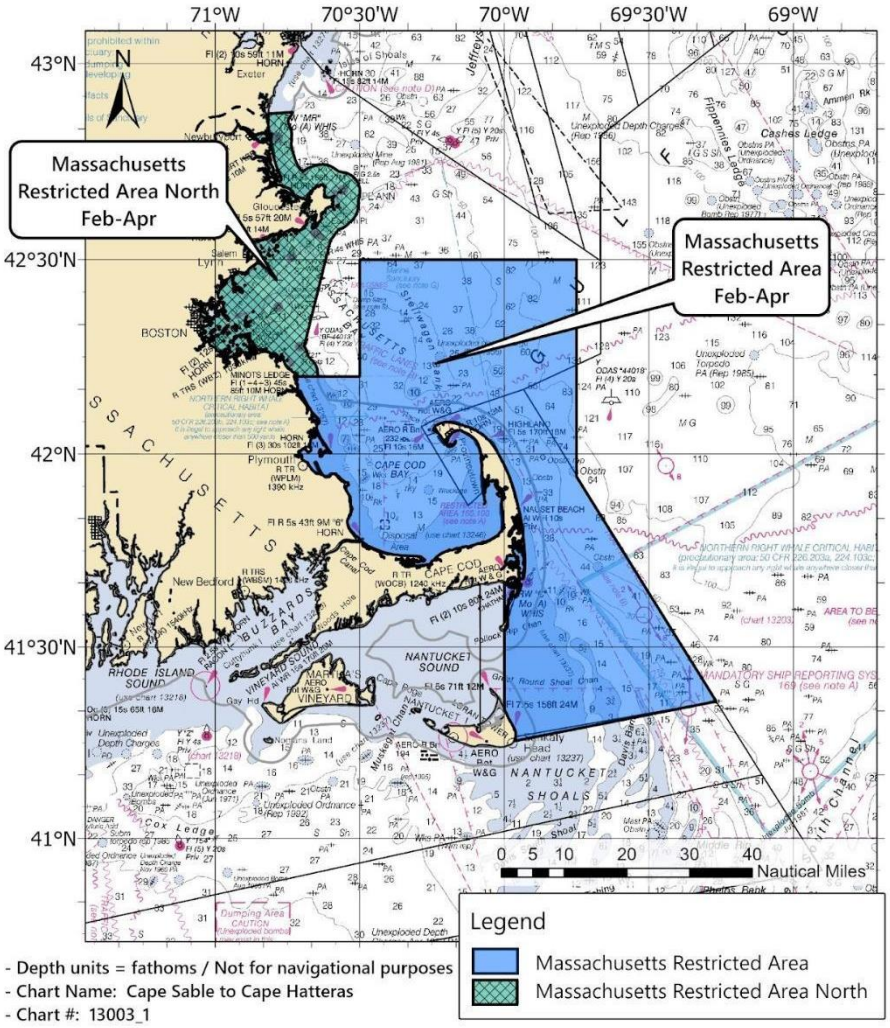
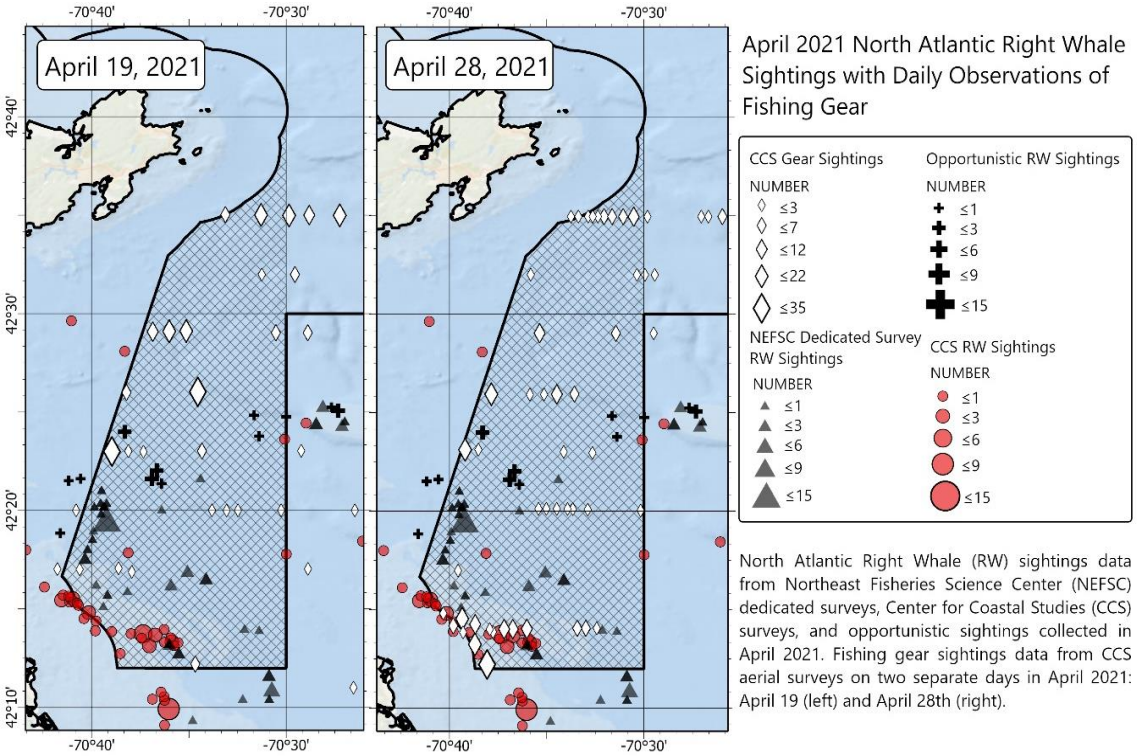


Figure 2: The area closed by this Emergency Rule is the hatched area. Sightings of right whales during April 2021 (red, gray, and black shapes) and gear observed on two different days are overlaid. RedGray circles show right whale sightings from the Center for Coastal Studies aerial surveys, gray triangles show sightings by the Northeast Fisheries Science Center's (NEFSC) dedicated aerial and shipboard surveys, and black crosses are opportunistic sightings collected by NEFSC. Fishing gear (white diamonds) observed by the Center for Coastal Studies on April 19, 2021, and April 28, 2021, two days that were selected as representative snapshots of fishing gear present in survey areas. Surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, offshore Rockport, MA. These maps are used for qualitative not quantitative comparison, and differ from Decision Support Tool data.



1.1 Affected Fisheries

As required by the MMPA, NMFS maintains a List of Fisheries that places each commercial fishery into one of three categories. Fisheries are categorized according to the level of mortality and serious injury of marine mammals that occurs incidental to that fishery. The categorization of a fishery in the List of Fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA such as registration, observer coverage, and take reduction plan requirements. Individuals fishing in Category I or II fisheries must comply with requirements of any applicable take reduction plan.

Category I fisheries are associated with frequent incidental mortality and serious injury of marine mammals. These fisheries have a mortality and serious injury rate of 50 percent or more of a stock's potential biological removal rate. Category II fisheries are associated with occasional incidental mortality and serious injury of marine mammals, and have a serious injury/mortality rate of more than 1 percent but less than 50 percent of a stock's PBR. Category III fisheries rarely cause serious injury or mortality to marine mammals. Category III fisheries have a serious injury/mortality rate of 1 percent or less of a stock's PBR (NOAA 2002).

The List of Fisheries indicates which fisheries NMFS may regulate under the Plan. Specific fisheries were initially identified for inclusion under the Plan based on documented whale interactions. In 1996, NMFS announced its intention to regulate the Gulf of Maine, U.S. mid-Atlantic lobster trap/pot fishery, U.S. mid-Atlantic coastal gillnet fishery, New England multispecies sink-gillnet fishery, and Southeastern U.S. Atlantic shark gillnet fishery (61 FR 40819-40821).

This list has evolved since 1996, reflecting both changes in nomenclature and modification of the Plan to address additional fisheries. This Emergency Rule focuses on lobster and Jonah crab trap/pot fisheries within the vicinity of the emergency closure in LMA 1, particularly Massachusetts permitted vessels that are most likely to be impacted by this measure.

1.2 Regulatory Alternatives

The scope of this analysis is limited to three alternatives that would temporarily modify the Plan to create an emergency restricted area to supplement the existing MRA during the month of April in 2022. This analysis only affects a small portion of federal waters within Lobster Management Area 1 (LMA 1) in the northeast portion of the waters covered under the Plan. The Alternatives were selected based on surveys conducted by the Center for Coastal Studies and the NEFSC that observed right whales and/or fixed fishing gear adjacent to the MRA in April 2021 and modeling conducted using a Decision Support Tool (DST). The DST is described in Appendix 3.1 Volume II of the 2021 FEIS (NMFS 2021) and the analyses in this document are further documented in section 4.1 of the associated Environmental Assessment.

Alternative 1: No Action (Status Quo)

Alternative 1, "No Action," leaves the current Plan intact with no regulatory changes proposed. This includes the restricted areas implemented by the Final Rule on September 17, 2021 (86 FR 51970) that went into effect October 18, 2021. This includes:

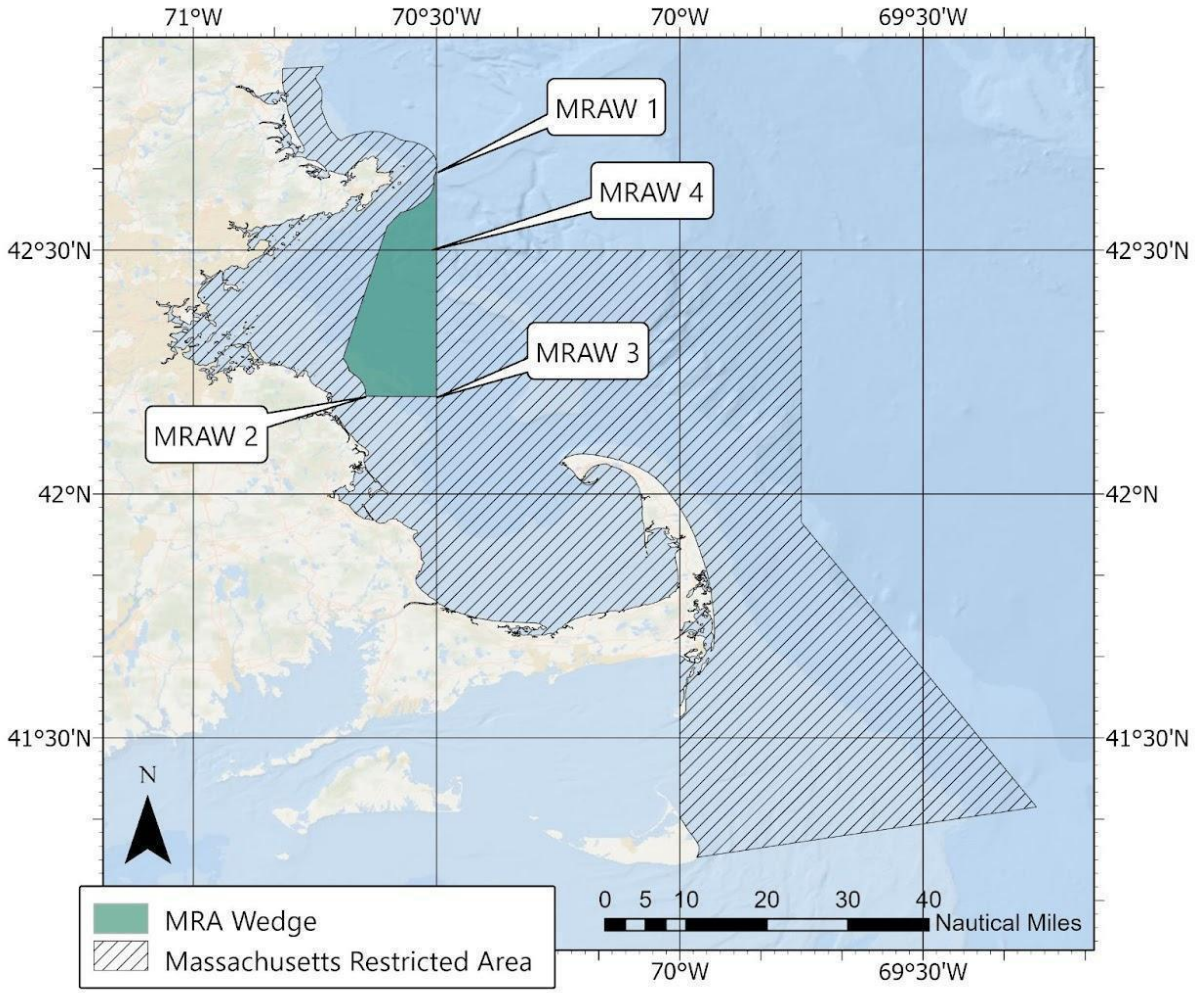
- Minimum traps per trawl requirements based within LMA 1:
    - Massachusetts state waters – 2 or no minimum
    - LMA 1 (3-12 miles) – 10
    - LMA 1 (12+ miles) – 20
- Modifications to existing restricted areas from seasonal fishing closures to seasonal closures to fishing with persistent buoy lines.
- Expanded geographic extent of the Massachusetts Restricted Area to include Massachusetts state waters north to the New Hampshire border.

Alternative 2: Preferred

Alternative 2, the Preferred Alternative, implements a new emergency closure that restricts the use of persistent lobster and Jonah crab trap/pot gear buoy lines from April 1, 2022 through April 30, 2022. The closure area is approximately 200 square miles (518 square kilometers) and begins

in federal waters east of Cape Ann, is bounded landward by the Massachusetts state waters and south along the 70°30′ W longitude line until it intersects with the MRA at the 42°12′N latitude line, and runs west along that line until it intersects the state water boundary (MRA Wedge; Figure 2.1). Authorizations for fishing without buoy lines in the MRA Wedge during this time must be obtained through an Exempted Fishing Permit.

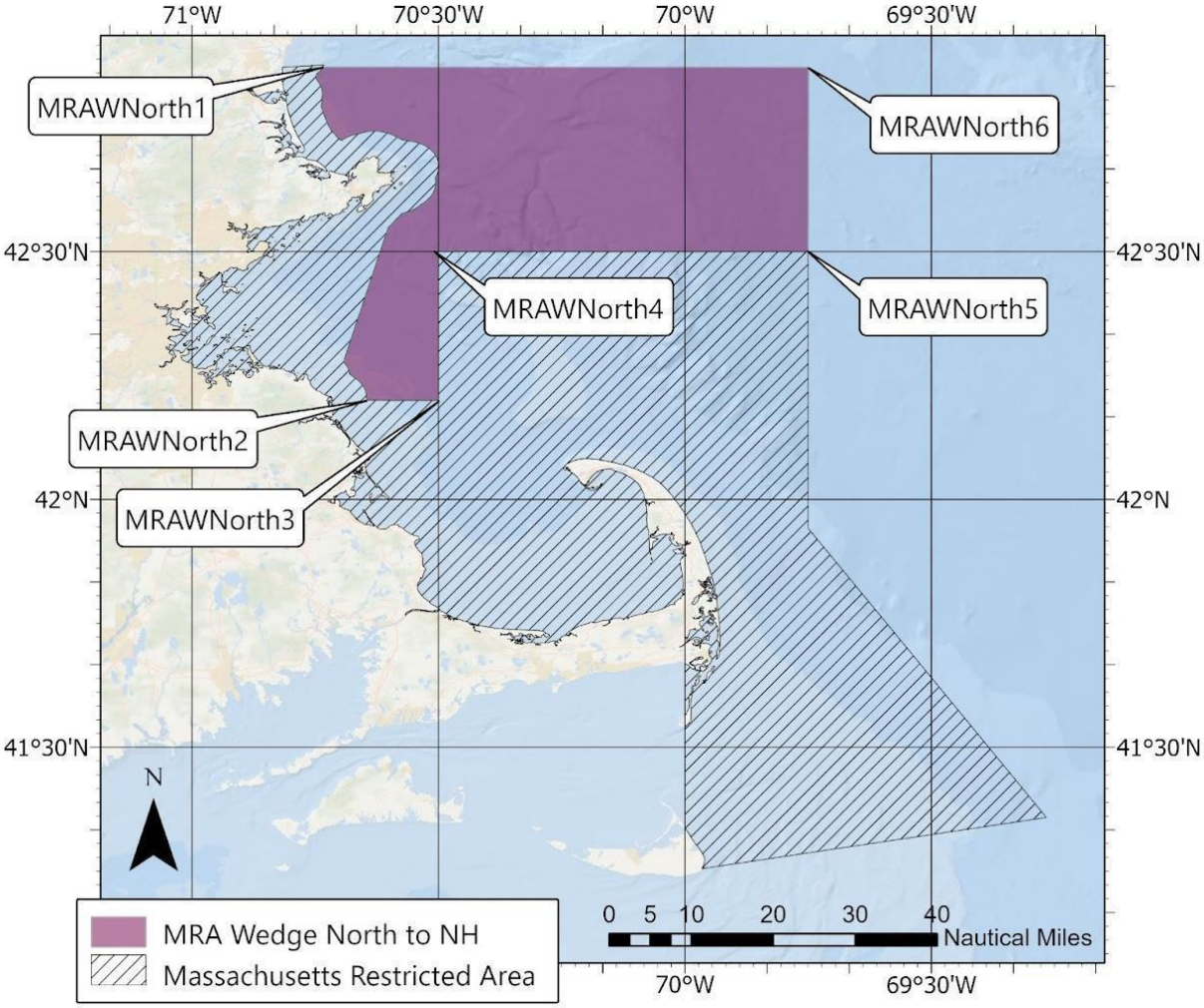
Figure 3: The area closed by this Emergency Rule in the Non-Preferred Alternative, MRA Wedge, is the shaded green area. The existing Massachusetts Restricted Area (MRA) is the hatched area. The boundary of MRA Wedge would remain seasonally closed to trap/pot fishing with buoy lines from April 1, 2022 through April 30, 2022.



Alternative 3: Non-Preferred Alternative

Alternative 3, the Non-Preferred Alternative also implements an emergency closure that restricts the use of persistent lobster and Jonah crab trap/pot gear buoy lines from April 1, 2022 through April 30, 2022. The closed area is approximately 1,300 square miles (3,367 square kilometers) and extends the northern LMA 1 MRA boundaries up to the New Hampshire border at 42°52.58′ N (MRA Wedge North; Figure 2.2). Authorizations for fishing without buoy lines in the MRA Wedge North during this time must be obtained through an Exempted Fishing Permit.

Figure 4: The area closed by this Emergency Rule in the Non-Preferred Alternative, MRA Wedge North to New Hampshire, is the shaded purple area. The existing MRA is the hatched area. The boundary of MRA Wedge North would remain seasonally closed to trap/pot fishing with buoy lines from April 1, 2022 through April 30, 2022.



2. Regulatory Impact Review

2.1. Economic Baseline for Comparison

The baseline for the economic analysis is Alternative 1, which requires no action. The number of fishing vessels and fisheries landing data used for this economic analysis are the averages from 2015 to 2019. For Alternative 2 and Alternative 3, it is estimated that 37 and 58 lobster and Jonah crab trap/pot vessels in the Northeast Region would be affected by the modification of the Plan respectively.

2.2. Time Horizon

The rule was published on March 2, 2022, and will only be in effect for the month of April 2022. Therefore, the costs and benefits will only be estimated for that month.

2.3. Benefit-Cost Framework

Benefit-cost analysis (BCA) is the preferred method for analyzing the consequences of a regulatory action such as modifying the requirements of the Plan. BCA is a well-established procedure for assessing the "best" course or scale of action, where "best" is that course which maximizes net benefits (i.e., benefits minus costs). Because BCA assesses the value of an activity in net benefit terms, it requires that a single metric, most commonly dollars, be used to gauge both benefits and costs. The data and economic models necessary to estimate costs may be difficult or costly to gather and develop, and a comprehensive analysis of the costs associated with a regulatory action is not always feasible. Nonetheless, the principle is straightforward, and it is generally possible in practice to develop a monetary estimate of at least some portion of regulatory costs. This is the case for costs stemming from temporary changes to the Plan, which would impose additional restrictions on commercial fishing operations.

Assessing the benefits of a temporary change to the Plan in a BCA framework is also straightforward in principle but much more difficult in practice. To the extent that new regulations would reduce the risk that whales will die or suffer a serious injury as a result of entanglement in commercial fishing gear, the Emergency Rule would produce real benefits. Ideally, these benefits would be measured first by a biological metric, and then by a dollar metric. A biological metric could take the form of the percentage of risk reduction, the associated expected decrease in extinction risk, increase in the annual growth of the population, or similar measures. Reduced mortalities and reduced nonfatal injuries would matter; decreased extinction risk would matter independently.

The value of protecting right whales might not be adequately or fully captured by people’s willingness to pay to protect whales. Their own welfare loss might be deemed relevant, regardless of that figure. In the Plan, moreover, the data required to complete such an analysis are not available. Estimation of the economic benefits attributable to each of the regulatory alternatives that NMFS is considering would require a more detailed understanding of the biological impacts of each measure than current models can provide. It also would require more extensive research than economists have conducted to date on the relationship between conservation and restoration of these species and associated economic values.

In the absence of the information required to conduct a full BCA, the discussion that follows presents a quantitative indicator of the potential impact of each alternative. It then presents estimates of the costs attributable to each alternative. As discussed later in this Regulatory Impact Review, the analysis uses this information to evaluate the cost of each percent of risk reduction of the regulatory alternatives under consideration, where risk is a product of co-occurrence combined with gear strength. Because the alternatives vary with respect to the benefits they would achieve, it is not possible to identify a superior option based on cost per unit of risk reduction alone. Nonetheless, the cost for each percent of risk reduction figures provide a useful means of comparing the relative impacts of the regulatory provisions that each alternative incorporates.

2.4. Economic Analysis of Alternatives

2.4.1. Benefits of the Alternatives

Although it is difficult to calculate the monetary benefits of whale protection from this short-term Emergency Rule, we could estimate the reduced risk reduction and co-occurrence score for each Alternative.

Under Alternative 1 (No Action), the current Plan management regime consisting of time/area closures, minimum trap per trawl requirements, use of weak links in the surface system, and gear marking requirements remains in place. Therefore, the closures included in the 2021 Final Rule are considered part of the status quo for this proposed action. Under Alternative 1, high negative impacts are expected because there would be a risk of entanglement due to the present number of buoy lines that would remain in the water when right whales are abundant in the area.

In the Massachusetts portion of LMA 1, there are 3,993 trawls of lobster trap/pots and 7,002 buoy lines present during the month of April (Table 1). During this same month, it is estimated that 94.4 right whales inhabit this portion of LMA 1, modeling the high density aggregations essential to right whale foraging and survival within Massachusetts and Cape Cod Bay. The DST estimates fishing effort across LMA 1 prior to the expansion of MRA to include Massachusetts State waters which now prohibits fishing trap/pots in federal and state waters February through April. However, no gear should be present in Massachusetts state waters during the emergency closure since it went into effect in 2021.

Alternative 2 would remove 626 buoy lines in MRA Wedge in April by restricting lobster and Jonah crab trap/pot buoy lines (Table 1). Within the Massachusetts portion of LMA 1, MRA Wedge has an average of 26 traps per trawl during the emergency closure month. Mean buoy line strength is 3,660 pounds (1,660 kg), double the maximum 1,700 pounds (771 kg) breaking strength for weak inserts/rope requirement that goes into effect on May 1, 2022. The DST estimates that the total number of right whales within the MRA Wedge is approximately 5 whales within the 200 square mile area. However, this whale density is likely an underestimate and is far below the number of whales sighted during April 2021by the Center for Coastal Studies and Northeast Fisheries Science Center (Figure 2).

Alternative 3 would also implement an emergency closure, but would close a larger area compared to Alternative 2 (1,297 square miles/3,359 square kilometers). The emergency restricted area implemented under Alternative 3, MRA Wedge North, would remain closed to the use of buoy lines by the lobster and Jonah crab trap/pot fishery from April 1, 2022 to April 30, 2022 (Table 1). Alternative 3 would remove 2,274 buoy lines from MRA Wedge North, each with a mean rope strength of 3,716 pounds (1,686 kg). An estimated 6.33 right whales are estimated to be present within the MRA Wedge North in April.

Table 1: Comparison of the Preferred and Non-preferred seasonal closures compared to the action area, actions by area, closure period, fishing gear configuration, and mean right whale density. The LMA 1 Massachusetts area data do not account for the MRA seasonal closure that prohibits trap/pot fishing in federal and state waters February 1 through April 30.

Proposal	Seasonal Closure Area (square mile)	Seasonal Closure Area (square km)	Closure Period	Total Number of Trawls	Total buoy Lines	Mean Trawl Length	Mean Rope Strength (lb)	Mean Rope Strength (kg)	Estimated Number of Whales in April
LMA 1: MA	-	-	-	3,933	7,002	17.7	3,175	1,440	94
MRA Wedge (Preferred)	200	518	April 1 - April 30	318	626	25.6	3,660	1,660	5
MRA Wedge North (Non-Preferred)	1,297	3,359	April 1 - April 30	1,142	2,274	26.9	3,716	1,686	6

If lines are removed from the water, the MRA Wedge emergency closure in April reduces the annual risk reduction by 5.6 percent and co-occurrence of trap/pot gear and right whales habitat by 3.3 percent. The MRA Wedge North reduces the annual risk reduction by 6.4 percent and co-occurrence of trap/pot gear and right whales habitat by 3.7 percent (Table 2). Reducing the risk that a right whale encounters buoy rope reduces the potential for an entanglement incident that could lead to serious injury or mortality. Removing lines, particularly lines without a maximum breaking strength of 1,700 pounds (771 kg), provides benefits to right whales present during the month of April, before weak line requirements go into effect on May 1, 2022.

Table 2: Comparison of reductions in entanglement risk and right whale co-occurrence by proposed seasonal closures within No Action, Preferred, and Non-Preferred Alternatives. The risk reduction is relative to annual total risk within the Massachusetts portion of LMA 1.

Seasonal Closure Area	Risk Reduction	Co-Occurrence Reduction
Alternative 1 (No Action)	-	-
Alternative 2 MRA Wedge (Preferred)	5.6%	3.3%
Alternative 3 MRA Wedge North (Non-Preferred)	6.4%	3.7%

2.4.2. Costs of the Alternatives

The compliance costs of three Alternatives were analyzed for this Emergency Rule. Costs analyzed include the costs of relocating or removing gear as well as lost revenue due lost landings. This is a revision from the preliminary analysis discussed in the preamble to the proposed rule (87 FR 11790, March 2, 2022) which did not consider the costs of gear relocation and removal.

Alternative 1 would leave the provisions of the Plan unchanged, and thus would have no economic impact relative to current regulatory requirements. Alternative 2, the Preferred Alternative, would bring short-term negative economic impacts to a number of lobster vessels in Southern Essex County, Suffolk County, Norfolk County and Northern Plymouth County.

Alternative 3, the Non-Preferred Alternative, expands the boundary of the MRA during April 2022 to include a larger area that would impact additional vessels in Essex County compared to the Preferred Alternative. The following section gives an overview of the analytic approach and results of economic impacts.

Analytic Approach

In order to comply with the Emergency Rule, fishermen have two options: the first is to move their traps from inside the emergency restricted area to adjacent northern and eastern waters and continue fishing and the second would be bringing all traps back to the dock and stop fishing for the month of April.

Fishermen's decisions are based on their trap location and potential costs. The proposed restricted areas are all located in federal waters and surrounded by current MRA. Once the areas are closed, it is not cost efficient for all vessels to move traps that are located in the southern portion of the emergency closure north of the MRA boundary. Therefore, based on the gear distribution in the Vessel Trip Report (VTR) data, we assume half vessels that currently set their traps in the Wedge Areas would retrieve their gear and stop fishing in April, and half vessels would relocate their gear for both Alternative 2 and 3.

To estimate economic impacts of this Emergency Rule, we first used the VTR data from 2015-2019 to identify the vessels impacted by each alternative by using their self-reported fishing coordinates. Although the coordinates in the VTR data could only represent the general location of the vessels, it is the best available data for spatial analysis. We then summarized the number of vessels and landing weight in pounds for both lobster and Jonah crab. Finally, we calculated the landing value by multiplying the weight and price. The monthly average prices for April were calculated by using NMFS dealer data from 2015 to 2019. All final values are adjusted to 2021 U.S. dollars by using GDP deflator from U.S. Bureau of Economic Analysis (2022).

It should be noted that, federally permitted fishing vessels that only carry lobster permits are not required to submit VTRs. In order to determine the total number of vessels fishing in this area, we divided the VTR landing value by the percent of VTR vessel coverage. NMFS federal permit data show that from 2015 to 2019, about 42 percent of Massachusetts federal lobster vessels in LMA 1 do not have a VTR requirement, which means the landing value from VTR data need to be divided by 58 percent.

Another factor that needs to be accounted for in the total cost estimate of an emergency closure is the estimated operating cost savings from vessels that stop fishing for the month of April. Vessels' operating costs usually include fuel and bait, ice, fresh water, and fishing and crew supplies etc. Labor costs are not included here because a lot of near shore vessels are owner operated, and it is also common practice that mates are paid based on landings rather than an hourly rate. These costs occur when a trip happens so that, if they stop fishing, these costs should be considered as savings. To determine cost savings, we use VTR data to determine the total number of fishing days in April, then we apply an average daily operating costs to calculate the total costs.

To estimate operating costs of transporting the traps, whether they will be brought back to the dock or moved outside the restricted area, we calculated the number of fishing days during April, and then the daily operating costs based on the average annual fishing days and total operating costs for lobster vessels. The detailed results will be presented in the next section.

Analysis Results

Vessel lost revenue

By using methods described above, preliminary data shows that 22 vessels fishing in the area would be affected by Alternative 2, according to VTR data, with a total lost revenue of $110,000 (Table 3). If Alternative 3 is implemented, 33 vessels known to fish in this area would lose $217,000 in total in April. Lobster values are much higher than the value for Jonah crabs and likely make up a large proportion of this estimate. These numbers represent pre-adjusted estimates, adjusted below based on the VTR coverage percentage in Table 4.

Table 3: Pre-adjusted number of vessels number and landing values by year in 2015-2019 VTR data (in $2021)

	Alternative 2				Alternative 3			
	Vessel Number	**Jonah Crab Value**	**Lobster Value**	**Total Value**	**Vessel Number**	**Jonah Crab Value**	**Lobster Value**	**Total Value**
2015	20	$740	$114,496	$115,236	31	$1,627	$213,201	$214,828
2016	25	$3,838	$111,643	$115,481	34	$4,847	$205,986	$210,833
2017	24	$1,056	$98,486	$99,541	33	$2,035	$165,751	$167,787
2018	19	$267	$144,314	$144,581	37	$794	$347,847	$348,641
2019	20	$225	$74,428	$74,652	32	$320	$144,530	$144,850
Average	22	$1,225	$108,673	$109,898	33	$1,924	$215,463	$217,388

Data source: NMFS 2015 to 2019 VTR

Vessel Operating Cost

We estimated vessel operating costs based on the cost surveys conducted by the Social Science Branch of the Northeast Fisheries Science Center for fishing year 2011, 2012 and 2015. Survey data show the average annual operating costs for lobster vessels in the Northeast Region is about $50,365 (in 2021 dollars). We determined that April trips account for only 5.7 percent of the total number of annual trips according to 2015-2019 VTR data. Therefore, we assigned $2,878 in operating costs to each vessel in April.

We use the daily operating costs to evaluate the economic impacts on vessels that need to transport traps back to the dock or to a new fishing ground. VTR data indicate that each vessel in the closed area fishes an average of 260 traps. With a carrying capacity of 40 to 50 traps for a medium sized lobster vessel, it would take 5 to 6 trips to remove all the gear outside of the closure. The number of trips should be the same regardless of whether they bring the gear back to dock or relocate them outside of the closure, which would require about 20 to 30 miles of traveling each way. On average we assume each vessel needs three full working days to transport all traps. If we include the time for them to move the traps back to the fishing grounds after the closure, it could be six extra days of effort. Also, VTR data show that a lobster vessel fishes about 50 days a year on average, so the operating costs for one fishing day would be around $1,000 based on the annual operating costs from the survey.

Final Results

After dividing the number of vessels and lost revenue in VTR data by the percent of vessels without reporting requirements (58 percent), we estimated that 37 and 58 vessels would be affected by Alternative 2 and 3, respectively. For Alternative 2, the total costs including both operational costs to remove or relocate gear and lost revenue due to landings loss range from an estimate of $158,701 to $275,968. For relocating vessels, the total cost estimate is around $61,000 to $122,000, and about $3,300 and $6,600 for each vessel; for vessels that stop fishing, the total cost is around $98,000 to $154,000, about $5,300 to $8,300 per vessel. For Alternative 3, 58 vessels could incur a total cost of $289,000 to $472,000. The total cost for relocating vessels ranges from $96,000 to $193,000, and unit cost per vessel is similar to the Alternative 2. The total cost for vessels that stop fishing is estimated to be from $192.000 to $279,000, and the unit cost per vessel is from $6,600 to $9,600 (Table 4).

The lobster prices we used for the analysis are from 2015 to 2019, which range from $6 to $8 per pound in Massachusetts in April. Dealer data in April 2021 show that the lobster price was about $8.8 per pound ($19.4/kg), and so far in 2022 is about $8.7 per pound ($19.2/kg). So the lost revenue in the analysis might be under-estimated.

Table 4: Adjusted final costs for vessels in Alternative 2 and 3 (in $2021)

	Alternative 2		Alternative 3	
	Lower cost	Higher cost	Lower cost	Higher cost
Relocating costs (half vessels)				
Lost revenue	$4,770	$9,540	$9,435	$18,870

	Alternative 2		Alternative 3	
Gear moving	$56,249	$112,497	$86,977	$173,954
Total costs	$61,018	$122,037	$96,412	$192,824
Cost/vessel	$3,298	$6,597	$3,325	$6,649
Stop fishing costs (half vessels)				
Lost revenue	$95,395	$95,395	$188,700	$188,700
Gear moving	$56,249	$112,497	$86,977	$173,954
(Cost savings)	$53,961	$53,961	$83,440	$83,440
Total costs	$97,683	$153,931	$192,237	$279,214
Cost/vessel	$5,280	$8,321	$6,629	$9,628
Total cost	$158,701	$275,968	$288,649	$472,038

Notes:
1. Total affected vessels in Alternative 2 is 37 and in Alternative 3 is 58.
2. We estimate lost revenue of the relocating vessels to be between 5 and 10 percent of the total landing value.
3. We estimate gear moving costs to take between 3 and 6 days at $1,000/day.

2.4.3. Relative ranking of Alternatives

As noted above, it is not feasible at present to estimate the economic benefits attributable to each of the regulatory alternatives that NMFS is considering. It is possible, however, to develop a relative ranking of the alternatives with respect to potential benefits, based on the estimated reduction of each alternative on the entanglement risk posed to right whales by commercial lobster and Jonah crab trap/pot buoy lines.

The biological impacts analysis presented in the EA relies primarily on NMFS' DST to examine how the regulatory alternatives might reduce the possibility of mortality and serious injury between right whales and lobster and Jonah crab trap/pot gear The model integrates information on buoy line density, line strength, and whale sightings to provide indicators of the potential for mortality and serious injury to occur as a result of entanglement. Risk reduction includes the chance of encounter estimated using co-occurrence and the relative severity of an encounter through the use of line strength. Biological impacts are characterized with respect to the percentage reduction in the overall risk reduction that each alternative would achieve. See FEIS Volume II Appendices 3.1 and 5.1 for more details on how risk reduction is derived.

Table 5 summarizes the compliance costs related to the estimated change in risk reduction under each action alternative relative to the No Action Alternative (Alternative 1). Alternative 2 achieves slightly less reduction in risk than Alternative 3. The DST model suggests the risk of right whale mortality or serious injury would be reduced by approximately 5.6 percent under

Alternative 2, which has an estimated total compliance costs of $158,701 to $275,968 for 37 vessels. For every unit of gear threat reduction, the cost of Alternative 2 is estimated at $28,339 to $49,280.

Alternative 3 achieved slightly better risk reduction than Alternative 2, with an estimated 6.4 percent decrease in right whale entanglement mortality or serious injury. This alternative would increase the likelihood of reducing right whale entanglement risk. However, the total compliance costs associated with gear threat reduction in Alternatives 3 are substantially higher, ranging from $288,649 to $472,038; or $45,101 to $73,756 for each unit of gear threat reduction. That is, each risk reduction unit of Alternative 3 would cost about 50 to 60 percent more than the cost per risk reduction unit in Alternative 2.

Table 5: A summary of total compliance costs related to right whale gear threat reduction (2021 dollars)

	Alternative 2	Alternative 3
Affected vessels	37	58
Risk reduction	5.6 %	6.4 %
Total compliance costs	$158,701 - $275,968	$288,649 - $472,038
Costs for each unit of gear threat reduction	$28,339 - $49,280	$45,101 - $73,756

While the comparison of the compliance costs of the risk reduction elements in each action alternative is an oversimplification, it demonstrates that Alternative 2 achieves the purposes of this Emergency Rule while also minimizing the potential economic impacts of the modifications to the Plan. That is, while Alternative 3 was estimated to achieve slightly higher co-occurrence reduction than the Preferred Alternative, both the total costs and per-unit risk reduction costs were much higher than the selected alternative. Therefore, Alternative 2 achieves the purpose and need for action, but with less economic impact on all regulated entities.

2.4.4. Uncertainties

A few assumptions are made for this analysis.

The first one is that we assumed half of the vessels that had previously fished in the wedge area would suspend their fishing activities in April 2021, and the other half would relocate their traps to northern waters. The proposed restricted areas are all located in federal waters and surrounded by the existing MRA. During the April emergency closure, it is difficult for vessels in the southern portion of the restricted area to redistribute their traps outside the northern or eastern boundaries, given the cost of operation and expected landings in April. Therefore, in our analysis we split the anticipated reaction of vessels between relocating and suspending fishing.

We also used VTR data in the calculation of the number of vessels and landing value, which may have limitations. We are aware that VTR are self-reported data and the catch and location data are limited in accuracy and variation for some vessels. However, the geographic information and gear configuration data could not be found in any other data sources consistently for lobster and

Jonah crab trap/pot fisheries. Therefore, we decided to use the data from recent years (2015-2019) after careful review and the removal of outliers.

Furthermore, due to the incompleteness of federal lobster VTR coverage, we divided the VTR landing value by the percent of VTR vessel coverage in order to estimate the total number of vessels fishing in this area. NMFS federal permit data show that from 2015 to 2019, about 42 percent of Massachusetts federal lobster vessels in LMA 1 do not have VTR requirement, which means the landing value from VTR data needed to be divided by 58 percent.

As previously noted, the inability to quantify and value the benefits of potential temporary changes to the Plan prohibits the use of BCA to identify the regulatory alternative that would provide the greatest net benefit. Instead, table 5 summarizes the estimated cost of complying with each regulatory alternative combined with the risk reduction estimated for each alternative.

2.5. Results of Regulatory Impact Analysis

As taken from the Executive Order, the purpose of Executive Order 12866 is to enhance planning and coordination with respect to new and existing regulations. This E.O. requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be "significant." E.O. 12866 requires a review of proposed regulations to determine whether or not the expected effects would be significant, where a significant action is any regulatory action that may:

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

In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider.

Given the information presented in this document and the analysis contained in the associated Environmental Assessment, it is hereby determined that the proposed action will not significantly impact the quality of the human environment as described above and in the Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. NMFS has considered the cost information presented above and believes that Alternative 2 (Preferred) offers the best option for achieving the goal of reducing acute entanglement risk adjacent to the MRA in 2022. In addition, Alternative 2 (Preferred) provides most of the benefits that would be achieved under

larger area closure, sacrificing only the relatively costly additional reduction in co-occurrence that would be achieved by extending the restricted area to the New Hampshire border. Based on these considerations, NMFS has identified Alternative 2 (Preferred) as its proposed approach to achieving the goals of the Plan.

3. References

NMFS. 2002. Workshop on the effects of fishing gear on marine habitats off the Northeastern United States October 23-25, 2001 Boston, Massachusetts. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, Massachusetts.

NFMS. 2021, June. Final Environmental Impact Statement (FEIS), Regulatory Impact Review, and Final regulatory Flexibility Analysis for Amending the Atlantic Large Whale Take Reduction Plan: Risk Reduction Rule Volume I. https://www.greateratlantic.fisheries.noaa.gov/public/nema/apsd/2021FEIS_Volume%20I.pdf

U.S. Bureau of Economic Analysis, "Table 1.1.4. Price Indexes for Gross Domestic Product". [accessed Feb 10, 2022]. Available from: https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey.