ENVIRONMENTAL ASSESSMENT
AND
FINAL REGULATORY IMPACT REVIEW
FOR A FINAL RULE TO MAKE PERMANENT THE MASSACHUSETTS RESTRICTED AREA WEDGE

JANUARY 2024

Contents:

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

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1 EXECUTIVE SUMMARY

In January 2023, NOAA's National Marine Fisheries Service (NMFS) prepared an Environmental Assessment (EA) of a 2023 emergency rule to Reduce Right Whale Interactions with Trap/Pot Gear (described in this document as the 2023 Emergency Rule EA) to analyze the emergency closure to trap/pot buoy lines in the Massachusetts Restricted Area Wedge (MRA Wedge), an area that includes the waters between State and Federal portions of the Massachusetts Restricted Area (MRA) for the full length of the MRA period (February 1-April 30). On September 18, 2023, NMFS published a proposed rule to permanently expand the boundaries of the MRA to include the MRA Wedge (88 FR 63917) and an accompanying Draft Environmental Assessment (Draft EA; NMFS 2023a). NMFS prepared this EA to analyze the environmental effects of alternative means of promulgating a final rule to make permanent the closure consistent with the stated purpose and need for action following recommendations from Massachusetts State and in accordance with the Marine Mammal Protection Act and the 2023 Consolidated Appropriations Act (H.R. 2617–1631—H.R. 2617–1632, Division JJ—North Atlantic Right Whales, Title I—North Atlantic Right Whales and Regulations). This EA substantially incorporates and relies on the 2023 Emergency Rule EA (FONSI signed January 25, 2023; NMFS 2023b) accompanying the 2023 emergency restricted area extension (88 FR 7362; February 3, 2023) and the Draft EA accompanying the proposed rule to make permanent the MRA Wedge (88 FR 63917, September 18, 2023; NMFS 2023a).

Summary of Purpose and Need

The action under the Preferred Alternative (Alternative 2), as described in Chapter 3, modifies the spatial boundaries of the MRA to include the area between State and Federal waters known as the MRA Wedge. The MRA Wedge in Massachusetts Bay is nearly circumscribed by the MRA, which is closed to trap/pot fishing with persistent buoy lines annually from February 1 to April 30. The MRA Wedge was closed by emergency rulemaking in 2022 and 2023 due to the immediate risk to North Atlantic right whale (*Eubalaena glacialis*) mortality and serious injury caused by buoy lines in an area with a high co-occurrence of whales and buoy lines. This risk is expected to recur annually. The Preferred Alternative will address this gap in protection and reduce the incidental mortality and serious injury of right whales, fin whales (*Balaenoptera physalus*), and humpback whales (*Megaptera novaeangliae*) in commercial trap/pot fisheries.

Under the No Action Alternative (Alternative 1), the boundaries of the MRA would not be promulgated or implemented, leaving the current Atlantic Large Whale Take Reduction Plan (Plan) intact with no regulatory changes. This includes the restricted areas implemented by the Final Rule on September 17, 2021 (86 FR 51970) that went into effect October 18, 2021 and requirements for minimum traps per trawl and weak inserts throughout the buoy line that went into effect May 1, 2022.

Affected Environment

The Affected Environment for the MRA Wedge is described in Chapter 5. The Affected Environment is described based on the valued ecosystem components (VECs) that may be impacted by the three alternatives within the portion of Lobster Management Area 1 adjacent to

Massachusetts (i.e., south of the New Hampshire border; MA LMA 1; action area). The 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 action are protected species, habitat, and the human community.

Impacts of the Alternatives

The impacts of the alternatives considered on each VEC described in the Affected Environment are in Chapter 6 and summarized here. Alternative 1 (No Action) would maintain the status quo to the current Plan intact as implemented in 2021. Alternative 2 (Preferred Alternative) would add approximately 200 square miles (518 square kilometers) of Federal waters adjacent to the existing MRA to the MRA during the existing closure period of February 1 through April 30. Alternative 3 would add approximately 1,297 square miles (3,359 square kilometers) to the MRA and extend the northern MRA boundaries up to the New Hampshire border during the same time period.

Protected species

The primary difference in biological impacts on protected species between the alternatives relates to the removal of buoy lines within the water column to reduce right whale entanglement risk within the MRA Wedge. Prohibiting the use of buoy lines from February 1 to April 30 would reduce entanglement risk for large whales, particularly for right whales because they are abundant in this area at this time of year. Under Alternative 1 (No Action), high negative impacts are expected because there would be a risk of entanglement due to the number of buoy lines that would remain in the water when right whales are abundant in the MRA Wedge. Relative to No Action, Alternative 2 (Preferred) would have a slight positive impact on species listed as endangered under the Endangered Species Act of 1973 (ESA-listed; right, fin, and sei whales) and protected species under the Marine Mammal Protection Act (MMPA; humpback and minke whales) because large whale entanglement risk in trap/pot gear is reduced. Relative to No Action, Alternative 3 would have a moderate positive impact on ESA-listed and MMPA protected species. Considered alone, ESA-listed and MMPA protected species would be moderately negative to slightly negatively impacted by Alternative 2, and negligible to slightly negatively impacted by Alternative 3, because these actions do not eliminate the potential for all interaction risk between fishing gear and marine mammals that could result in mortality and serious injury from entanglements throughout the year and the species' range.

Habitat

Alternative 1 (No Action) would maintain baseline levels of biological impacts on benthic habitats, and negligible to slight negative impacts on habitat due to disturbance of benthic habitat. In comparison to No Action, Alternative 2 and Alternative 3 are expected to have a negligible to slight positive impact on the MA LMA 1 habitat. If on-demand fishing is implemented in closed areas, it is not expected that Alternative 2 or Alternative 3 would significantly change the amount of gear that comes into contact with the seafloor. Compared to Alternative 2 and Alternative 3, No Action is expected to have negligible impacts on affected fish habitats. Considered on their own, Alternative 2 and Alternative 3 would likely have a negligible to slight negative impact on the environment due to continued disturbance from long trawls outside of the closure period.

Human Community

Alternative 1 (No Action) would maintain the status quo, which has a negligible impact on fishing communities in the short term, and might have a slight negative impact in the long term. 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 Alternative 2 result in an estimated annual cost (including lost revenue) of $339,000 to $608,000 with approximately 26 to 31 affected vessels, compared to No Action. The total costs for Alternative 2 across five years are around $1.7 million to $3 million. Alternative 2 would impact lobster and Jonah crab Massachusetts permitted vessels fishing from Southern Essex County, Suffolk County, Norfolk County, and Northern Plymouth County. Vessels in Plymouth County could be the most vulnerable to the action under Alternative 2, 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 53 to 66 vessels for an annual estimated cost (including lost revenue) of $898,249 to $1,452,797, compared to No Action. For Alternative 3, the total compliance costs across five years are around $4.5 million to $7.3 million. Alternative 3 has similar social impacts to Alternative 2, except it will affect more vessels in Essex County that fish in the Northern waters offshore and north of Cape Ann. The social and economic impacts on the human community would decrease year by year as fishermen adapt to the restricted area.

Cumulative Impacts

We analyzed the impacts of all alternatives on physical habitat, protected species, and human communities. When Alternative 2, the Preferred Alternative, is considered in conjunction with all other impacts from past, present, and reasonably foreseeable future actions, it is not expected to result in any significant impacts, positive or negative; therefore, no significant cumulative effects on the human environment are associated with the action considered under the Preferred Alternative.

Conclusions

A description of the expected environmental impacts and any cumulative impacts of the alternatives are provided in Chapter 6. The analyzed action under the Preferred Alternative is not associated with significant impacts to the socioeconomic or physical environment, individually or in conjunction with other actions.

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2.3 List of Acronyms

ALWTRP	Atlantic Large Whale Take Reduction Plan
ALWTRT	Atlantic Large Whale Take Reduction Team
APA	Administrative Procedure Act
BCA	Benefit-cost Analysis
BEA	Bureau of Economic Analysis
CAA	Consolidated Appropriations Act, 2023
CCS	Center for Coastal Studies
CEA	Cumulative Effects Analysis
CEQ	Council on Environmental Quality
CZMA	Coastal Zone Management Act of 1972
DAS	Days-At-Sea
DST	Large Whale Decision Support Tool
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFP	Exempted Fishing Permit
EO	Executive Order
ESA	Endangered Species Act of 1973
FEIS	Final Environmental Impact Statement
FMP	Fishery Management Plan
FONSI	Finding of No Significance Determination
FRFA	Final Regulatory Flexibility Analysis
FY	Fishing Year
GARFO	Greater Atlantic Regional Fisheries Office
GOM	Gulf of Maine
HAPC	Habitat of Particular Concern
HMA	Habitat Management Area
IFQ	Individual Fishing Quota
IQA	Information Quality Act
IRFA	Initial Regulatory Flexibility Analysis

LAGC	Limited Access General Category
LMA	Lobster Management Area
MA DMF	Massachusetts Division of Marine Fisheries
MA LMA 1	Massachusetts' portion of the Lobster Management Area 1
MMPA	Marine Mammal Protection Act of 1972
MRA	Massachusetts Restricted Area
MRA Wedge	Massachusetts Restricted Area Wedge
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSTP	Mixed Species Trap/Pot
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PBR	Potential Biological Removal
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
SAR	Stock Assessment Report
SNE	Southern New England
SSB	Social Science Branch
TAC	Total Allowable Catch
TAL	Total Allowable Landings
UME	Unusual Mortality Event
VEC	Valued Ecosystem Component
VTR	Vessel Trip Report

3 INTRODUCTION AND PURPOSE

In accordance with the National Environmental Policy Act, the regulations published by the Council on Environmental Quality, and NOAA's Companion Manual for NAO 216-6A (2017), this Environmental Assessment evaluates potential environmental impacts of an action for implementation by NOAA's National Marine Fisheries Service under Section 118 of the Marine Mammal Protection Act to modify the regulations implementing the Atlantic Large Whale Take Reduction Plan. Significant impacts are not anticipated as a result of this action because the proposed modifications to the Massachusetts Restricted Area (MRA) are small relative to the current MRA extent, limited economic impacts are expected, and any indirect effects are likely beneficial for the environment.

3.1 Background

3.1.1 Large Whale Entanglement Risk in the Action Area

The North Atlantic right whale (*Eubalaena glacialis*, hereafter referred to as right whale) population has been in decline since 2010, with the most recent published estimate of right whale population size in 2022 at 356 whales (95 percent confidence interval: 346-363) (Linden 2023; Figure 7 below) with a strong male bias (Hayes et al. 2023, Pace et al. 2017, Pace 2021). The steep population decline is a result of high levels of human-caused mortality from entanglement in fishing gear and vessel strikes in both the U.S. and Canada. An Unusual Mortality Event (UME) was declared for the population in 2017, due to high rates of documented vessel strikes and entanglement in fishing gear. As of January 18, 2024, the UME includes 36 detected mortalities (17 in 2017, 3 in 2018, 10 in 2019, 2 in 2020, 2 in 2021, 0 in 2022, and 2 in 2023). In addition, 35 serious injuries were documented (6 in 2017, 6 in 2018, 3 in 2019, 6 in 2020, 5 in 2021, 4 in 2022, 4 in 2023, and 1 in 2024). Lastly, 51 morbidity (or sublethal injury or illness) cases were documented (12 in 2017, 12 in 2018, 6 in 2019, 6 in 2020, 2 in 2021, 7 in 2022, and 6 in 2023; https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2024-north-atlantic-right-whale-unusual-mortality-event). Documented mortalities and serious injuries represent a minimum; in some years population models estimate up to 64 percent of all mortalities are not seen and not accounted for in the right whale observed incident data (Pace et al. 2021, Pace et al. 2017).

The right whale is listed as an endangered species under the Endangered Species Act (ESA) and is a strategic stock under the Marine Mammal Protection Act (MMPA). NMFS is required by the MMPA to reduce mortality and serious injury incidental to commercial fishing to below a stock's potential biological removal (PBR) level. PBR is 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." In the most recently published stock assessment report (Hayes et al. 2023), PBR for the right whale population is 0.7 whales per year. Between 2010 and 2022, there has not been a single year where observed mortality and serious injury of right whales was below PBR. Moreover, total estimated mortality is higher than observed mortality (Hayes et al. 2023, Linden 2023, Pace et al. 2021).

The Atlantic Large Whale Take Reduction Plan (Plan) was implemented in 1997 pursuant to Section 118 of the MMPA (16 U.S.C. 1387) to reduce mortality and serious injury of three stocks of large whales (fin, humpback, and North Atlantic right) incidental to certain Category I and II fisheries. Under the MMPA, a strategic stock of marine mammals is defined as a stock: (1) for which the level of direct human-caused mortality exceeds the PBR level; (2) 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 (3) which is listed as a threatened or endangered species under the ESA or is designated as depleted under the MMPA (16 U.S.C. 1362(19)). The right whale is a strategic stock because the human-caused mortality exceeds the PBR level and because it is listed as endangered under the Endangered Species Act. When incidental mortality or serious injury of marine mammals from commercial fishing exceeds a stock's PBR level, the MMPA directs NOAA's National Marine Fisheries Service (NMFS) to convene a take reduction team of stakeholders that includes the following: Representatives of Federal agencies; each coastal State that has fisheries interacting with the species or stock; appropriate Regional Fishery Management Councils; interstate fisheries commissions; academic and scientific organizations; environmental groups; all commercial and recreational fisheries groups using gear types that incidentally take the species or stock; and if relevant, Alaska Native organizations or Indian tribal organizations.[1]

The Atlantic Large Whale Take Reduction Team (Team) has 59 members, including 23 trap/pot and gillnet fishermen or fishery representatives. The background for the take reduction planning process and initial development of the Plan is provided in the preambles to the proposed (62 FR 16519, April 7, 1997), interim final (62 FR 39157, July 22, 1997), and final (64 FR 7529, February 16, 1999) rules implementing the initial plan. The Team met and recommended modifications to the Plan, implemented by NMFS through rulemaking, several times since 1997 in an ongoing effort to meet the MMPA take reduction goals.

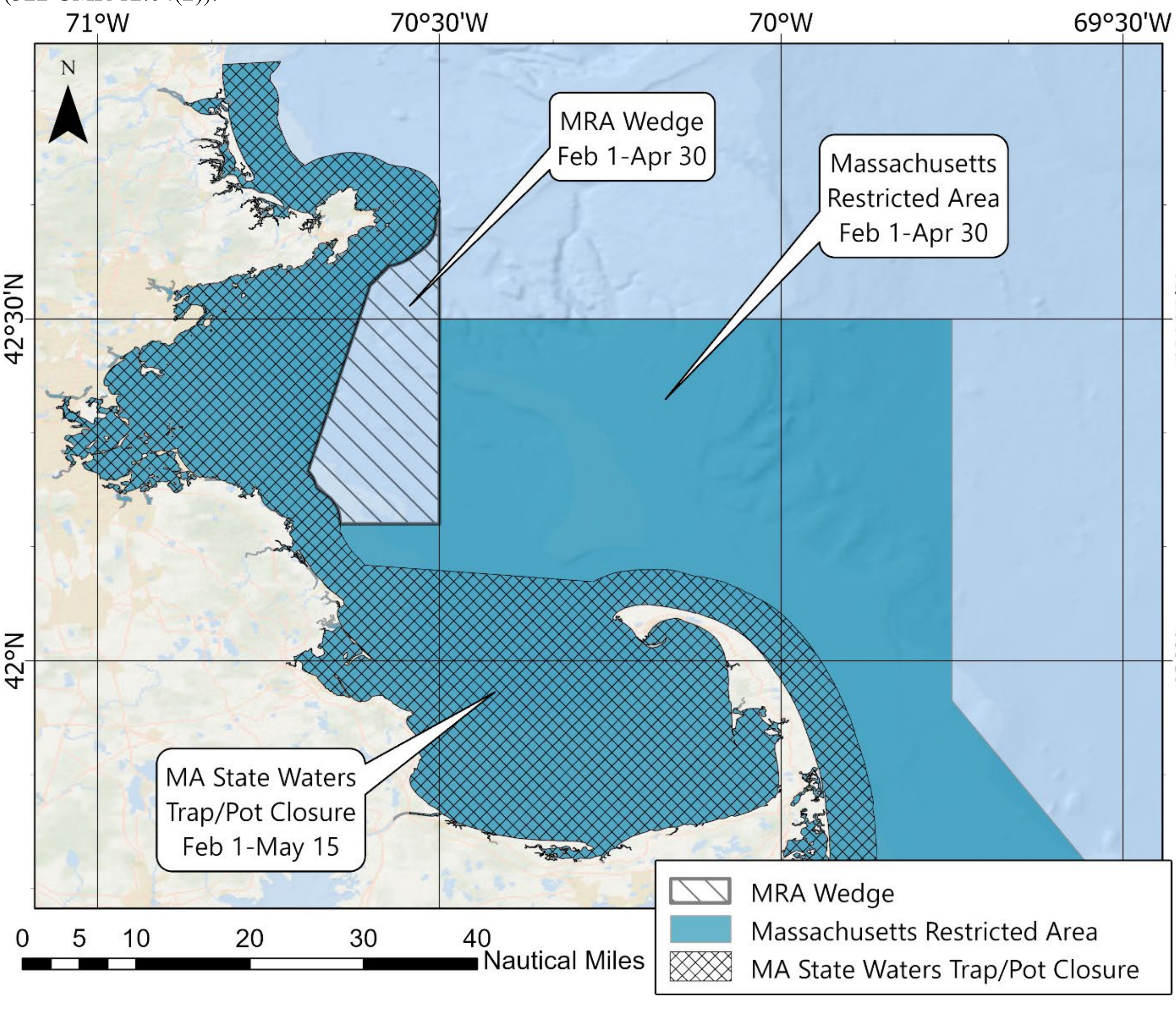
The most recent modification to the Plan was implemented by a final rule published on September 17, 2021 (86 FR 51970). Mortalities and serious injuries of right whales continue at levels exceeding the right whale's PBR. Additional data on right whale population estimates including cryptic (unobserved) mortality (Pace et al. 2021, Pace et al. 2017), the stock's decline, changes in distribution and reproductive rates, and entanglement-related mortalities and serious injuries that have been documented in recent years can be found in Subsection 5.1.1 of this Environmental Assessment, Chapters 2 and 4 of the Final Environmental Impact Statement (NMFS 2021b), and the preamble to the 2021 final rule (86 FR 51970, September 17, 2021).

The 2021 final rule (86 FR 51970, September 17, 2021) inadvertently left a critical gap in protection for right whales in waters surrounding the Massachusetts Restricted Area (MRA). Observational sightings from 2018 through 2023 provide empirical evidence of the high risk of overlap between right whales and buoy lines in this area (see Figures 2 and 3 below). The 2021 final rule expanded the geographic extent of the MRA under the Plan to mirror the area included in the 2021 Massachusetts State Commercial Trap Gear Closure to Protect Right Whales (322 CMR 12.04(2); hereafter referred to as MA State Waters Trap/Pot Closure) which extended restrictions north to the New Hampshire border (Figure 1 below). The MRA expansion, as

[1] There are no Alaska Native or Indian tribal organizations participating on the Atlantic Large Whale Take Reduction Team.

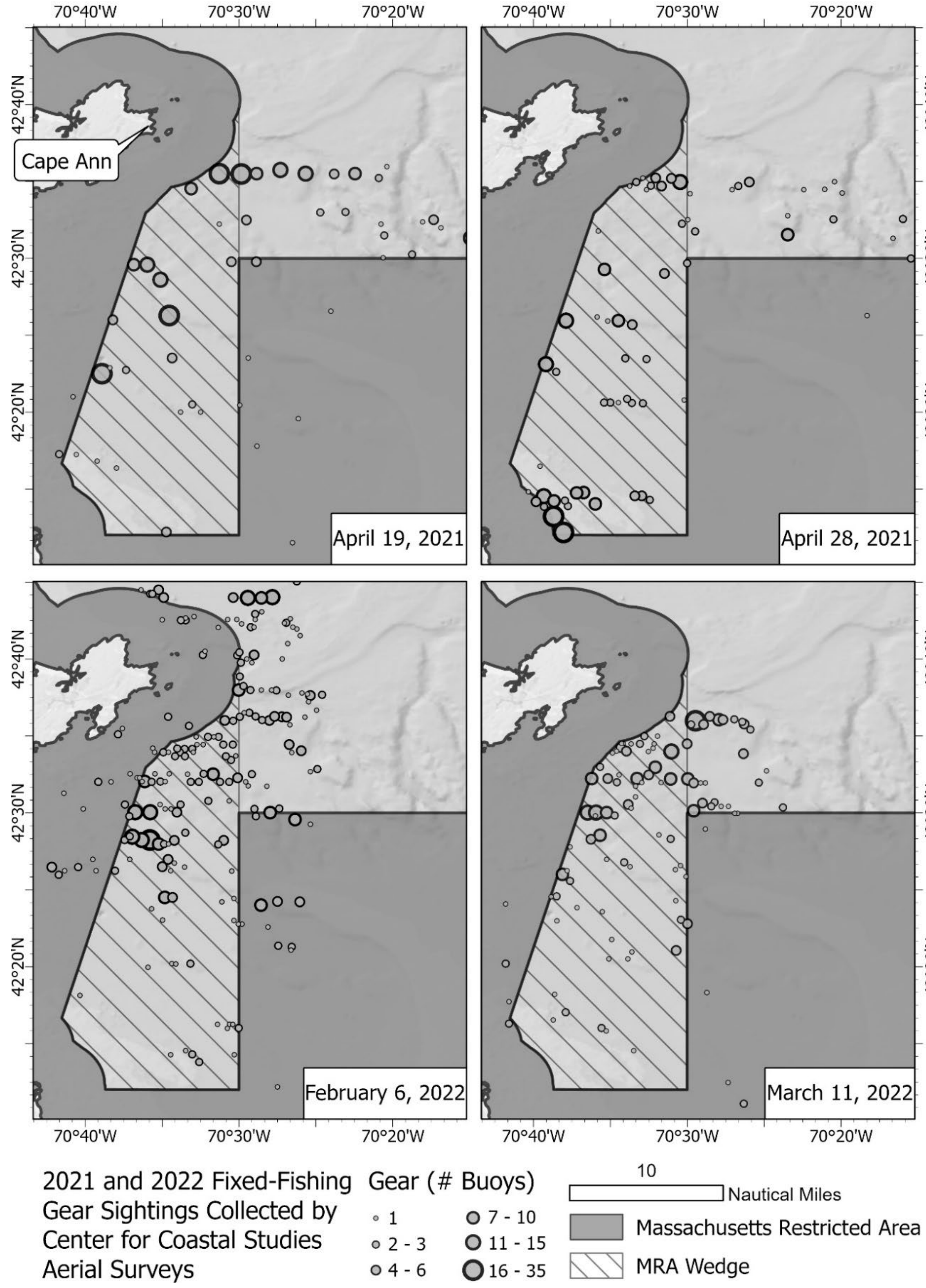
implemented under the Plan, is in place from February 1 through April 30, while the MA State Waters Trap/Pot Closure is closed from February 1 through May 15, with the option to open early on April 30 or extend the closure in May depending on right whale sightings and copepod abundance. The implementation of the 2021 MRA expansion left approximately 200 square miles (518 square kilometers) of Federal waters, called the Massachusetts Restricted Area Wedge (MRA Wedge), nearly enclosed by State and Federal closures. In addition to gear normally fished in the MRA Wedge during these months, the state water closure caused gear aggregation in this area and created the need for a similar seasonal closure of the MRA Wedge. Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) reported consistent observations of right whales within the MRA Wedge from February through April 2018-2023 (Figure 3). Aerial surveys conducted by CCS in April 2021 and February and March of 2022 also documented the presence of aggregated fixed-fishing gear in the MRA Wedge and in waters north of the MRA (Figure 2).

Figure 1: Massachusetts Restricted Area, MRA Wedge, and MA State Waters Trap/Pot Closure Areas. Massachusetts Restricted Area waters are closed to commercial trap/pot buoy lines from February 1 through April 30. Massachusetts State regulations prohibit trap/pot fishing from February 1 through May 15, but can be extended past May 15 in the continued presence of North Atlantic right whales or rescinded after April 30 in their absence (322 CMR 12.04(2)).



In January 2022, NMFS received letters and emails from Massachusetts Division of Marine Fisheries (MA DMF), Stellwagen Bank National Marine Sanctuary, and non-governmental organizations expressing concerns about this gap in restricted waters and the heightened risk of entanglement for right whales during the MRA closure period from February through April (See Appendix 3.1 for Letters of Concern). These letters and underlying information were discussed with the Team in a January 2022 Team webinar. State, academic, and non-governmental organizations expressed support for including the MRA Wedge in a future Plan amendment, while Massachusetts fishing representatives expressed concerns about economic impacts during a season when effort is generally low and price is sometimes high. The Team was not asked to vote on a recommendation during this webinar, but the MRA Wedge was discussed as a future possible Plan amendment and suggested as worth consideration for expedited rulemaking due to its potential for significant right whale risk reduction. After further reviewing available information and considering the high risk of entanglement in this area, NMFS prepared and issued an emergency rule prohibiting trap/pot fishery buoy lines within the MRA Wedge for the month of April 2022 (87 FR 11590, March 2, 2022). Though the January 2022 letter from MA DMF requested a closure to coincide with the MRA closure period, running from February through April, the 2022 emergency closure in the MRA Wedge was only implemented in April 2022 due to the several months it took to prepare a new emergency rule and Environmental Assessment (NMFS 2022b) analyzing the potential economic and biological impacts of the closure.

Figure 2: Fixed-fishing gear observed by Center for Coastal Studies (CCS) on April 19, 2021, April 28, 2021, February 6, 2022, and March 11, 2022 within portions of the Massachusetts Restricted Area, MRA Wedge, and adjacent waters. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



At the time of the 2022 emergency action, NMFS had already begun working with the Team to develop recommendations for a second round of modifications to the Plan because new population information indicated a need for further risk reduction to reduce mortality and serious injury of right whales to below PBR in U.S. commercial fisheries. Concurrently, NMFS faced litigation on the 2021 Batched Fisheries Biological Opinion (NMFS 2021a) analyzing the authorizations of several fisheries including the lobster and Jonah crab fisheries under the ESA, and the distinct 2021 amendment to the Plan issued under the MMPA (86 FR 51970, September 17, 2021). On July 8, 2022 the District Court for the District of Columbia held that the 2021 final rule violated the MMPA for failing to include measures expected to reduce mortality and serious injury to below the PBR level within six months of implementation (Center for Biological Diversity, et al., v. Raimondo, et al., (Civ. No. 18-112 (D.D.C.))). On September 9, 2022, NMFS announced it was scoping in advance of additional rulemaking (87 FR 55405) to meet its MMPA mandate as described by the Court's decision. Then on November 17, 2022, the Court ordered NMFS to promulgate a new MMPA-compliant Plan rule by December 9, 2024 (Center for Biological Diversity, et al., v. Raimondo, et al., (Civ. No. 18-112 (D.D.C.))).[2] Team meetings and deliberations that began in early 2022 concluded in December 2022 with a majority but non-consensus vote on recommendations for a Plan amendment to implement new measures to further reduce right whale entanglement mortality and serious injury in U.S. commercial fisheries regulated under the Plan. Among the recommended measures was a spatially expanded MRA that would address the entanglement risk in the MRA Wedge and waters farther north, including Jeffreys Ledge. On December 12, 2022, MA DMF requested that NMFS extend the MRA Wedge closure into 2023 and 2024, or until new long-term measures are implemented (See Appendix 3.1 for Letters of Concern).

On December 29, 2022, President Biden signed H.R. 2617, the Consolidated Appropriations Act, 2023 (CAA), into law that deemed the Plan's 2021 amendment "sufficient to ensure that the continued Federal and State authorizations of the American lobster and Jonah crab fisheries are in full compliance" with the MMPA and the ESA until December 31, 2028 with an exception for the MRA Wedge (see Subsection 7.11 for more details).

On January 4, 2023, following the signing of the CAA, MA DMF reiterated its concerns about the unprotected waters of the MRA Wedge and indicated full support for an annual closure of the area from February through May, or as long as the adjacent areas (*i.e.*, Federal or State waters) remain closed. When the 2022 emergency rulemaking was published (87 FR 11590, March 2, 2022), NMFS anticipated that the upcoming modifications to the Plan would address the risk associated with the lack of permanent seasonal restrictions in the MRA Wedge. However, in light of the Court's decisions, a Plan rule addressing the MRA Wedge was not feasible by February 2023, given that the Court instructed NMFS to promulgate the Plan amendment with measures necessary to meet the PBR level within six months of implementation and the Team had not completed deliberations on recommended measures until December 2, 2022.

[2] In Maine Lobstermen Association v. NMFS, 70 F.4th 582 (D.C. Cir. 2023), the D.C. Circuit Court of Appeals vacated the 2021 Batched Fisheries Biological Opinion with respect to right whales and the lobster and Jonah crab fisheries. The Court also remanded the 2021 Plan Amendment to NMFS without vacatur. The 2021 Plan Amendment remains live and enforceable while NMFS reconsiders the rulemaking. This EA considers the MRA Wedge closure in light of that decision.

Accordingly, the entanglement risk associated with a lack of seasonal restrictions in the MRA Wedge could not be feasibly addressed by a Plan amendment in time to mitigate an immediate and significant adverse impact to right whales in the MRA Wedge during the MRA closure period in 2023.

On January 31, 2023, NMFS announced an extension of the 2022 emergency rule closing the MRA Wedge to trap/pot fishing with buoy lines from February 1 to April 30 while adjacent Federal waters within the MRA were similarly restricted (88 FR 7362, February 3, 2023) and a final rule closing the MRA Wedge on a permanent seasonal basis could be prepared. Although this extension was not coterminous with the 2022 emergency rule (*i.e.*, the extension's closure period began on February 1, 2023 rather than May 1, 2022) it was consecutive with the emergency rule given the seasonality of entanglement risk to right whales in the MRA Wedge.

On August 22, 2023, MA DMF again reiterated strong support for a permanent annual closure of the MRA Wedge from February through April due to "a level of entanglement risk that is troubling and begs for a permanent management solution." MA DMF stated in a letter to NMFS that the "gap in the closure…created a refuge for fishers to place their gear, leading to extraordinarily high gear densities in the Wedge Area. DMF believes most gear in this area is infrequently hauled and largely being stored in this location…" (See Appendix 3.1 for Letters of Concern). MA DMF also provided empirical gear and whale sightings data from 2021 through 2023 that demonstrated the high co-occurrence of gear and right whales (Figures 2, 3, and 11-13).

On September 18, 2023, NMFS published a proposed rule to amend the Plan (88 FR 63917) to expand the boundaries of the MRA to include the waters between State and Federal waters known as the MRA Wedge with an accompanying draft Environmental Assessment (EA; NMFS 2023a) analyzing several alternative actions, including the preferred alternative to expand the boundaries of the MRA to include the MRA Wedge for the entirety of the annual seasonal closure period from February 1 through April 30. A 30-day public comment period began on September 18, 2023, and ended on October 18, 2023. During the 30-day public comment period, NMFS requested public comments on the timing and spatial extent of the closure, and comments on and support for the proposed alternatives analyzed in the draft EA. We reviewed and considered all written and oral public submissions received during the comment period. Comments on the proposed rule and draft EA were accepted as electronic submissions via *regulations.gov* on docket number NOAA-NMFS-2023-0083. We also accepted public comments at two in-person public hearings on September 26, 2023, in Gloucester, MA, and on September 28, 2023, in Buzzards Bay, MA.

A total of 26 individuals or groups submitted written comments through the *regulations.gov* comment portal, and 9 speakers submitted comments orally at the public hearings. One speaker submitted the same comment three times, at both public hearings, as well as through written comment. Two speakers submitted the same comments twice, at a public hearing and through a written comment. In total, we received comments from 31 unique commenters (individuals or groups). Of these 31 commenters, 7 were fishermen, 3 were fishing industry associations (2 commenters were members of the same organization, but their comments were different), 6 were other non-governmental organizations, 11 were other members of the public, 2 were state fishery resource managers, and 2 were federal resource managers. Of the 31 commenters, 13 supported Alternative 1 (No Action), 9 supported Alternative 2 (Preferred), 8 supported Alternative 3, and 1 commenter did not express support for any alternative. Overall, 17 commenters supported taking action, while 13 did not.

Alternative 2 (Preferred) largely follows the recommendations from MA DMF, which strongly requested that the measures be finalized in time for fishermen to be able to safely remove their gear. This EA incorporates information, questions, concerns, and suggestions provided by public comment.

3.2 Purpose and Need

Aerial surveys from 2021 and 2022 capturing gear sightings on specific days when surrounding State and Federal waters of the Massachusetts Restricted Area (MRA) are closed to buoy lines demonstrate the high risk of entanglement that right whales face while in or traversing the waters of the Massachusetts Restricted Area Wedge (MRA Wedge; Figure 2). Additionally, visual sightings and acoustic detections of right whales throughout winter and spring in the MRA Wedge and surrounding waters continue to indicate that right whales are in the MRA Wedge or likely traveling through this gap to feed in waters in and around Massachusetts Bay (Figures 3 and 4). Gear presence likely increased in the MRA Wedge waters as fishermen pushed out of surrounding restricted State and Federal waters moved gear into this small open area and continued to actively fish following the 2021 final rule (86 FR 51970, September 17, 2021). Gear is also likely to increase if fishermen place gear into unrestricted waters of the MRA Wedge in anticipation of the May 1 opening of Federal waters. The storage of gear in anticipation of Federal waters opening may be especially likely in April when right whale sightings are still high. Given the high likelihood that endangered right whales are present throughout this area and in adjoining waters during these months, the MRA Wedge poses a particularly high risk of mortality or serious injury from entanglement in fishing gear. It is critical that the waters of the MRA Wedge be formally included within the MRA to prevent the likelihood of an immediate and significant entanglement risk to right whales in the MRA Wedge.

The purpose of the action under the Preferred Alternative (Alternative 2) is to reduce the acute risk of right whale entanglement in trap/pot fisheries in waters adjacent to the existing MRA by expanding the boundaries of the MRA to a spatial extent necessary to address the gap in protection described above. Recent survey data demonstrates the likelihood of high overlap between right whales and buoy lines in this area at this time. There is an urgent need to prevent the take of right whales in U.S. commercial trap/pot fisheries managed under the Atlantic Large Whale Take Reduction Plan (Plan), to the greatest extent possible, because even one take that causes mortality or serious injury exceeds the Potential Biological Removal level for this population. Modifying the boundaries of the MRA to include the Federal waters within the MRA Wedge would address a critical gap in restrictions. The expanded boundaries of the MRA to include the MRA Wedge would reduce entanglement risk where there is a particularly high chance of entanglement that was not addressed in the Plan’s 2021 modifications of the MRA (86 FR 51970, September 17, 2021).

This Environmental Assessment (EA) is being prepared using the 2020 Council on Environmental Quality National Environmental Policy Act Regulations as modified by the Phase I 2022 revisions. The effective date of the 2022 revisions was May 20, 2022 and reviews begun after this date are required to apply the 2020 regulations as modified by the Phase I revisions unless there is a clear and fundamental conflict with an applicable statute. This EA began on October 3, 2023, and accordingly proceeds under the 2020 regulations as modified by the Phase I revisions.

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

Figure 3: North Atlantic right whale sightings spanning February-April 2018-2023 in the Massachusetts Restricted Area, MRA Wedge, and adjacent waters. North Atlantic right whale sightings were collected through dedicated aerial surveys conducted by Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) and dedicated shipboard surveys conducted by CCS, NEFSC, and Stellwagen Bank National Marine Sanctuary. Opportunistic sightings were reported from various platforms including, but not limited to, CCS, U.S. Coast Guard, New England Aquarium, Boston Harbor Cruises, and Massachusetts Environmental Police. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.

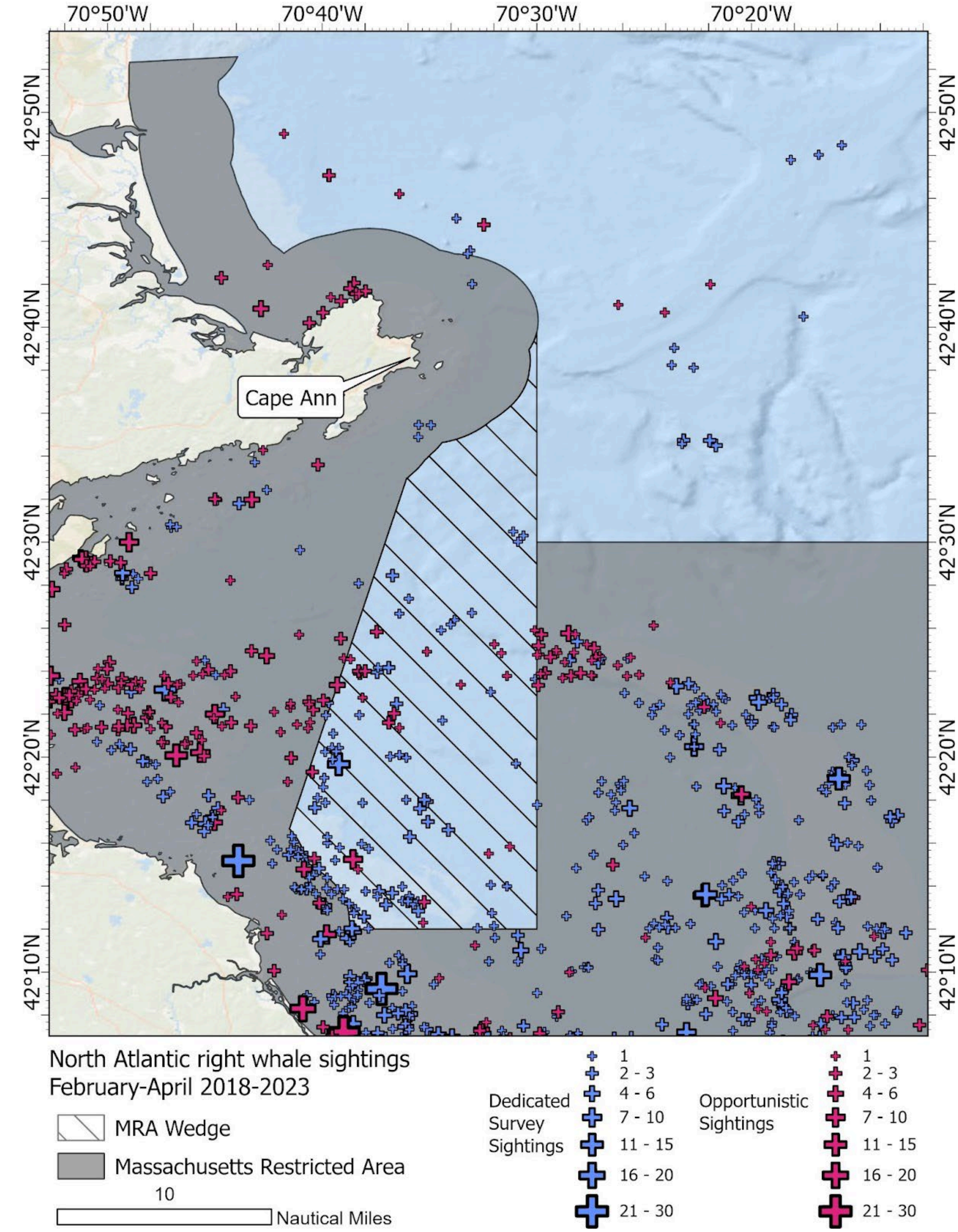
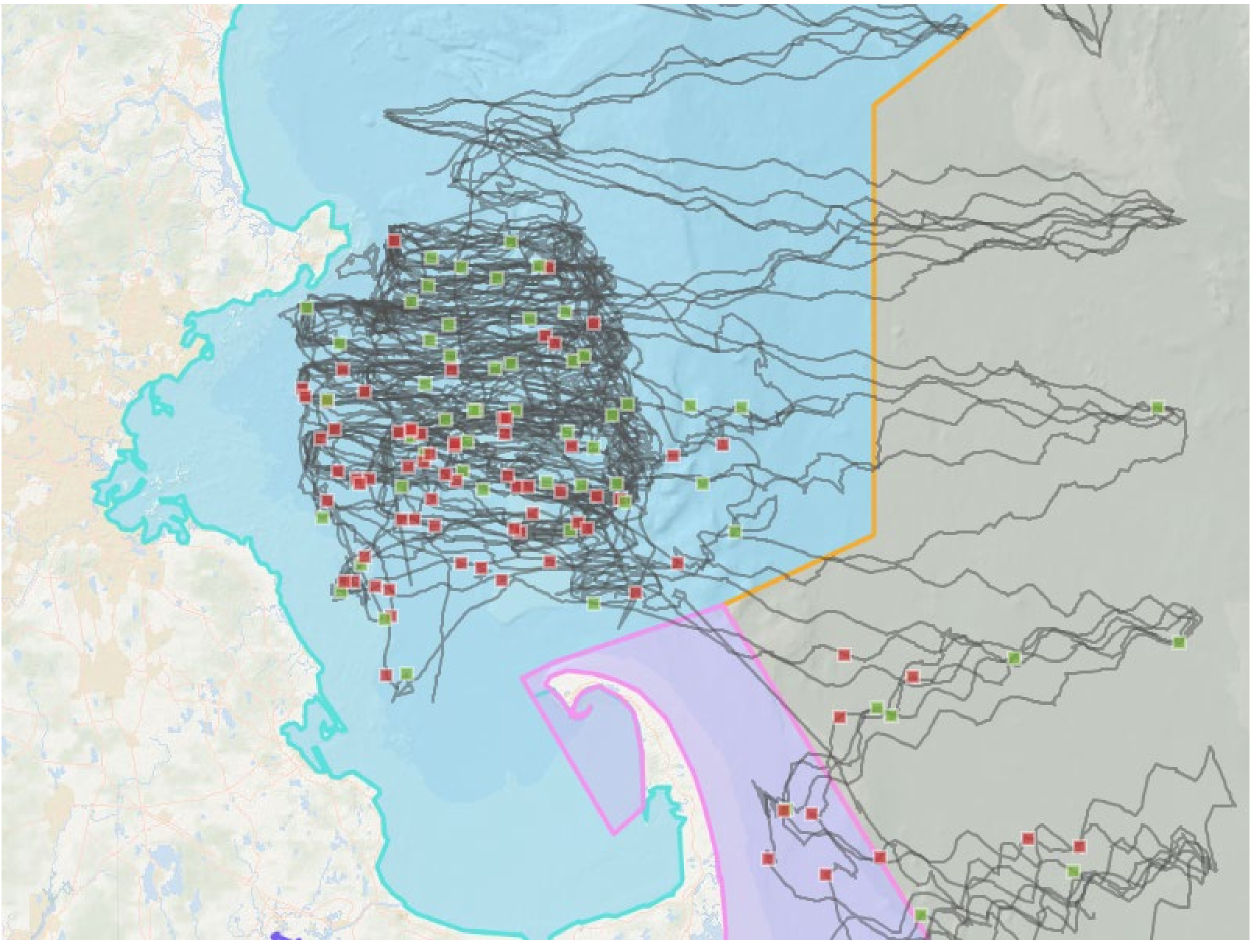


Figure 4: Definite (red squares) and possible (green squares) acoustic detections of North Atlantic right whales in Massachusetts Bay from February 1 through April 30, 2018-2022. The acoustic detection data comes from Slocum Glider surveys deployed near the Stellwagen Bank National Marine Sanctuary and Gulf of Maine (Baumgartner 2021). Survey track lines from the Slocum Glider surveys are depicted by the gray lines. Data from Passive Acoustic Cetacean Map Website (PACM 2023; Accessed January 22, 2024 https://apps-nefsc.fisheries.noaa.gov/pacm/#/narw).



3.2.1 Scope of the Analysis

The scope of this analysis is limited to three alternatives - one No Action Alternative (Alternative 1) that would maintain status quo and two action alternatives modifying the Plan to expand the spatial boundaries of the existing MRA that prohibits trap/pot fishing with buoy lines February 1 through April 30. This analysis 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 shown in Figure 1).

4 SUMMARY OF MANAGEMENT ALTERNATIVES

The alternatives were selected based on the results of surveys conducted by Center for Coastal Studies and the Northeast Fisheries Science Center that observed North Atlantic right whales from February through April of 2018-2023 and/or fixed fishing gear adjacent to the Massachusetts Restricted Area throughout February, March, and April in 2021 and 2022; acoustic and visual detections of North Atlantic right whales from various platforms collected February through April of 2020-2023; and quantitative modeling using the Large Whale Decision Support Tool. The data and analyses are further described in Subsection 6.2.

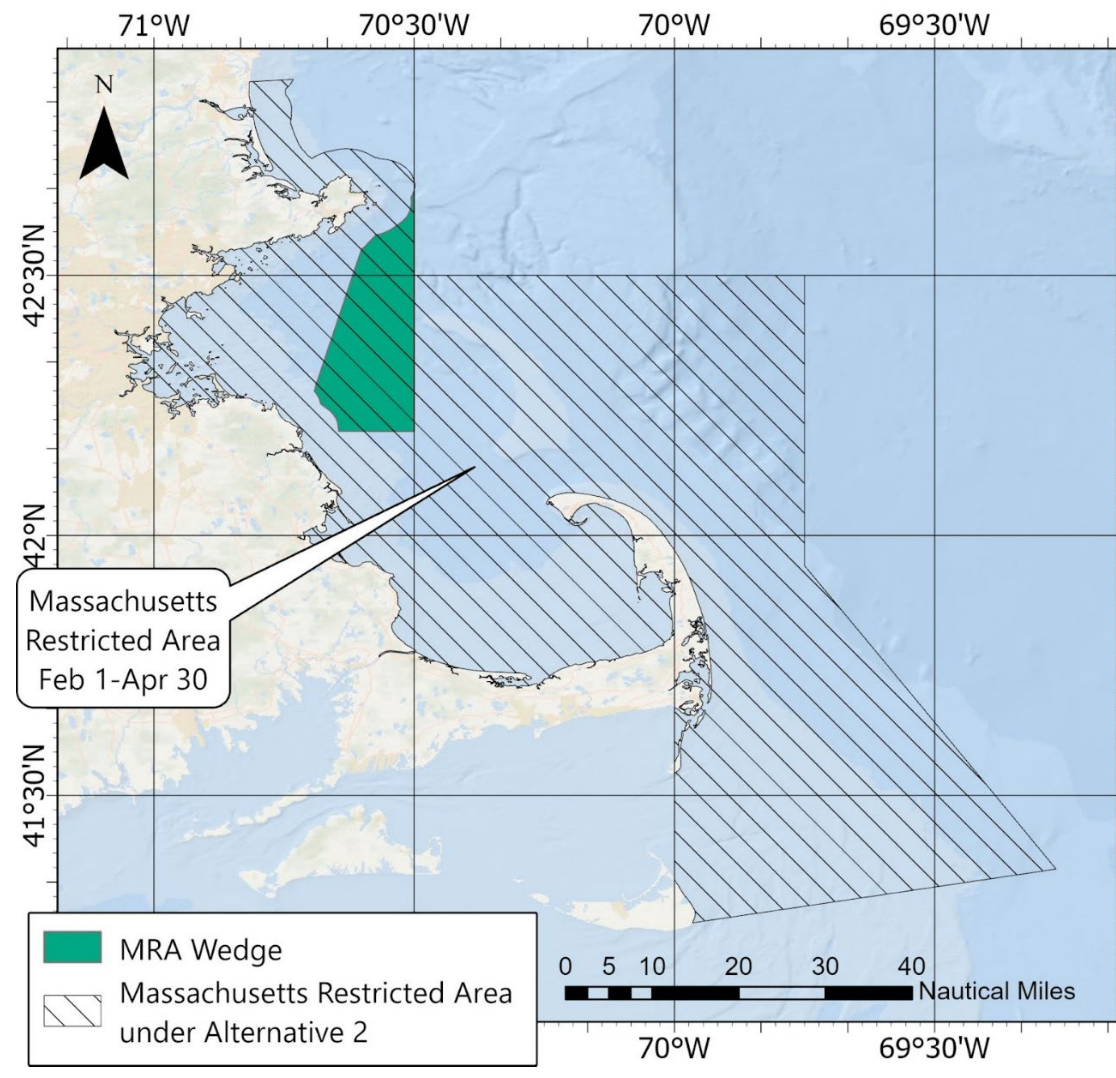
4.1 Alternative 1: No Action (Status Quo)

Alternative 1, No Action, leaves the current Atlantic Large Whale Take Reduction Plan intact with no regulatory changes. This includes the restricted areas implemented by the Final Rule on September 17, 2021 (86 FR 51970) that went into effect October 18, 2021 and requirements for minimum traps per trawl and weak inserts throughout the buoy line that went into effect May 1, 2022.

4.2 Alternative 2: Preferred

Alternative 2, the Preferred Alternative, would add approximately 200 square miles (518 square kilometers) of Federal waters to the existing Massachusetts Restricted Area (MRA) closure that restricts the use of persistent trap/pot gear buoy lines from February 1 through April 30. The Federal waters, referred to as the Massachusetts Restricted Area Wedge (MRA Wedge), begin east of Cape Ann, are bounded landward by the Massachusetts state waters and south along the 70°30′ W longitude line until they intersect with the MRA at the 42°12′N latitude line, and run west along that line until it intersects the state water boundary (Figure 5). Authorizations for fishing without buoy lines using on-demand gear (sometimes referred to as ropeless gear) in the MRA during this time must be obtained through an Exempted Fishing Permit until modifications to regulations are implemented that allow alternative gear marking schemes.

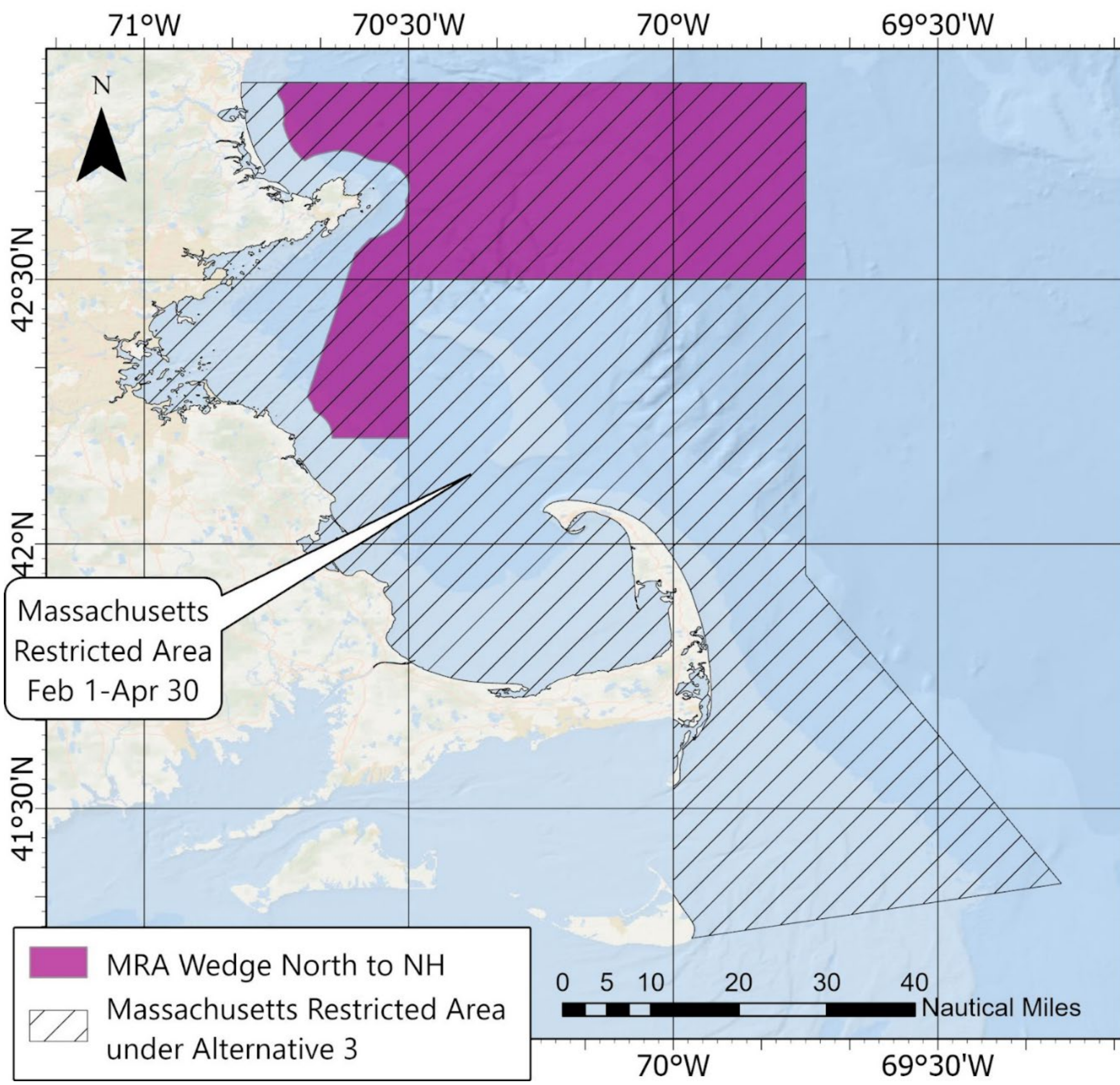
Figure 5: Alternative 2 (Preferred Alternative) would add approximately 200 square miles (518 square kilometers) of Federal waters, referred to as the MRA Wedge, to the Massachusetts Restricted Area during the existing closure period of February 1 through April 30. The Massachusetts Restricted Area would remain closed to trap/pot fishing with buoy lines from February 1 through April 30.



4.3 Alternative 3

Alternative 3 would add approximately 1,297 square miles (3,359 square kilometers) of Federal waters to the existing Massachusetts Restricted Area (MRA) closure that restricts the use of persistent trap/pot gear buoy lines from February 1 through April 30. Alternative 3 would extend the northern MRA boundaries up to the New Hampshire border at 42°52.58′ N (MRA Wedge North to NH; Figure 6). Authorizations for fishing without buoy lines using on-demand gear (sometimes referred to as ropeless gear) in the MRA during this time must be obtained through an Exempted Fishing Permit until modifications to regulations are implemented that allow alternative gear marking schemes.

Figure 6: Alternative 3 would add approximately 1,297 square miles (3,359 square kilometers) of Federal waters, referred to as the MRA Wedge North to New Hampshire to the Massachusetts Restricted Area during the existing closure period of February 1 through April 30. The Massachusetts Restricted Area would remain closed to trap/pot fishing with buoy lines from February 1 through April 30.



4.4 Alternatives Considered but Rejected

An expansion of the Massachusetts Restricted Area (MRA) to include a closure of the Massachusetts Restricted Area Wedge (MRA Wedge) in April only, rather than February through April, was considered but rejected because preliminary analysis indicated this alternative does not meet the purpose and need of this action. An April-only closure of the MRA Wedge would not adequately reduce the acute risk of entanglements in an area of high risk adjacent to the MRA during February and March while waters within the MRA are closed to trap/pot fishing with buoy lines (Figures 2-4, and 10-13). An April-only MRA Wedge closure could result in the accumulation of buoy lines in the MRA Wedge during February and March when right whales are present, which could result in the mortality and serious injury of large whales during that time. Therefore, we have determined that an expansion of the MRA to include a closure of the MRA Wedge in April only, rather than February through April, does not sufficiently address the entanglement risk present and the alternative was considered but rejected from further analysis.

NMFS also received a comment recommending a smaller approach for modifying the MRA boundaries, citing both a need for fishing grounds access and a perceived lack of whale presence in Federal waters off of Cape Ann, MA. However, dedicated aerial and shipboard survey observation data noted high abundance of right whales in the MRA Wedge (Figures 2, 10, 14, 16, and 18). Acoustic detections of right whales were also documented in February, March, and April (Figures 4, 15, 17, and 19). Sighting locations are specific to when the whale was observed and are an empirical confirmation of presence at a point in time. It is also well-documented that the whales are highly mobile, within and between foraging and breeding areas (Mate et al. 1997, Baumgartner et al. 2017, Johnson et al. 2020). Additionally, Massachusetts Division of Marine Fisheries (MA DMF) provided NMFS with data indicating that fixed- gear in large aggregations within and around the MRA Wedge (Figures 3, 11-13). Accordingly, protective areas encompass waters between sighting locations.

Right whales begin arriving in Cape Cod Bay and surrounding waters as early as December and typically leave the area during the month of May (Jacquet et al. 2007, Hlista et al. 2009, Pendleton et al. 2009, Plourde et al. 2019, Ganley et al. 2019), increasing the risk of entanglement during this timeframe. Aggregations of right whales in Cape Cod Bay are particularly dense beginning in February and extending through April, indicating that they use the MRA Wedge seasonally and as they transit in and out of the area (Johnson et al. 2021; survey results from February-April 2018-2013 depicted in Figures 3, 10, 14, 16, and 18). Ganley et al. (2019) found that sightings data do not accurately reflect peak whale presence due to diving behavior that reduces time on the surface. Higher abundances occur in January through March than are detectable through simple whale counts or sightings per unit effort, and the month of peak abundance varies annually, sometimes occurring in March or April (Pendleton et al. 2022). Aerial and shipboard surveys are only able to detect whales at the sea surface; for example, whales may be present below the surface or at depth, evading detection by aerial and shipboard surveys. Additionally, other factors including visibility, weather conditions, survey funding, and survey paths can impact the probability of a right whale sighting from aerial and shipboard surveys and opportunistic reporting. Therefore, a lack of sightings is not a clear indicator of whale absence, but may be related to a lack of detection. Furthermore, traditional whale surveys conducted by plane or by ship have focused efforts on surveying waters in Cape Cod Bay, not

Federal waters east of Cape Ann and northward. Aerial surveys are only conducted for several hours of each flight, and accordingly, the aerial survey data represents a snapshot of where whales are at that moment in time (Johnson et al. 2020). Acoustic detection depends on the presence of a vocalizing whale, and acoustic detection may be impacted by the presence of other ambient noise, distance of a vocalizing whale from the recorder, and other oceanographic conditions (Davis et al. 2023). Right whale presence cannot be accounted for in areas or moments in time that are not surveyed, and in this case, the “absence” of whales on a visual sightings and acoustic detection map may also be related to a lack of survey effort. Because there have been instances of acoustic detections of vocalizing whales that were undocumented by concurrent aerial surveillance (Murray et al. 2022), acoustic data collection is an important supplement to the visual sightings data. Importantly, the presence of buoy lines used by the trap/pot fishery during these months creates an acute entanglement risk in an area where right whales are known to aggregate and feed (Figure 2-4, and 10-13). MA DMF has indicated the MRA Wedge and adjacent surrounding waters are being utilized as an area for gear storage (as opposed to storing the gear on land) during periods fishermen are not actively fishing (see Appendix 3.1 for Letters of Concern). Sightings of fix-fishing gear in the MRA Wedge and adjacent waters surrounding the MRA confirm MA DMF’s concern that buoy lines are in an area during months when right whales are present. Reducing the size of the MRA Wedge does not provide adequate protection for whales from entanglement risk posed by trap/pot fishing gear; consequently, a smaller approach to the spatial extent of the MRA Wedge was considered but rejected for further analysis. See Subsection 6.2 for more information on seasonality of right and other large whale presence and fixed-gear in the action area.

5 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This Chapter describes the valued ecosystem components (VEC) that may be affected by the three alternatives within the Massachusetts portion of Lobster Management Area 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:** Subsection 5.1 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 action.
- **Habitat:** Subsection 5.2 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:** Subsection 5.3 describes the fisheries as well as the social and economic environment most likely to be impacted by the alternatives under consideration.

5.1 Protected Species

The following discussion examines the potential impacts of proposed management actions on protected species. Table 1 shows the protected species that were considered and identifies which of those may be impacted by the action. NMFS identified five species of Atlantic large whales that are likely to be directly impacted by the implementation of a seasonal restricted area (Subsection 5.1.1). Subsection 5.1.1 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 minke whales (*Balaenoptera acutorostrata*). Subsection 5.1.2 provides information on the protected species not likely to be impacted by the 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 Subsection 4.1 of the 2021 Final Environmental Impact Statement (referred to as the 2021 FEIS) for Amending the Atlantic Large Whale Take Reduction Plan Volume 1 (NMFS 2021b).

Information regarding marine mammal distribution, abundance, potential biological removal (PBR) levels, and sources of mortality and serious injury can be found in the most recent marine mammal Stock Assessment Report (SAR). NOAA prepares marine mammal SARs annually, as directed by the Marine Mammal Protection Act (MMPA). The 2022 SAR was published on August 11, 2023 (88 FR 54592; Hayes et al. 2023), and the 2021 SAR was published on August 3, 2022 (87 FR 47385; Hayes et al. 2022). This Environmental Assessment (EA) also relies on Linden (2023) population size estimates for North Atlantic right whales at the beginning of 2022 using the most recent year of available sightings data collected through December 2022 (Figure 7). The updated right whale population estimate will be provided to the Atlantic Scientific

Review Group for consideration in the 2024 Atlantic SAR process. Information provided in this EA is from either the 2022 SAR or 2021 SAR, unless otherwise indicated.[3]

Table 1: The species and critical habitat that were considered, their current status, and which ones are likely to be impacted by the analyzed actions. "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
		Humpback Whale	Protected (MMPA)
		Fin Whale	Endangered
		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 Bight, 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)

[3] 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 the potential biological removal (PBR) level. The humpback whale chapter has not been updated since 2019, thus values on population abundance, stock status, and PBR are from the 2019 SAR.

	Offshore Bottlenose Dolphin	Protected (MMPA)
	Common Dolphin	Protected (MMPA)
	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

5.1.1 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[4] that interact with Category I and Category II fisheries, which are fisheries with frequent (Category I) or occasional (Category II) mortalities and serious injuries of marine mammals. All marine mammals are protected by the MMPA.

Five species of Atlantic large whales may be present in the affected environment throughout the spring and have the potential to be impacted by the analyzed actions: North Atlantic right whales (right whales), Gulf of Maine humpback whales (humpback whales), fin whales, sei whales, and minke whales. These large whales are also known to interact with Category I and II fisheries in the western North Atlantic Ocean and are susceptible to entanglement in trap/pot fishing gear. Fin, sei, and right whales are also listed as endangered under the Endangered Species Act (ESA)

[4] 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.

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

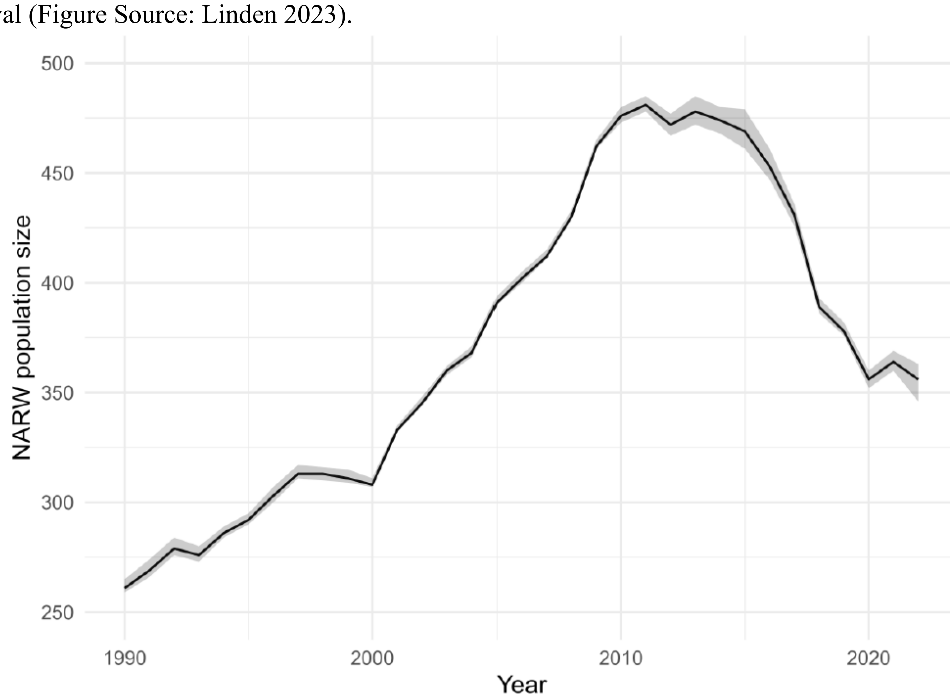
The North Atlantic right whale (*Eubalaena glacialis*; right whale) is a baleen whale found in temperate and subpolar latitudes in the North Atlantic Ocean. Historic right whale populations were severely depleted by commercial whaling, and despite protections from commercial harvest, the population remains 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 2021b). 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 al. 2017, Krzystan et al. 2018, Murray et al. 2022). 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 southern New England, Cape Cod Bay, and the Gulf of Maine (Wikgren et al. 2014, Davis et al. 2017, Mayo et al. 2018, Quintano-Rizzo et al. 2021,) 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) and in surrounding waters where high densities of copepods occur (Hudak et al. 2023). Right whale critical habitat of approximately 29,763 square nautical miles (55,121 square 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. 2019). 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, 2019b), 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, 2019b), make it challenging to predict locations and timing of 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, Stewart et al. 2022). For more information on distribution of prey and right whale feeding behavior, refer to Subsection 4.1.1.1 of Chapter 4 and Subsection 8.3.3.7 of Chapter 8 in the 2021 FEIS (NMFS 2021b).

The right whale is listed as endangered under the ESA and is well below the optimum sustainable population level (Hayes et al. 2023). The population has been in decline since 2010, with the most recent published estimate of right whale population size in 2022 at 356 whales (95 percent confidence interval: 346-363; Linden 2023; Figure 7) with a strong male bias (Hayes et al. 2023, Pace et al. 2017, Pace 2021). The most recent population size estimate shows the steep population decline observed in 2015-2020 may be slowing; however, the right whale population is still experiencing mortality at rates above recovery thresholds (Linden 2023). In the most recently published stock assessment report (Hayes et al. 2023), PBR for the North Atlantic right whale population is 0.7 whales per year, down from 0.8 as published in the 2020 SAR (Hayes et al. 2021). The estimated total annual estimated mortality for right whales in the U.S. and Canada between 2015 and 2019 is 31.2 (Hayes et al. 2023, Pace 2021, Pace et al. 2017). The annual average of observed range-wide total human-caused mortality and serious injury from 2016 to 2020 is 8.1, including 5.7 observed incidental mortalities and serious injuries attributed to fishery interactions and 2.4 observed vessel collisions (Hayes et al. 2023; Table 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 1.2 from 2016 to 2020 (Hayes et al. 2023). The annual estimated mortality of right whales over the most recent 5 year period (2017/2018 to 2021/2022) is 21.6 (Linden 2023).

Figure 7: Population size of North Atlantic right whales estimated from a Bayesian capture-recapture model of sightings data from 1990-2022. Solid line indicates median of posterior distribution, with shading for the 95% credible interval (Figure Source: Linden 2023).



The right whale population is experiencing an Unusual Mortality Event (UME) that began in 2017 due to high rates of documented vessel strikes and entanglement in fishing gear (Hayes et al. 2023, Daoust et al. 2018, Bourque et al. 2020). Approximately 74 percent of all mortalities and serious injuries in adult cases with known cause of death have been attributed to entanglements since the beginning of the UME (see https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-north-atlantic-right-whale-unusual-mortality-event; Accessed December 4, 2023). Anthropogenic mortality has limited the recovery of the right whale (Corkeron et al. 2018). While mortalities and serious injuries from vessel strikes decline after vessel speed regulations were implemented (78 FR 73726, December 8, 2013; Conn and Silber 2013, Van der Hoop et al. 2014, Martin et al. 2015, Crum et al. 2019), both entanglement in fishing gear and vessel strikes remain significant threats (Kraus et al. 2016, Sharp et al. 2019). Effective management measures rangewide that reduce human impacts, particularly those caused by entanglement and vessel strikes, could promote recovery of the right whale population, as demonstrated, for example, by a North Atlantic right whale population viability analysis (Runge et al. 2023).

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 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 putting them more at risk for vessel strikes, and deeper maximum dive depths which increases time spent closer to the seafloor and the probability of interaction with fishing gear (Dombroski et al. 2021). While weak rope and weak links likely reduce the severity of entanglements, they are not likely to reduce the frequency of entanglements, and our current understanding of the effects of sublethal entanglements suggests that they reduce fitness and successful breeding (Knowlton et al. 2022, Pettis et al. 2017, van der Hoop et al. 2017, Cassoff et al. 2011)

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. 2023). 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. 2022, 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. 2022). 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. 2022, Knowlton et al. 2012, Pace et al. 2017, Robbins et al. 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, despite evidence of human causes, no cause of death was determined and it is likely that 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 2021b).

Table 2: The estimated abundance, potential biological removal level (PBR), and average annual observed mortality for Atlantic large whale species likely to be impacted by the analyzed alternatives. See Linden (2023) for more information on population size estimates for North Atlantic right whales at the beginning of 2022. Refer to the 2022 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment Report (SAR; Hayes et al. 2023) for a full summary of abundance and mortality levels. 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. 2022. Because observed mortalities and serious injuries only represent a fraction of observed cases, some of these species are 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	**356**	0.7	8.1
Humpback Whale	**1,396**	22	16.25
Fin Whale	**6,802**	11	1.8
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 in this stock and the minimum population estimate is 1,380 (Hayes et al. 2020; Table 2). 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 (Hayes et al. 2020).

As with right whales, the primary known sources of anthropogenic mortality and serious injury of humpback whales are commercial fishing gear entanglements and vessel strikes. Robbins et al. (2009) found that 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 the 2021 FEIS, NMFS 2021b). From 2015 through 2019, observed human-caused mortalities averaged 16.25 animals per year, with 9.35 incidental fishery interactions and 6.9 vessel collisions (Henry et al. 2022). These results include only observed mortality and serious injury. Unobserved anthropogenic impacts on humpback whales is likely, but has not been calculated to date. A UME was declared in 2017 after a spike in humpback whale strandings along the East Coast of the U.S. Partial or full necropsy examinations were conducted on approximately half of the whales. Of the humpback whales examined (90 percent), 40 percent of the cases had evidence of human interactions, either vessel strike or entanglement (see https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2024-humpback-whale-unusual-mortality-event-along-atlantic-coast; Accessed January 18, 2024).

Fin Whale

The fin whale is found in all major oceans and was considered to be composed of three subspecies until recently: *Balaenoptera 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. 2022). 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, North Carolina.

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 (Hayes et al. 2023; Table 2). The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor is assumed to be 0.1 because the fin whale is listed as endangered under the ESA. Thus, PBR for the western North Atlantic fin whale is 11 (Hayes et al. 2023). The species' overall population size may provide some resilience to current threats, but trends remain largely unknown (Hayes et al. 2022).

Documented sources of anthropogenic mortality of fin whales include entanglement in commercial fishing gear and vessel 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). Approximately 22.7 percent of all observed mortality and serious injury were attributed to entanglements between 2010 and 2019, with most interactions occurring with trap/pot and unidentified gear (see Chapter 2 of the 2021 FEIS, NMFS 2021b). The minimum annual rate of anthropogenic mortality and serious injury to fin whales, between 2015 and 2019, was 1.85 per year, 1.45 of those from fishing entanglement, and 0.4 per year from vessel strikes (Hayes et al. 2022, Henry et al. 2022).

Sei Whale

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 the Plan boundaries and ranges from the U.S. East Coast to Cape Breton, Nova Scotia and east to 42°00'W longitude (Hayes et al. 2022). The Nova Scotia stock in the North Atlantic is estimated to be 6,292 individuals with a minimum population size of 3,098 individuals (Hayes et al. 2023; Table 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; Payne et al. 1990). 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, North Carolina 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 (see Chapter 2 of 2021 FEIS, NMFS 2021b). 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 (Hayes et al. 2022; Table 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 Whale

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, and acoustic surveys have commonly detected their presence on the shelf (Hayes et al. 2022, Risch et al. 2013). Acoustic detections in Stellwagen Bank peaked in fall and winter (September to December), while detections off New York appear to peak in spring (Risch et al. 2014). Where recording effort spanned the shelf, acoustic detections were highest near the shelf break and deep waters.

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 of 17,002 (Hayes et al. 2023; Table 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 9.55 mortalities due to incidental fishery interactions, 0.2 from observed fishery interaction, and 0.8 caused by vessel collisions (Hayes et al. 2022).

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 2021b). A UME 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 (https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2024-minke-whale-unusual-mortality-event-along-atlantic-coast).

5.1.2 Species and Critical Habitat Not Likely to be Impacted

Based on the best available information, Table 1 provides a list of species not likely to be impacted by the action alternatives. 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 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-stockassessment-reports-region; Hayes et al. 2023; Sea Turtle Disentanglement Network, unpublished data; NMFS Observer Program, unpublished data; see OBIS-SMAP at https://seamap.env.duke.edu/). The alternatives 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 the Gulf of Maine DPS of Atlantic salmon. Therefore, the action will not result in the destruction or adverse modification of any designated critical habitat (NMFS 2014, NMFS 2015a, 2015b).

5.2 Habitat

Modification of the Atlantic Large Whale Take Reduction Plan (Plan) 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 action area (Figure 8, Table 3). Because this action is not expected to affect pelagic habitats, the species and life stages listed in Table 3 are all benthic. For detailed discussion of EFH and Habitat Areas of Particular Concern regulatory requirements, key components of lobster habitat in detail, and how the Plan can influence habitat, reference Subsection 4.2 of the 2021 Final Environmental Impact Statement for Amending the Atlantic Large Whale Take Reduction Plan Volume 1 (referred to as 2021 FEIS; NMFS 2021b).

Figure 8: 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).

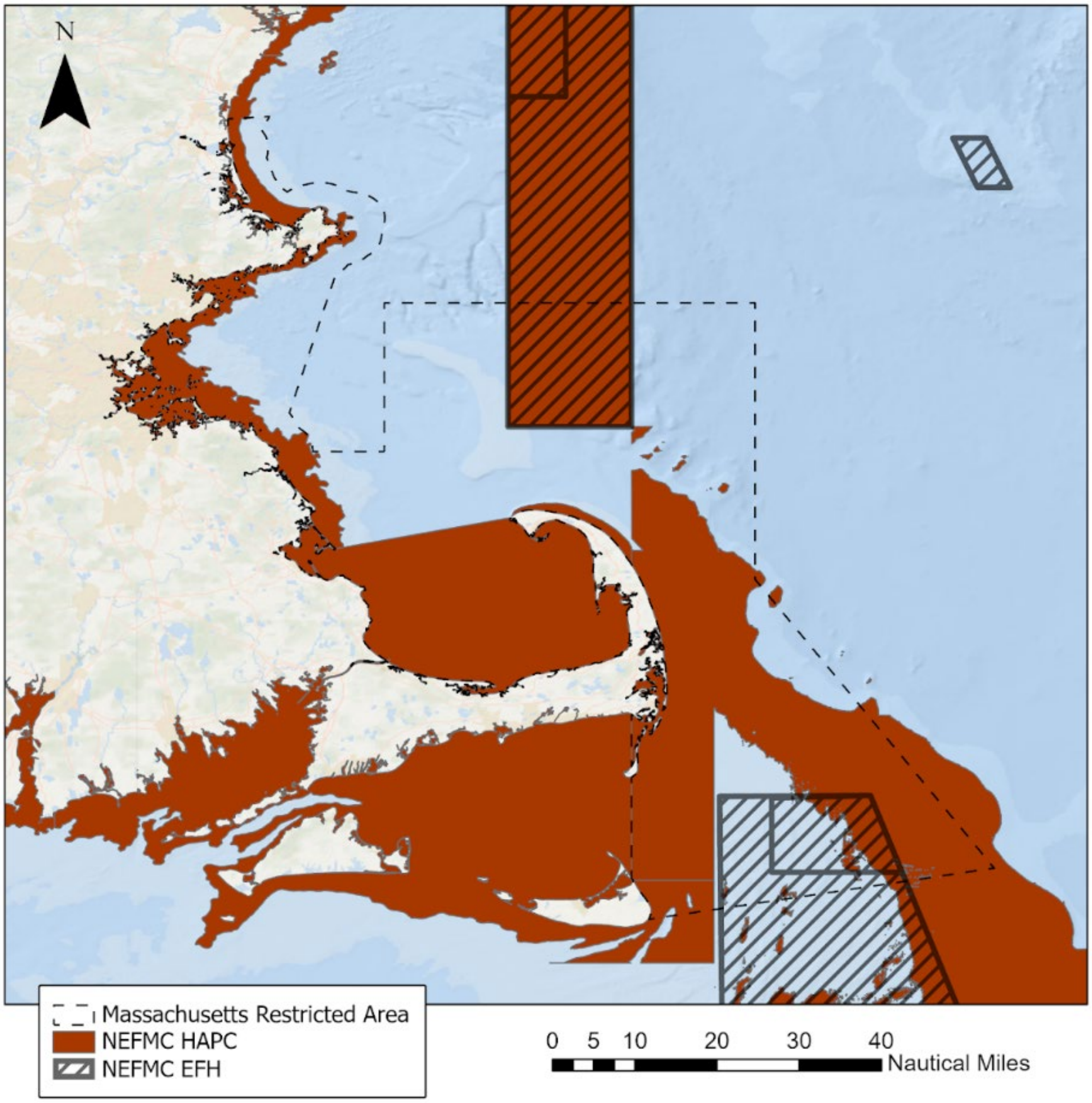


Table 3: List of Essential Fish Habitat for different species and life history stages within the Affected Environment. Depth in meters (1 meter is approximately 3.3 feet).

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 1 meter
Offshore hake	Juveniles	160-750	Pelagic and benthic habitats
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 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.

5.2.1 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 EFH 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).

5.2.2 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).

5.2.3 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.

5.2.4 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).

5.2.5 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.

5.2.6 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 (2300 feet). 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 (MA LMA 1), including Massachusetts Bay (Alternative 2 and Alternative 3), Ipswich Bay, and other waters offshore of northern Massachusetts (Alternative 3). Water depth ranges from one meter (3.3 feet) to 200 meters (656.2 feet) (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 2021b).

Inshore estuarine and rock areas make up two key components of inshore lobster habitat. For the purpose of this 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 (per square 3.3 feet).

- **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 per square meter (per square 3.3 feet). 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 (per square 3.3 feet) 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 (49 to 148 feet). 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 midcoast 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 50 cm (1.6 feet) in length) was observed sheltering lobsters and was used in the transplant experiments.

Lobster shelters 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 5.7 square meters (61.4 square feet) 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 seasonal closure area. 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 (4.9 feet) 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 (per square 3.3 feet) 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 (per square 3.3 feet).
- **Mud Base with Burrows:** This habitat occurs offshore mainly in the deep basins, in depths up to 250 meters (821 feet). This environment is extremely common offshore. Lobsters occupy this habitat, but no density estimates are available.

5.3 Human Community

5.3.1 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 Vessel Trip Report (VTR) data from 2017 to 2021, 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.[5] 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 4 displays the lobster landing pounds by county in Massachusetts from 2017 to 2021.

[5] Vessels that only have lobster permits are not required to submit Vessel Trip Reports (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.

Table 4: American lobster landing pounds in Massachusetts counties by year from 2017-2021.

County	2017	2018	2019	2020	2021
Barnstable	3,352,363	2,968,793	2,671,530	2,435,627	2,149,544
Bristol	1,993,809	2,105,482	2,263,234	2,425,182	2,218,481
Dukes	90,776.50	80,010.70	75,597.90	80,167.30	93,559.80
Essex	6,659,528	8,165,759	7,640,883	7,055,319	8,742,081
Middlesex			340.9		
Nantucket	2,887.25	5,573.50	2,583.90	2,856.90	9,937
Norfolk	426,431	425,454	398,522	320,552	265,730
Plymouth	3,331,984	3,271,027	3,346,593	2,890,407	2,961,195
Suffolk	635,346	675,144	630,176	501,741	386,176
Total	16,493,125	17,697,243	17,029,462	15,711,853	16,826,704

Data source: ACCSP dealer report 2017-2021.

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 FMP for Jonah crab 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 coastwide standard for claw harvest to respond to 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 5 displays the yearly landing pounds of Jonah crab by county from 2017 to 2021.

Table 5: Jonah crab landing pounds in Massachusetts counties by year from 2017-2021.

County	2017	2018	2019	2020	2021
Barnstable	2,084,672	1,642,723	1,606,744	1,645,983	1,506,681
Bristol	9,416,030	11,370,068	7,507,008	6,600,901	3,821,477
Dukes	3,757.10	668.47	333.3	390.6	308.66
Essex	171,207	223,045	513,091	304,979	293,024
Nantucket	1,410	151			
Norfolk	721	6,009.28	2,067.71	4,168	
Plymouth	20,545.40	7,841.35	44,358.90	20,352.60	78,382
Suffolk			505	18	
Total	11,698,342	13,250,506	9,674,107	8,576,792	5,699,873

Data source: ACCSP dealer report 2017-2021.

5.3.2 Affected Human Communities

When considering the effect of these proposed actions 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.[6] 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 Massachusetts adjacent to the restricted area: Essex County, Norfolk County, Suffolk County, and Plymouth County.

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

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 Gallopín'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.[7]

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:

- **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

[7] 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

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 5.1. 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 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 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	10.7%	3.6%	1.24	1.21	1.55	2.79	1.42	1.06
MA	Suffolk	Boston Harbor	807,252	64,582	17.5%	4.5%	3.33	2.33	2.67	4	2	1
MA	Norfolk	Cohasset	705,388	99,511	6.5%	3.0%	1.16	1.08	1.68	2.84	1.04	1
MA	Plymouth	Plymouth, Scituate, Hingham	518,132	85,654	6.2%	3.2%	1.11	1.11	2.25	2.46	1.5	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.

6 IMPACTS OF THE MANAGEMENT ALTERNATIVES

6.1 Impact Designation Descriptions

Using the criteria outlined below and summarized in Table 7, this Environmental Assessment analyzes the expected impacts of the alternatives for the valued ecosystem components (VECs): protected species, habitat, and human communities as defined in Chapter 5. 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 analyzed alternatives. 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 7 and Figure 9.

Table 7: Impact determinations for Valued Ecosystem Components. 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 goal for commercial fisheries to reduce incidental mortality and serious injury of marine mammals to insignificant levels approaching a zero mortality and serious injury rate.

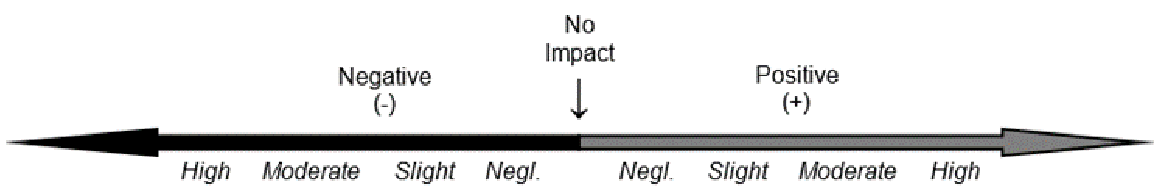
General Definitions

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	Negligible	To such a small degree to be indistinguishable from no impact		

General Definitions

VEC	**Resource Condition**		**Direction of Impact**
indicate any existing	Slight	To a lesser degree / minor	e.g. Slight Negative or Slight Positive
uncertainty	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 9: Depiction of the relative direction and magnitude of impacts on valued ecosystem components.



6.1.1 Protected Species

The impacts of the alternatives on protected species take into account impacts to species listed as endangered under the Endangered Species Act of 1973 (ESA-listed), as well as impacts to non-ESA listed MMPA protected species in good condition (*i.e.*, marine mammal stocks that are not depleted and for which mortality and serious injuries caused by human interactions do not exceed the potential biological removal (PBR) level) or poor condition (*i.e.*, marine mammal stocks that are depleted or for which human caused mortality and serious injury exceeds or nearly exceeds PBR). These impact descriptors apply to the Protected Species VEC.

6.1.1.1 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.

6.1.1.2 MMPA Protected Species

The stock conditions for marine mammals not listed under the ESA varies by species; however, all are legally protected under the Marine Mammal Protection Act (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 long term MMPA goal 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.

6.1.2 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.

6.1.3 Human Community

Socioeconomic impacts are considered in relation to potential changes in landing amounts, 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.

6.2 Evaluating the Protected Species Impacts of the Alternatives

6.2.1 Observations of Protected Species Demonstrating Co-Occurrence with Fixed-Fishing Gear

Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) reported consistent observations of right whales within the Massachusetts Restricted Area Wedge (MRA Wedge) and surrounding waters during dedicated surveys conducted February through April in 2018-2023 (Figures 10, 14, 16, and 18). Aerial surveys conducted by CCS in April 2021 and February and March of 2022 also documented the presence of aggregated fixed-fishing gear in the MRA Wedge and in waters north of the Massachusetts Restricted Area (MRA; Figures 2, 11-13). The fishing gear is thought to be a mix of actively fished gear and, in April, 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 and Massachusetts State regulations prohibit commercial trap/pot fishing in State waters February 1 through May 15 (322 CMR 12.04(2); Figure 1).

Figure 10: North Atlantic right whale sightings spanning February-April 2018-2023 in the Massachusetts Restricted Area, MRA Wedge, and adjacent waters. Right whale sightings were collected through dedicated aerial surveys conducted by Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) and dedicated shipboard surveys conducted by CCS, NEFSC, and Stellwagen Bank National Marine Sanctuary. Opportunistic sightings were reported from various platforms including, but not limited to, CCS, U.S. Coast Guard, New England Aquarium, Boston Harbor Cruises, and Massachusetts Environmental Police. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.

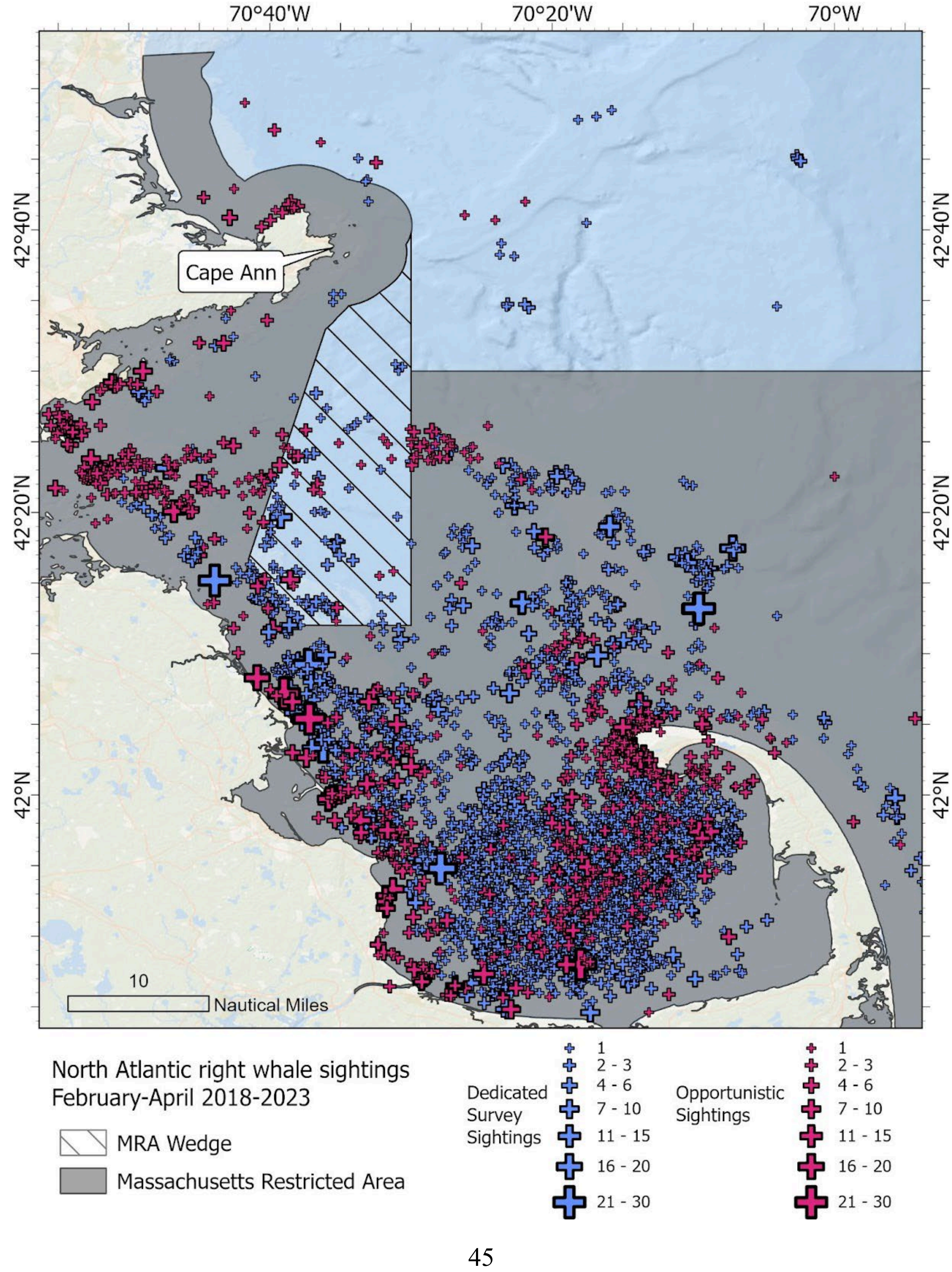
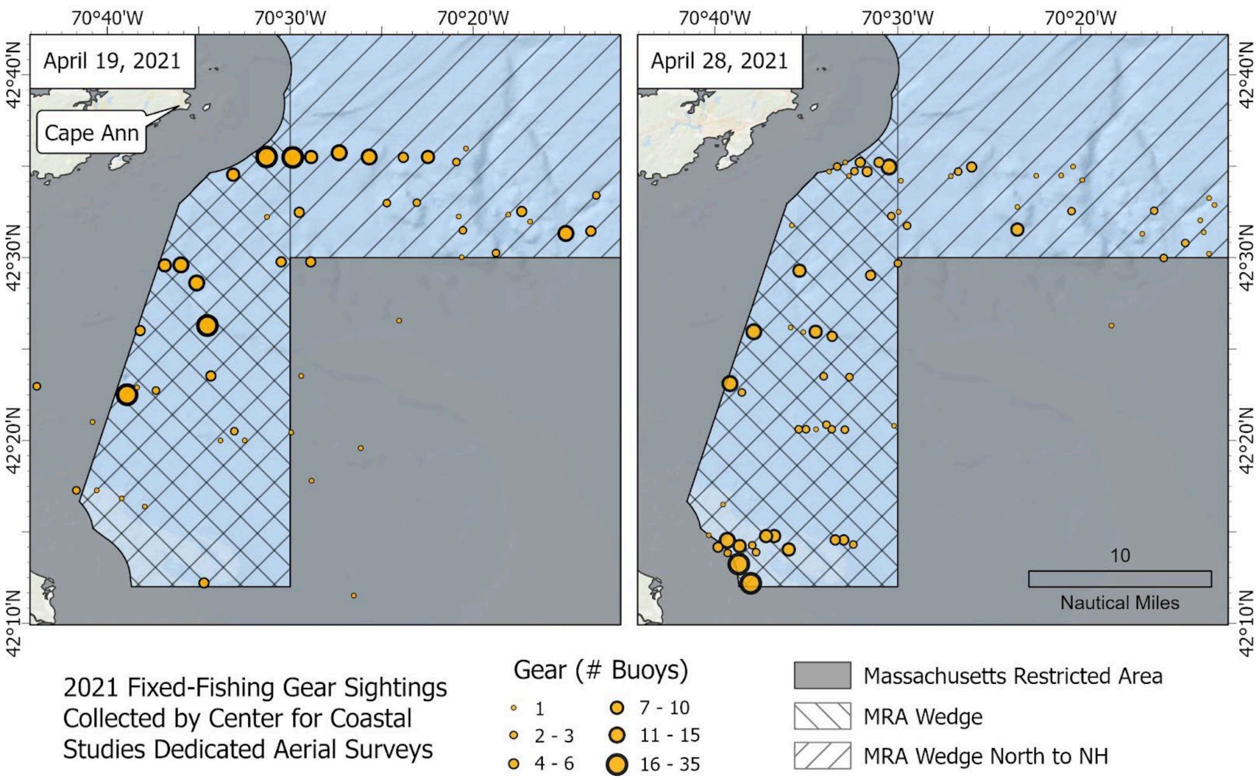


Figure 11: Fixed-fishing gear observed within Massachusetts Bay in April 2021. Fishing gear data were collected by Center for Coastal Studies (CCS) on April 19, 2021 and April 28, 2021 and provided by Massachusetts Division of Marine Fisheries. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.

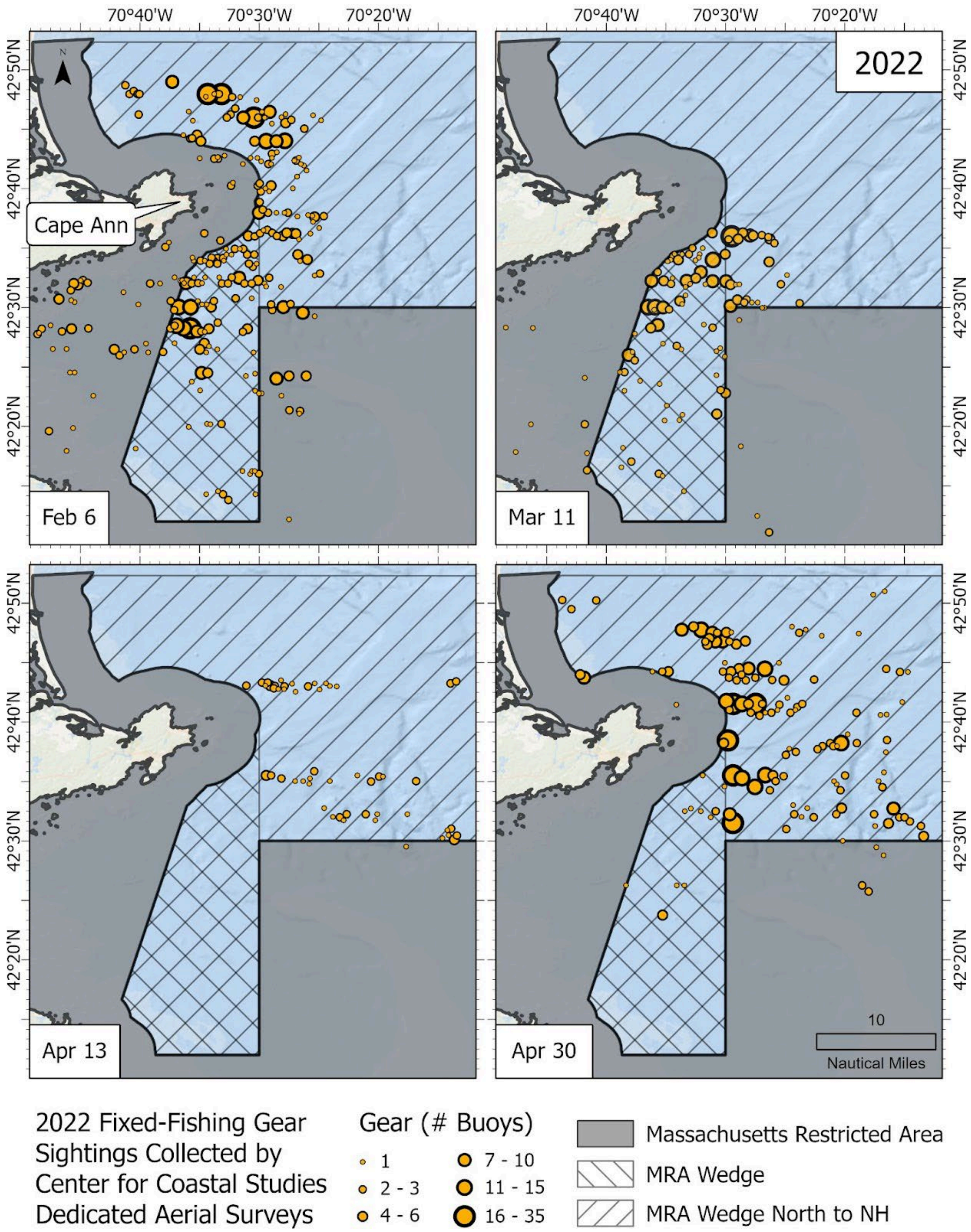


Dedicated aerial surveys provide snapshots of variations in the amount and distribution of gear in the MRA Wedge over time. Figure 11 is a representation of fixed fishing gear (*i.e.*, trap/pot or gillnet gear) sightings documented during dedicated aerial surveys conducted by CCS over two days in April 2021, ahead of the May 1 opening of the MRA. On April 28, 2021, CCS captured higher fixed-gear presence along the boundaries of the MRA and MRA Wedge around three nautical miles off Cohasset and Scituate compared to gear presence in the same area on April 19, 2021. The data do not indicate what type of fixed fishing gear was observed (meaning the gear could be trap/pot or gillnet gear) or when that gear was placed in the water. Lobster and Jonah crab fishing effort is substantially higher than gillnet effort in this area during February, March, and April, and therefore, we know lobster and Jonah crab trap/pot gear to make up the large majority of the observed buoy lines. This is consistent with observations of gear/buoy line removal during the emergency closure periods in 2022 and 2023. It is likely the aerial survey data are an underestimate of the actual fixed-gear density present in the MRA Wedge because fixed-gear was sighted opportunistically while crews were conducting whale survey missions; surveys for fixed-gear have not been frequently conducted. However, the fixed-gear sightings are evidence of buoy line presence during a period where right whales are present and transiting in Cape Cod Bay.

Evidence of potential entanglement risk in the MRA Wedge can be observed by the changes in fixed-fishing gear presence prior to and during the emergency closure implemented within the

MRA Wedge by the 2022 emergency rule (87 FR 11590, March 2, 2022). On March 2, 2022, NMFS notified the public that approximately 200 square miles (518 square kilometers) of Federal waters adjacent to the MRA would be closed to trap/pot fishing with buoy lines from April 1, 2022 to April 30, 2022. Dedicated aerial surveys conducted by CCS on February 6, 2022 and March 11, 2022 show dense aggregations of fixed gear within MRA Wedge Federal waters (Figure 12). On April 13, 2022, aerial surveys recorded fixed- fishing gear in groups ranging from one to six buoys in the Federal waters east of Cape Ann, Massachusetts, northeast of the MRA Wedge. The aerial surveys did not observe fixed gear in the MRA Wedge on April 13, 2022, though this is likely to be an underestimate of actual gear still present within the MRA Wedge because the aerial survey flight paths are optimized to survey for large whales, not fishing gear. An aerial survey conducted on April 30, 2022, the day before the May 1 opening of Federal waters in the MRA, indicated an increase in gear presence in waters east of Cape Ann, with the number of buoys ranging from single buoys to groups of more than sixteen buoys. The data suggest that fishermen stage their gear ahead of the May 1 open season to facilitate rapid movement into closure areas once opened.

Figure 12: Fixed-fishing gear observed within Massachusetts Restricted Area, MRA Wedge, and adjacent Federal waters in 2022. Fishing gear data were collected by Center for Coastal Studies (CCS) and provided by Massachusetts Division of Marine Fisheries. The Massachusetts Restricted Area was closed to trap/pot fishing with buoy lines from February 1 through April 30, and the MRA Wedge was closed to trap/pot fishing with buoy lines from April 1 through April 30, 2022 via the 2022 Emergency Rule (87 FR 11590, March 2, 2022). Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



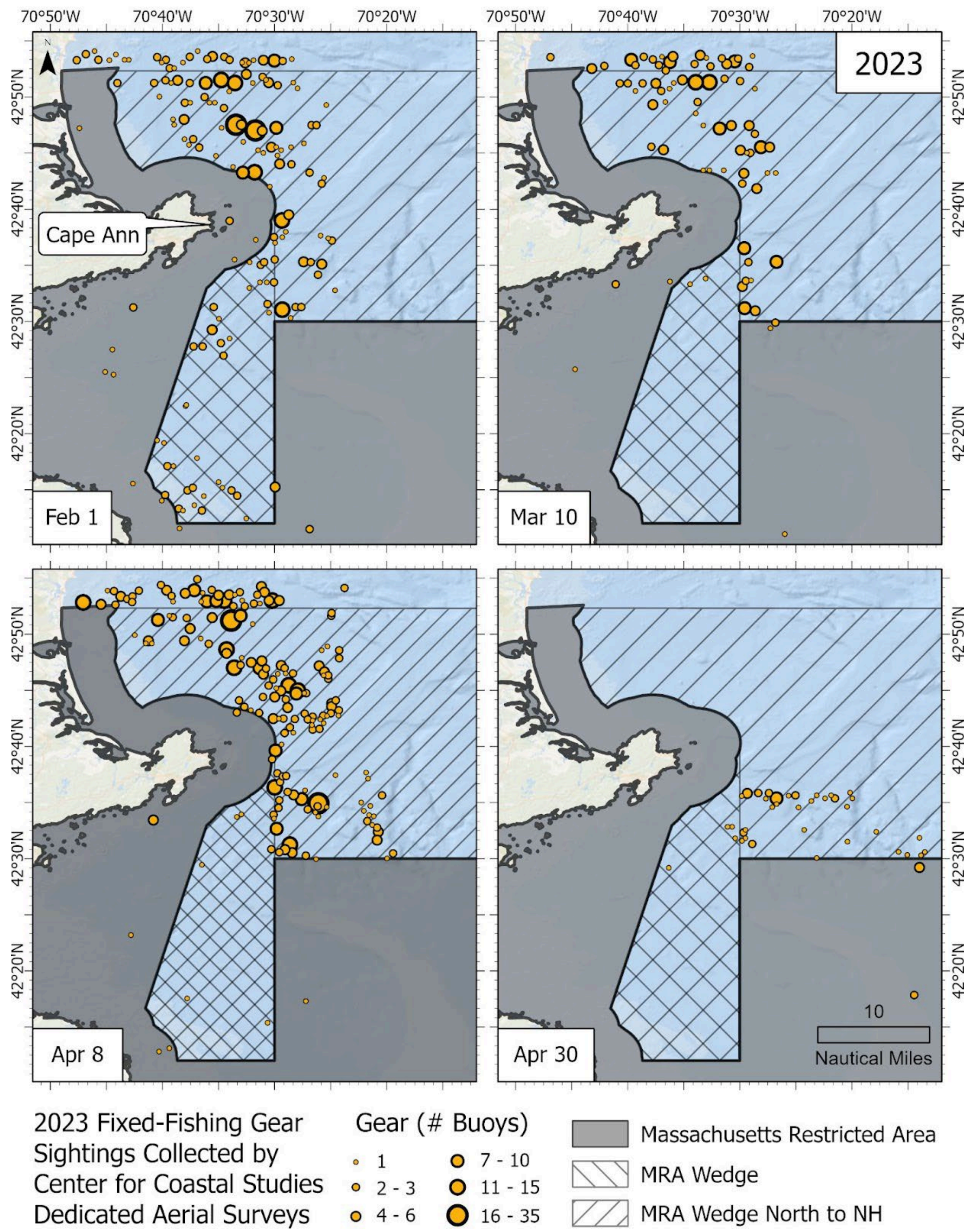
On January 10, 2023, Massachusetts Division of Marine Fisheries (MA DMF) sent an email to state lobster permit holders that stated that the NMFS Regional Administrator had informed MA DMF that NMFS intended to implement an emergency closure of the MRA Wedge "imminently" (See Appendix 3.1 for Letters of Concern). On January 31, 2023, NMFS announced an emergency closure of the MRA Wedge from February 1 through April 30, 2023 to coincide with the MRA closure period in place annually from February 1 through April 30 (88 FR 7362, February 3, 2023). Dedicated aerial surveys conducted by CCS on February 1, 2023 collected information on the fixed-gear presence. On February 1, 2023, just prior to the published emergency closure regulations, surveys documented buoys in groups from one to twenty-one throughout the MRA, MRA Wedge, and surrounding State and Federal waters (Figure 13). Fishing gear was also sighted within the MRA. March 10, 2023 CCS survey data show fishing gear in Federal waters just outside of the MRA and MRA Wedge and northeast of Cape Ann. CCS observed a similar gear placement pattern outside the MRA and Wedge closure boundaries on April 8, 2023. On April 30, 2023, CCS surveys show less fishing gear than the previous three flight days. Sightings documented on April 30, 2023 are likely to be an underestimate of actual fixed-fishing gear present in and around the MRA and MRA Wedge.

Systematic surveys for whales are done differently than surveys for gear, and gear surveys are not typically conducted so data on gear density within the action area are not available for comparison across seasons or years. Aerial survey flight paths are optimized for whale detection in Cape Cod Bay rather than on providing a robust dataset for gear presence. The survey flight paths do not typically extend northward into State and Federal waters offshore of New Hampshire and Maine, making it challenging to infer the density of fixed-gear north and east of Cape Ann. Without survey track lines, it is difficult to infer if the absence of gear sightings in this area is related to lack of survey effort in this area or if the area was surveyed and gear was simply not observed in this area.

Survey data provide limited snapshots of gear presence on each of the surveyed days, but the observations align with the associated fishing behaviors of either removing or relocating lobster and Jonah crab trap/pot gear when restrictions are in place. It is apparent that the entanglement risk posed by buoy lines was reduced in the MRA Wedge during the closure period from April 1, 2022 to April 30, 2022 because gear was either removed or relocated outside of the MRA Wedge (Figure 12). The 2023 emergency rule (88 FR 7362; February 3, 2023) restricting fishing with buoy lines also removed entanglement risk in the MRA Wedge from February 1, 2023 (the day after the closure was announced to the public) until April 30, 2023 (Figure 13).

The gear sightings data also suggest that gear is staged outside of the restricted area in preparation for the opening of Federal waters of the MRA on May 1. Note that the adoption of vessel tracking requirements by lobster fishermen with Federal permits, already in place for Massachusetts vessels and anticipated by the end of 2023 for others, will provide improved information about the amount and location of gear being actively fished (see Subsection 6.5.4.1 for more information on this fishery management action).

Figure 13: Fixed fishing gear observed within Massachusetts Restricted Area, MRA Wedge, and adjacent Federal waters in 2023. Fishing gear data were collected by Center for Coastal Studies (CCS) and provided by Massachusetts Division of Marine Fisheries. The Massachusetts Restricted Area was closed to trap/pot fishing with buoy lines from February 1 through April 30, and the MRA Wedge was closed to trap/pot fishing with buoy lines from February l through April 30, 2023 via the 2023 Emergency Rule (88 FR 7362, February 3, 2023). Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



The MRA was first implemented in 2015, and was originally intended to restrict trap/pot fishing from January through April due to the recurring seasonal presence of right whales in the area (79 FR 36585, June 27, 2014). Instead of a smaller closure limited to Cape Cod Bay, the MRA's boundaries offered greater protection to right whales given their presence in the area north of Race Point and Outer Cape Cod. However, the MRA was amended prior to implementation to allow fishing during January, not because whales were not present in the region, but because it is a key month for the fishing industry (79 FR 73848, December 12, 2014). Though right whales and the associated entanglement risk are present annually in Federal waters adjacent to Massachusetts before and after the MRA trap/pot closure, the MRA Wedge poses an acute entanglement risk to right whales from February through April during the MRA closure.

Right whales are known to aggregate in Cape Cod Bay in winter and spring to forage on copepods (Watkins and Schevill 1976, Mayo and Marx 1990, Mayo et al. 2018). The whales begin arriving in Cape Cod Bay and surrounding waters as early as December and typically leave the area during the month of May (Jacquet et al. 2007, Hlista et al. 2009, Pendleton et al. 2009, Plourde et al. 2019, Ganley et al. 2019). Abundance of right whales in Cape Cod Bay during winter and spring has increased over time, despite a declining population size, making protection of Cape Cod Bay and surrounding waters during their presence particularly important for population recovery (Ganley et al. 2019, Hudak et al. 2023). Ganley et al. (2019) found that sightings data do not accurately reflect peak whale presence due to diving behavior that reduces time on the surface. Higher abundances occur in January through March than are detectable through simple whale counts or sightings per unit effort and the time of peak abundance varies annually, sometimes occurring in March or April (Pendleton et al. 2022). Furthermore, right whale use of the Cape Cod Bay has increased in recent years as spring temperatures warm up earlier in the year, suggesting the time of peak abundance may continue to occur earlier in the year in the future due to climate change (Ganley et al. 2022).

Detections of right whales in the MRA and surrounding waters from February through April continue to demonstrate that whales occupy and travel through the MRA Wedge to feed in waters in and around Massachusetts Bay (Figures 10, and 14-19). While the detection rates each month are not directly comparable because the data have not been corrected for differences in survey effort across time, the visual and acoustic detection data indicate that right whales are observed in the presence of fixed-fishing gear. Though many right whales aggregate within Cape Cod Bay, they are highly mobile and are also detected visually or acoustically in and around Massachusetts Bay and the MRA Wedge, with a notable increase from February through April (Johnson et al. 2021). Dedicated survey data on right whale presence in February and March in Massachusetts Bay and the MRA Wedge likely underestimate the actual presence of right whales, given lower survey effort in the area north of Cape Cod Bay and variation in whale detection during these months (Ganley et al. 2019). As the right whale's food source declines in April within Cape Cod Bay (Hlista et al. 2009, Ganley et al. 2019, Ganley et al. 2022, Hudak et al. 2023), right whale distribution accordingly shifts and the presence of right whales in the MRA Wedge increases as they leave Cape Cod Bay, contributing to a peak of sightings in Massachusetts Bay in April.

Figure 14: North Atlantic right whale February sightings spanning 2018-2023 in the Massachusetts Restricted Area, MRA Wedge, and adjacent waters. Right whale sightings were collected through dedicated aerial surveys conducted by Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) and dedicated shipboard surveys conducted by CCS, NEFSC, and Stellwagen Bank National Marine Sanctuary. Opportunistic sightings were reported from various platforms including, but not limited to, CCS, U.S. Coast Guard, New England Aquarium, Boston Harbor Cruises, and Massachusetts Environmental Police. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.

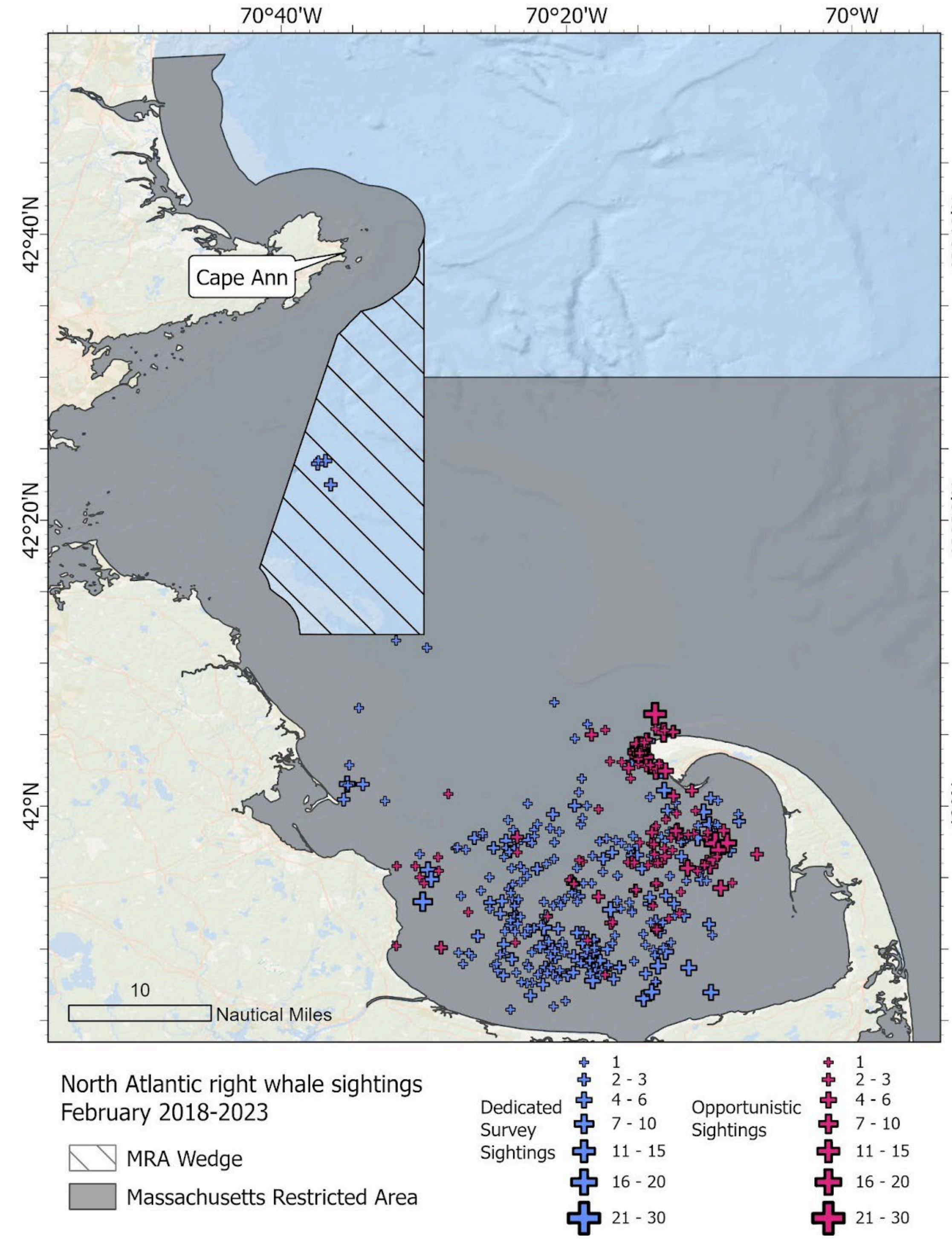


Figure 15: Definite acoustic (red circles), possible acoustic (yellow circles), and definite visual (dark gray) detections of North Atlantic right whales from February 2020-2023. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed November 17, 2023, https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.

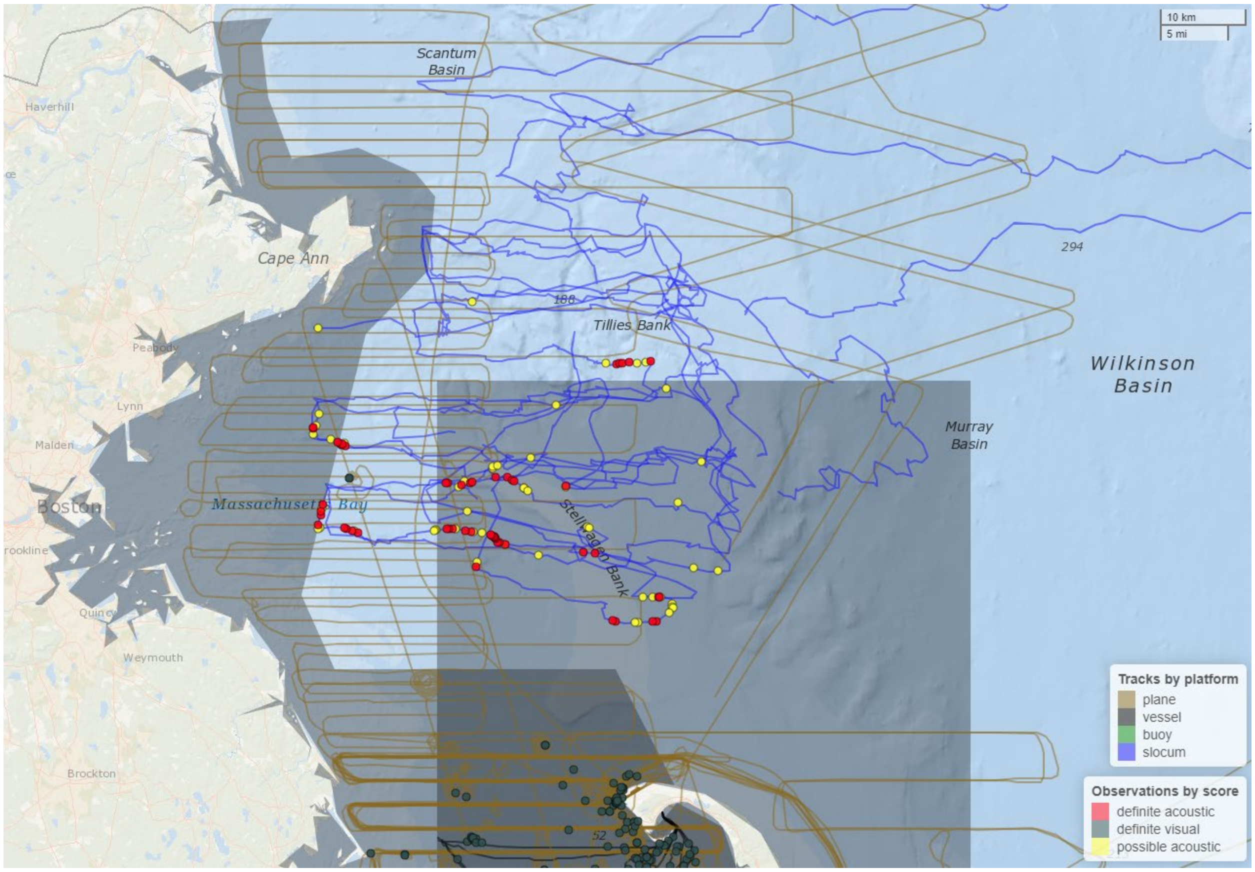


Figure 16: North Atlantic right whale March sightings spanning 2018-2023 in the Massachusetts Restricted Area, MRA Wedge, and adjacent waters. Right whale sightings were collected through dedicated aerial surveys conducted by Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) and dedicated shipboard surveys conducted by CCS, NEFSC, and Stellwagen Bank National Marine Sanctuary. Opportunistic sightings were reported from various platforms including, but not limited to, CCS, U.S. Coast Guard, New England Aquarium, Boston Harbor Cruises, and Massachusetts Environmental Police. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.

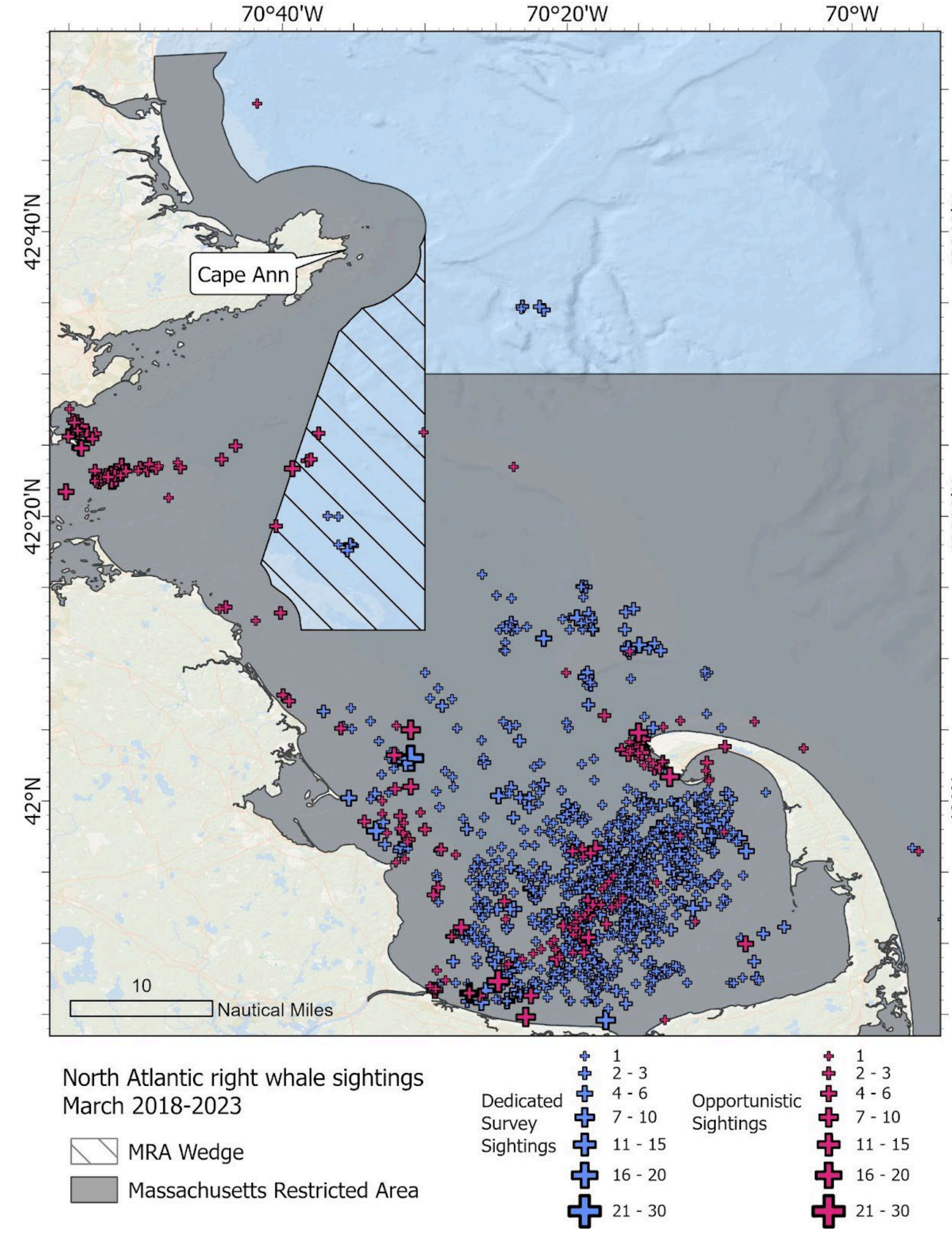


Figure 17: Definite acoustic (red circles), possible acoustic (yellow circles), and definite visual (dark gray) detections of North Atlantic right whales from March 2020-2023. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed November 17, 2023, https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.

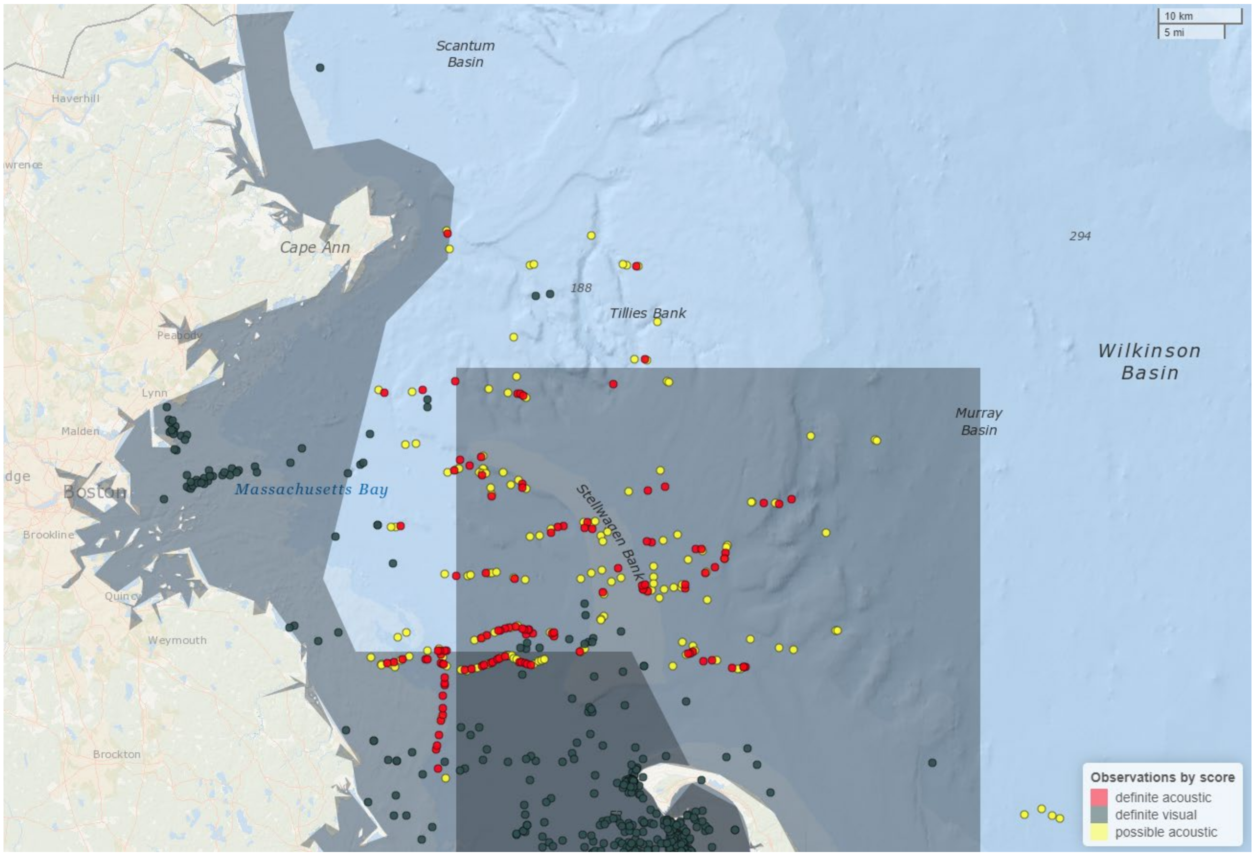


Figure 18: North Atlantic right whale April sightings spanning 2018-2023 in the Massachusetts Restricted Area, MRA Wedge, and adjacent waters. Right whale sightings were collected through dedicated aerial surveys conducted by Center for Coastal Studies (CCS) and the Northeast Fisheries Science Center (NEFSC) and dedicated shipboard surveys conducted by CCS, NEFSC, and Stellwagen Bank National Marine Sanctuary. Opportunistic sightings were reported from various platforms including, but not limited to, CCS, U.S. Coast Guard, New England Aquarium, Boston Harbor Cruises, and Massachusetts Environmental Police. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.

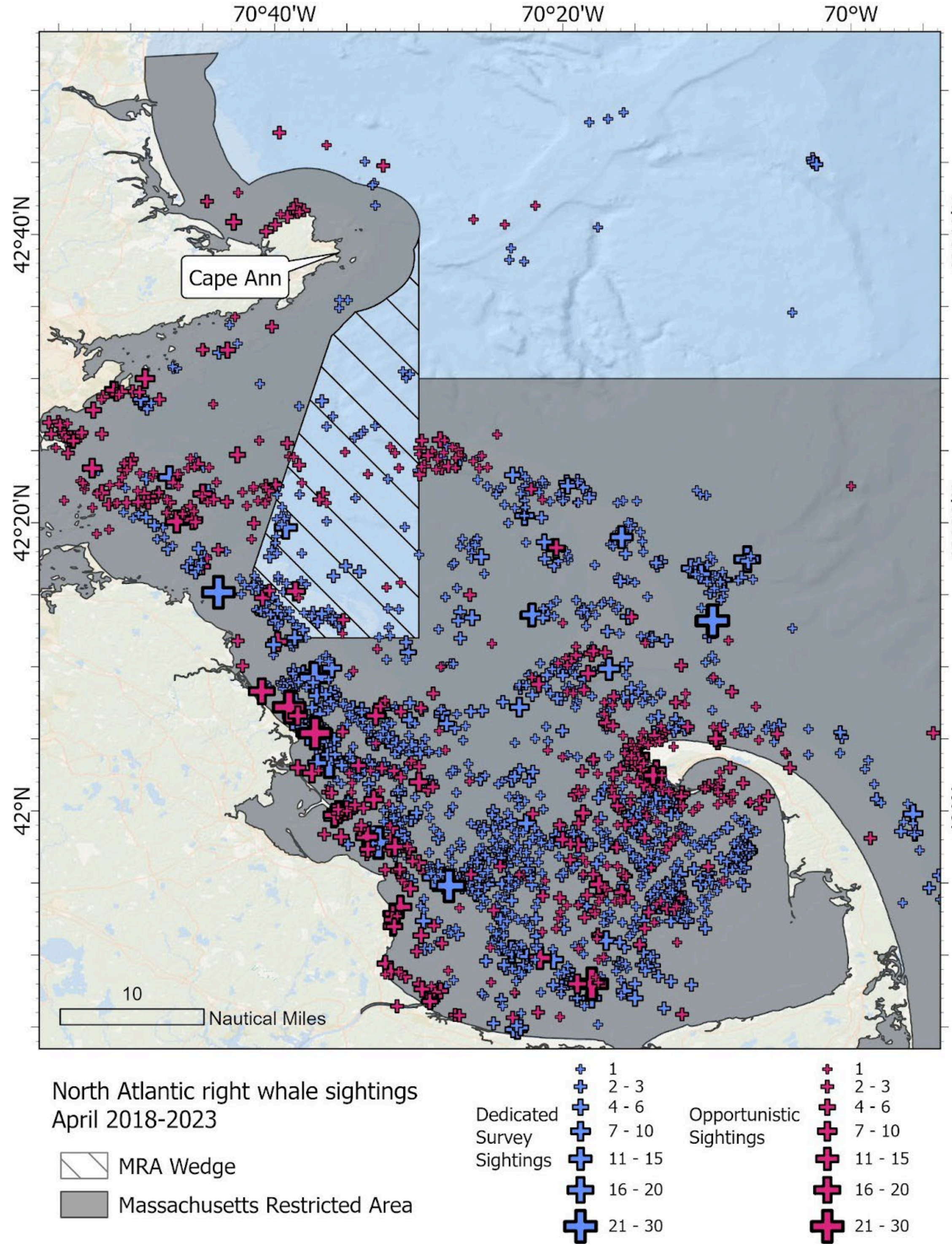
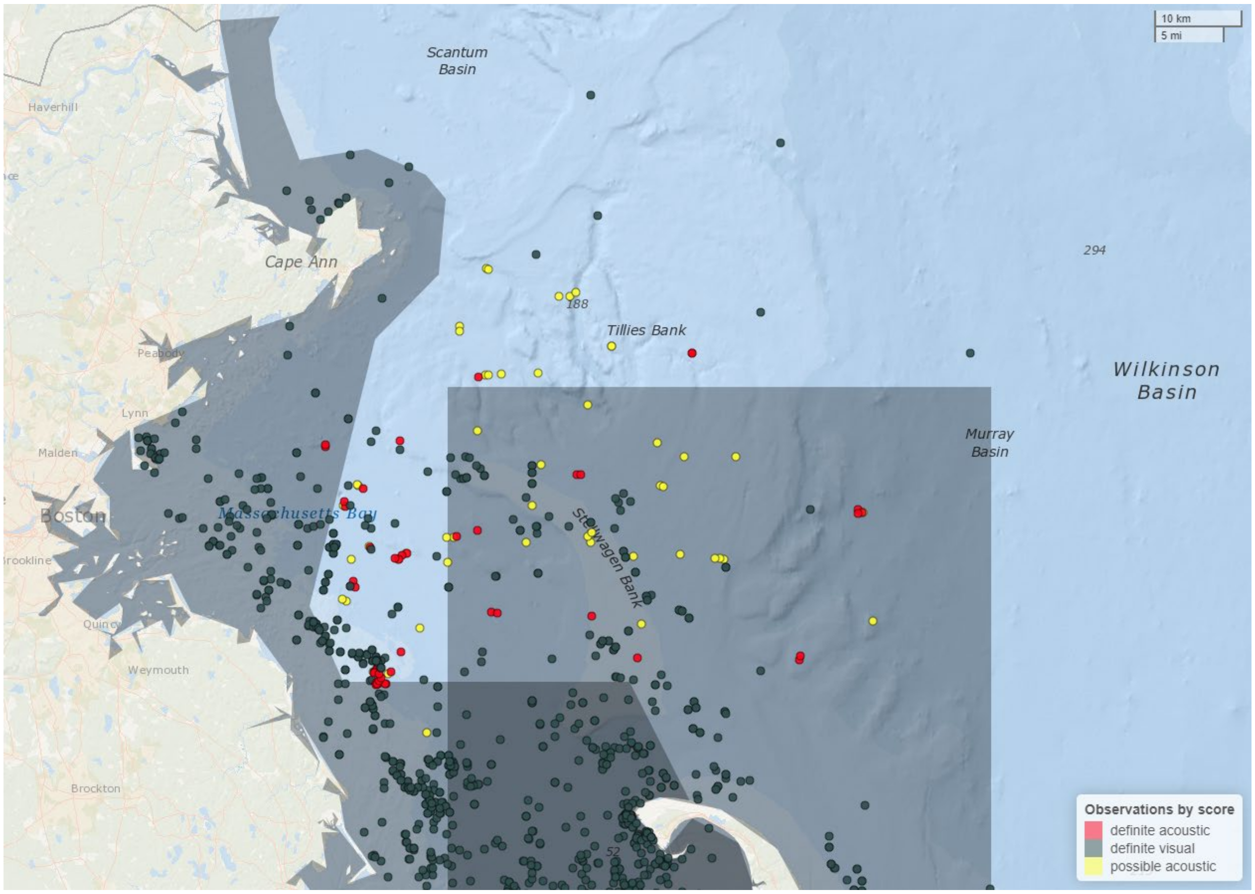


Figure 19: Definite acoustic (red circles), possible acoustic (yellow circles), and definite visual (dark gray) detections of North Atlantic right whales from April 2020-2023. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed November 17, 2023, https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



6.2.2 Comparison of Alternatives: Overview of the Decision Support Tool Analysis

The Large Whale Decision Support Tool (DST) is a peer-reviewed model developed by NMFS Northeast Fisheries Science Center to help managers, decision makers, and stakeholders evaluate the spatial and temporal overlap between fishing gear and North Atlantic right whale (right whale) along the East Coast. The model effectively allows comparison of the relative risk reduction among action and non-action alternatives. It also provides a reasonable estimate of the overall risk reduction for the alternatives. 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. In addition to the empirical evidence of the risk to right whales in the MRA Wedge, the following analysis uses DST Version 4.1.0 to quantitatively evaluate and compare likely risk outcomes for relevant management actions.

The first layer of the model describes the line density per unit area independent of the characteristics of individual lines (e.g. rope strength). The line density component of the DST for the geographic area relevant to this action is based on fishery inputs developed from state and Federal trip reports and vessel permits (Miller et al. 2024). Permits were used to build state and Federal fishery inputs separately, dividing these further by landed species subgroups. Depending on the level of detail available in trip reports, fishery inputs were built by allocating gear to reported spatial areas, across depth gradients within spatial areas, or distributing gear around spatial coordinates. For each reporting vessel, gear configurations associated with each trip report were used to determine the summed total number of buoy lines by month and area. This layer was constructed using data collected from 2015 through 2018 for lobster, 2010 through 2020 for other Federal trap/pot fisheries, and 2012 through 2019 for other trap/pot fisheries in state waters. These data pre-date the current boundaries of the MRA and the Massachusetts State Commercial Trap Gear Closure to Protect Right Whales (322 CMR 12.04(2)). Fishing effort layers were reviewed and validated by Federal and state resource managers along with fishing industry representatives on the Atlantic Large Whale Take Reduction Team (Team).

A second layer in the DST model assesses the risk associated with different gear configurations, accounting for the various breaking strengths of individual lines. Gear with higher breaking strength is expected to be more risky to whales because it is harder to break and therefore more likely to result in serious injury or mortality. A gear threat model was built using empirical 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 accounts for 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.

The final layer is a right whale habitat-based density model. The DST employs a right whale habitat-based density model built by researchers at Duke University's Marine Geospatial Ecology Laboratory in the Nicholas School of the Environment (hereafter referred to as the Duke University whale density model or right whale habitat density layer) that estimates the spatiotemporal distribution and density of right whales throughout the action area based on observations of whales from standardized surveys from January 2010 through September 2020 and co-located oceanographic and habitat variables (Version 12, released February 14, 2022; Roberts et al. 2016a, Roberts et al. 2016b, Roberts et al. 2020, Roberts et al. 2021, Roberts and Halpin 2022). The Duke University whale density model then uses oceanographic and habitat variables across the region to create a map of likely whale presence. The DST model also incorporates the Duke University whale density layers for humpback whales, which includes whale survey data from 2009 through 2019 (Roberts et al. 2016a), and fin whales, which includes survey data from 1998 through 2020 (Roberts et al. 2016a). These additional humpback and fin whale habitat density layers were used to determine projected density in Alternative 2 and Alternative 3 action areas. Given constraints in updating the most current version of the Duke University whale density model, the right whale habitat density layer input in the DST does not include more recent right whale sightings data collected after September 2020, such as the empirical data collected during aerial surveys conducted by CCS, nor does it include aerial and shipboard surveys conducted by the NEFSC, acoustic detections, or opportunistic sightings. However, the Duke University whale density model does undergo a rigorous, peer-reviewed validation process that applies current empirical data (*i.e.*, recent sightings and acoustic detection data) by comparing it to the final estimated whale habitat density layers (for more information on the data use and validation process of the whale habitat density model see Roberts et al. 2016a, Roberts et al. 2016b, Roberts et al. 2020, Roberts et al. 2021, Roberts and Halpin 2022). The Duke University whale density models for right, humpback, and fin whales will continue to be updated over time, and a new version of the right whale habitat density layer is expected to be incorporated into the DST as it becomes available.

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/16 square kilometers) and a high resolution (1 square nautical mile/1.6 square kilometers) option. The analysis in this Environmental Assessment (EA) was conducted using the high resolution setting on a one square nautical mile (1.6 square kilometer) grid.

Each model run allows for the selection of a variety of spatially explicit management measure scenarios 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 reduction in risk throughout an entire year. 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 relative risk reduction to estimate the risk of a serious entanglement, which takes into account the overlap between whale habitat density, line density, and the strength of the line. Together, these components estimate the approximate risk of an entanglement that will result in mortality or serious injury, where a higher density of lines, higher estimated habitat density of right whales, and/or high line strength increase the eventual estimate of relative 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 mortality or serious injury.

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 (MA LMA 1; action area). MA LMA 1 limits the scope of the analysis to the action area and calculates entanglement risk reduction relative to the total risk landscape within the spatial scope of this action (that is, risk reduction relative to all risk in MA LMA 1). The second round of analyses expanded the spatial constraint to the trap/pot fishery in the Northeast Region Trap/Pot Management Area, approximately 94 percent of fixed gear buoy lines in the right whale range within U.S. waters (NMFS 2021b). Increasing the spatial constraint to the Northeast Region provides a relative estimate of localized risk reduction within the context of the larger area, allowing comparison of this action with estimated risk reduction of the 2021 amendments to the Atlantic Large Whale Take Reduction Plan (Plan), including the restricted areas implemented by the final rule on September 17, 2021 (86 FR 51970) that went into effect October 18, 2021 and requirements for minimum traps per trawl and weak inserts throughout the buoy line that went into effect May 1, 2022.

In June 2023, NMFS hosted an informational webinar to present a change in the 2021 final rule DST risk assessment approach. The 2021 final rule analyses identified a 40 foot (12.2 meters) weak link interval as equivalent to a fully weak line (Additional details can be found in Chapter 5 in the recent Final Environmental Impact Statement accompanying the 2021 final rule; NMFS 2021b). Since then, NMFS and the state of Massachusetts approved weak link intervals of 60 feet (18.3 meters) equivalency for fully weak lines, in part because rope is sold in 60 foot (18.3 meters) increments providing a natural place for a weak connection. Researchers who originally proposed a 40 foot (12.2 meters) increment agreed that the 60 foot (18.3 meters) interval was likely equal in effectiveness to a 40 foot (12.2 meters) increment. Modeling 60 foot (18.3 meters) intervals as equivalent to weak rope did not change the number of inserts required under the Plan, only the relative risk reduction contribution of the requirement. The revised analysis increased the estimated risk reduction of the 2021 final rule by approximately 1 to 2 percent. The 2021 amendments to the Plan reduced entanglement risk by approximately 48 percent relative to all fixed-gear fisheries under the Plan and approximately 52 percent relative to the lobster and Jonah crab trap/pot fisheries in the Northeast Region Trap/Pot Management Area. This difference in analytical approach does not have a significant impact on the outputs of the analyses considered in this EA but does explain the slight differences in risk reduction values included within the draft EA (NMFS 2023a) published alongside the proposed rule to make permanent the MRA Wedge within the Massachusetts Restricted Area (88 FR 63917, September 18, 2023).

It is important to model fishing behavior across the region to understand how this action may redistribute effort, and consequently entanglement risk, across the Northeast Trap/Pot Management Area. Within MA LMA 1 and the Northeast Trap/Pot Management Area, changes anticipated due to the addition of the MRA Wedge to the MRA were analyzed in two ways, taking into account gear location and whether gear would be removed (lines out) or relocated (lines moved). We know from existing restricted areas that removal of all gear 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 state waters. However, some fishermen with Federal permits would be able to move their fishing gear to an area in Federal waters outside of restricted area boundaries, as may have occurred in 2021. Discussions with Massachusetts fishermen in 2022 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, if possible (Mike Lane comments to the Team in January 2022; Robert Martin, pers. comm. 2022). A similar mixed response is expected, with fishermen from more northern ports closer to open waters relocating gear to open Federal waters, and fishermen from the more southern ports further from closure boundaries removing their gear. This analysis considered both extremes (a "gear reduction" scenario under which all buoy lines were removed from the water and a "closure" scenario under which all buoy lines were relocated outside of the restricted area) to estimate the range of maximum and minimum levels of risk reduction anticipated based on fishing behavior. The effects of these two responses differ slightly depending on how they correspond to overlap between right whales and trap/pot gear. When fishing is suspended or on-demand technologies (sometimes referred to as ropeless fishing gear) are employed and lines are removed from the water entirely under gear reduction scenarios, there is typically a straightforward decrease in risk of entanglement. For closure scenarios in which fishing gear is relocated beyond the boundaries of the restricted area, relative risk may either increase or decrease depending on if the newly relocated gear is placed in areas where whales are likely to be present. If lines are moved to an area of high whale presence, relative risk will increase; whereas if lines are relocated to an area where whales are not likely to be present, relative risk will decrease. For optimal conservation, the 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 whale presence and/or create a "curtain effect" along the borders of the restricted area (see Subsection 6.2.4 for more information on the curtain effect).

In this EA, the DST is used to support the direct observations of co-occurrence between right whales and fishing gear by comparing and estimating the relative risk outcomes of the two action alternatives on large whale species. The analysis evaluated risk reduction of the action alternatives on top of the baseline risk reduction estimates achieved through implementation of the 2021 final rule (86 FR 51970, September 17, 2021), comparing it within the two spatial constraints (risk relative to the risk in MA LMA 1 and the risk relative to the entire Northeast Trap/Pot Management Area) that would be achieved by the two anticipated fishery behavior scenarios: fishermen either removing gear from the water (Gear Reduction) or relocating gear outside of the restricted area (Closure). Closure scenarios maintain the number of buoy lines within the water to be the same before and after a management intervention. The analysis of the status quo assumes compliance with current requirements. For a detailed description of model settings and results see Appendix 6.1.

Finally, it is important to acknowledge uncertainty in all quantitative models, including the DST. The DST was developed to help evaluate relative risk of entanglement in different geographic locations, and the relative risk outcomes under different mitigation actions, and, to date, represents the best available quantitative tool for U.S. fixed-gear fisheries in the U.S. Atlantic. In late January 2023, a peer review panel convened to examine the DST, and the panel recommended various additions to the model inputs, structure, and outputs to improve how uncertainty is accounted for and communicated to stakeholders. On June 15, 2023, NMFS hosted an informational webinar on the outcomes and subsequent work to address the reviewers' recommendations, some of which could be done in the short term while others will take longer. As intended however, the DST remains the best method NMFS has for quantifying risk and comparing reasonable estimates of the overall risk reduction of possible management scenarios. While not intending to imply precision, model outputs of risk reduction values will be reported using decimals as an aid to allow comparison between the various alternatives. Results obtained using the tool inform, but do not specify or determine, management decisions. The DST will continue to be updated as more information and data become available.

6.2.3 The Relative Impacts of Alternative 1 on Protected Species

Under Alternative 1 (No Action), the current Plan's management regime consisting of time/area closures, minimum trap per trawl requirements, use of weak buoy line inserts or buoy line, and gear marking requirements remain in place. The closures included in the Preferred Alternative of the 2021 final rule are considered part of the status quo for this action (see Subsection 4.1) because they were implemented on September 17, 2021 and gear modifications went into effect on May 1, 2022. Under No Action, 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 MRA Wedge when right whales are abundant.

Table 8 shows the expected whale densities for right, humpback, and fin whales by month within the alternatives to expand the spatial boundaries of the MRA to include either the MRA Wedge (under Alternative 2) or the MRA Wedge North to New Hampshire (under Alternative 3). In MA LMA 1, right whale habitat density is estimated to increase each month as time passes from February through April. Right whale estimated density peaks in April, reflecting the importance of that month in the action area. The high density aggregations of right whales in Cape Cod Bay motivated the implementation of the large seasonal MRA that was designed to separate right whales from fishing gear.

Table 8: Comparison of estimated total number of whales by species within the MRA Wedge (Alternative 2-Preferred) and MRA Wedge North to New Hampshire (Alternative 3) areas by month (February, March, and April). The estimated total number of whales are the estimates of whales present during each month at any given time as projected by the whale habitat density models created by Jason Roberts and Duke University (Right Whale Habitat-based Density Model Version 12: Roberts et al. 2016a, Roberts et al. 2016b, Roberts et al. 2020, Roberts et al. 2021, Roberts and Halpin 2022; Humpback whale: Roberts et al. 2016a; Fin whale: Roberts et al. 2016a).

	Right Whale			Humpback Whale			Fin Whale		
Area	**Feb**	**Mar**	**Apr**	**Feb**	**Mar**	**Apr**	**Feb**	**Mar**	**Apr**
MRA Wedge (Alternative 2: Preferred)	0.04	1.4	3.3	0.2	0.2	0.9	0.4	0.3	0.8
MRA Wedge North to NH (Alternative 3)	6.7	2.4	4.6	2	2.4	17.6	8.3	7.1	7.6

Without taking action, the aggregation of trap/pot gear in the MRA Wedge remains an imminent threat to the right whale population as well as to other large whales in the area. No Action continues the status quo of the Plan's 2021 implementation of seasonal restricted areas and presents a high to moderate negative entanglement 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, No Action has a slight negative impact because No Action would allow fishing activities with buoy lines that present an entanglement risk to protected species in a relatively small area (approximately 200 square miles/518 square kilometers) of Federal waters outside of the MRA. Relative to Alternative 3, No Action will have a moderate negative impact because Alternative 3 would close a substantial area (approximately 1,297 square miles/3,359 square kilometers) to the lobster and Jonah crab, and other trap/pot fisheries that under No Action would remain open. As has been noted, buoy lines used by the trap/pot fisheries present an entanglement risk. Under No Action, 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.

6.2.4 The Relative Impacts of Alternative 2 on Protected Species

Alternative 2 would modify the spatial boundary of the MRA to include approximately 200 square miles (518 square kilometers) of Federal waters referred to as the MRA Wedge. The boundaries of the MRA under Alternative 2 would include the area that lies between state and Federal waters within the MRA and prohibit trap/pot fishery buoy lines from February 1 through April 30, matching the existing MRA closure season (Figures 1 and 5). As discussed in Subsection 6.2.1, dedicated aerial surveys collected data showing the temporal and spatial co-occurrence of right whales and fixed-fishing gear within the MRA Wedge and adjacent Federal waters of the MRA (Figures 10-13). The use of buoy lines by fixed-gear fisheries pose an entanglement risk to right whales, and other large whale species.

As discussed in Subsection 6.2.1, right whales have historically been surveyed in Cape Cod Bay, but recent data collected during dedicated visual and acoustic surveys during the months of February through April 2018-2023 demonstrate that right whales occupy and travel through the MRA Wedge to feed in waters in and around Massachusetts Bay (Figures 10, 14-19). Not only were more whales sighted each passing month, they were sighted in larger groups over time from February through April (Figures 14, 16, and 18). Dedicated survey data on right whale presence in February and March in Massachusetts Bay and the MRA Wedge likely underestimate the actual presence of right whales, given lower survey effort in the area north of Cape Cod Bay and variation in whale detection during these months (Ganley et al. 2019).

As noted above in Table 8, the Duke University whale density model estimates that approximately 0.04 right whales are likely present at any given time in the MRA Wedge throughout the month in February; approximately 1.4 in March; and approximately 3.3 in April. The recent right whale sightings data, not yet incorporated in the model, demonstrate a higher concentration of right whales than the Duke University whale density model incorporated within the DST (See Appendix 6.2.4 for figures of whale sightings mentioned in this paragraph). For example, on February 23, 2021, the NEFSC aerial survey team observed seven right whales inside the MRA Wedge. On April 8, 2021, a dedicated NEFSC aerial survey team observed 40 right whales in groups of up to 3 within the MRA Wedge. Later the same month, on April 28, 2021, the Center for Coastal Studies aerial survey team observed 19 right whales in the MRA Wedge. On March 7, 2022, NEFSC reported sighting three groups of three right whales (nine whales total) in the middle portion of the MRA Wedge around 42°20′ North latitude. On April 14, 2023, five right whales (a group of four and one individual) were sighted in the southernmost portion of the MRA Wedge. Opportunistic sightings were also reported. On March 14, 2020, two groups of two and three right whales (five whales total) were reported in the middle portion of the MRA Wedge around 42°20′ North latitude. On April 25, 2022, an opportunistic sighting of a group of seven right whales was reported in the southern portion of the MRA Wedge, off of North Scituate. These visual sightings dates are only a subset of reported sightings in the MRA Wedge, as shown in Figure 10 and Figures 14, 16, and 18. These figures also illustrate a high density of right whale sightings around the MRA Wedge, and these whales likely enter or transit through the MRA Wedge. Right whale presence often goes undetected, and detectability can depend on behavioral states (transiting, feeding, socializing; Hain et al. 1999, Pendleton et al. 2009, Clark et al. 2010, Ganley et al. 2019, Ceballos et al. 2022), and on survey conditions including weather, visibility, personnel experience, and survey frequency.

Historically, survey efforts have focused on Cape Cod Bay, Stellwagen Bank, Nantucket Shoals, and the continental shelf near Block Canyon. Other habitats utilized by right whales such as Massachusetts Bay, Federal waters north and east of Cape Ann, and Lobster Management Area 3 have not been as frequently surveyed. Additionally, surveys surrounding the action area and surrounding Federal waters were conducted with more frequency beginning in 2021, following the increase in the proportion of the right whale population utilizing Cape Cod Bay over time (Mayo et al. 2018, Ganley et al. 2019, Meyer-Gutbrod et al. 2022). Therefore, the current proportion of the right whale population feeding and transiting through the MRA Wedge (Alternative 2, Preferred) and MRA Wedge North to New Hampshire (Alternative 3) may still be underrepresented by the sightings data and opportunistic reports.

For the purposes of comparing the relative risk reduction of Alternatives 2 and 3, the DST considered two likely fishing behaviors in response to the MRA Wedge seasonal closure to estimate a range of maximum and minimum relative risk reduction, as discussed in Subsection 6.2.2. The maximum relative risk reduction considers the effects of vessels removing all buoy lines from the water (gear reduction scenario), whereas the minimum risk reduction considers the effects of vessels relocating all of their gear to areas outside of the restricted area (closure scenario). Actual risk reduction will likely fall between the two analyzed extremes. The greater the reduction in overlap between right whales and buoy lines, 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 provides greater benefit to right whales present than if the lines are moved elsewhere within the range of the right whales.

The DST estimates that the addition of the MRA Wedge to the MRA February 1 through April 30 reduces entanglement risk to right whales posed by lobster and Jonah Crab trap/pot gear fished in the MA LMA1 area by 13 to 16.5 percent, depending on whether gear is relocated outside of the boundaries of the MRA or removed, respectively (Table 9). The risk relative to the entire Northeast Trap Pot Management Area lobster and Jonah crab fishery is estimated to be reduced by 1.8 to 2.3 percent with the addition of the MRA Wedge (Table 9). These estimates suggest that the difference in risk reduction between gear removal and relocation may be fairly small, but there are limitations in the ability of the model to predict where gear is reset and in what density. Gear that is relocated in particular areas in high numbers could pose more of a risk than the model results reflect. February shows the possibility of a slight increase in risk if all gear was moved outside of the closure but, as indicated in Subsection 6.2.2, we anticipate a mix of responses with a good portion of the gear being removed from the water instead of relocated into other areas in high density. The action area is a particular concern for storage of gear in April prior to the May 1 opening of the Federal MRA because right whale density in the MRA Wedge is estimated to be highest in April. In the absence of buoy line restrictions, fishermen are likely to relocate gear along the boundaries of MRA in the waters of the MRA Wedge, staging for a rapid relocation into newly opened Federal waters May 1.

Table 9: Comparison of Large Whale Decision Support Tool relative reduction in estimates of North Atlantic right whale entanglement risk by month within the seasonal restricted areas described in Alternative 2 (Preferred) and Alternative 3. Under Alternative 2, the Massachusetts Restricted Area is modified to include the MRA Wedge, and under Alternative 3, the Massachusetts Restricted Area boundaries are expanded northward to New Hampshire to include MRA Wedge North to New Hampshire. Under Closure scenarios, gear is relocated outside of the seasonal restricted area, leaving the number of buoy lines within the water the same before and after a management intervention. Under Gear Removed scenarios, fishing gear is removed from the waters. The MA portion of LMA 1 refers to the Massachusetts portion of Lobster Management Area 1. The Northeast Region refers to the lobster and Jonah crab trap/pot fishery in the Northeast Region Trap/Pot Management Area. See Subsection 6.2.2 for an overview of the Large Whale Decision Support Tool and analyses included in this Environmental Assessment.

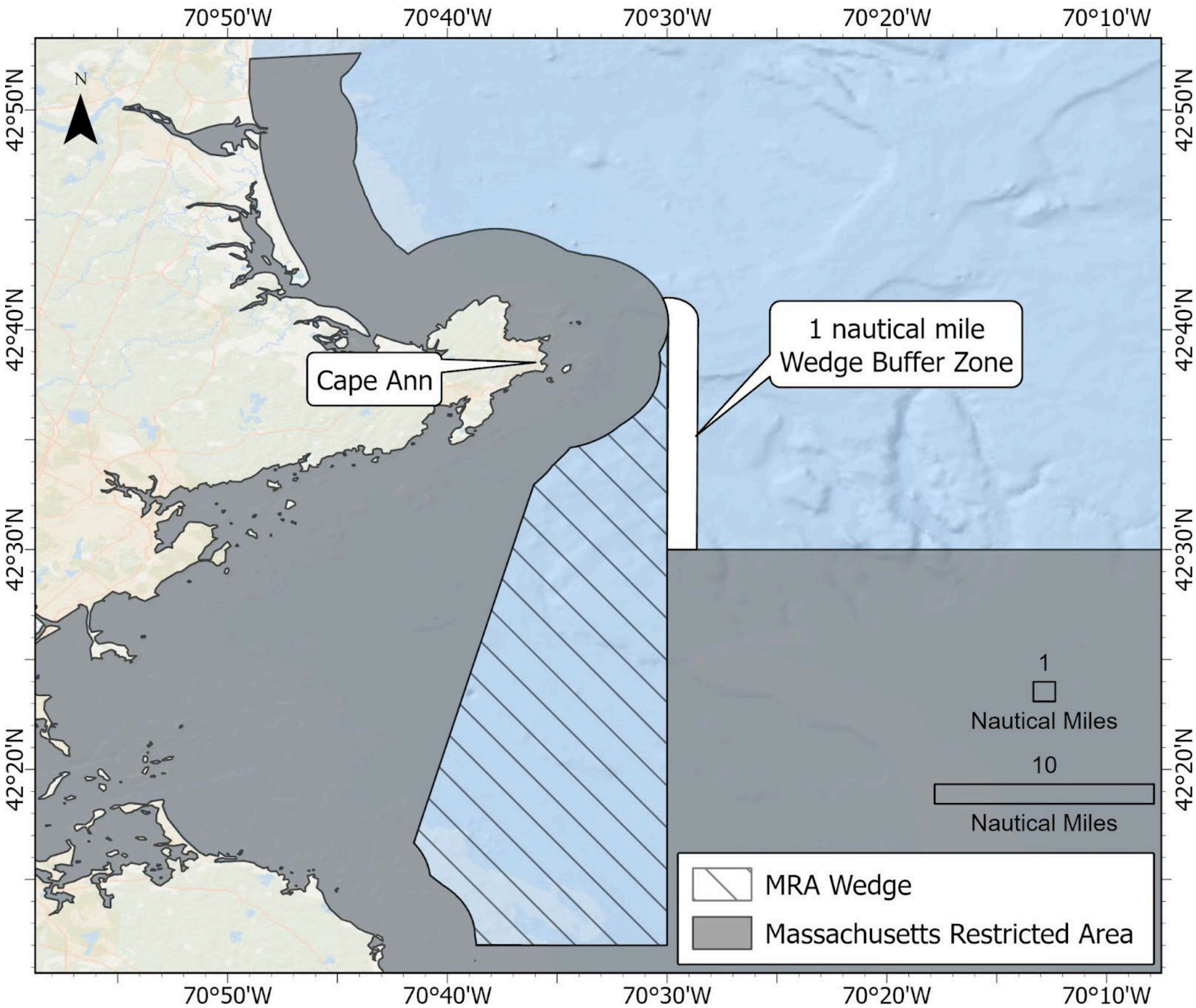
Estimated Relative Risk Reduction under Alternative Action Areas	Closure				Gear Removed			
Relative to MA portion of LMA 1	Feb	Mar	Apr	Feb 1-Apr 30	Feb	Mar	Apr	Feb 1-Apr 30
with MRA Wedge (Alternative 2: Preferred)	-1.9%	3.6%	11.3%	**13%**	0.1%	4.1%	12.3%	**16.5%**
with MRA Wedge North to NH (Alternative 3)	9.9%	2.6%	10.1%	**22.6%**	15.8%	6.4%	16.1%	**38.3%**
Relative to All Northeast Trap/Pot	**Closure**				**Gear Removed**			
with MRA Wedge (Alternative 2: Preferred)	-0.3%	0.5%	1.6%	**1.8%**	0.0%	0.6%	1.7%	**2.3%**
with MRA Wedge North to NH (Alternative 3)	1.4%	0.4%	1.4%	**3.1%**	2.2%	0.9%	2.2%	**5.3%**

Right whales are expected to disperse during this period, and several members of the Team and the public have raised concerns about the potential for a "curtain effect" in which fishermen displaced by the MRA Wedge closure will instead choose to set their gear along the perimeter of the closure boundary in an area referred to as the Wedge Buffer Zone (Figure 20). The DST does consider this in the process of redistributing traps in a closure scenario. Traps are preferentially left closer to the closures according to a cost function that balances the cost of moving gear against the benefit of moving the gear to unrestricted fishing habitat. We examined the Vessel Trip Report (VTR) data from 2019 to 2023[8] to see if there were any identifiable trends in fishing effort outside of the MRA Wedge following the 2022 and 2023 emergency closures. In 2022, the MRA Wedge was closed for the first time in April by emergency action (87 FR 11590, March 2, 2022). There was only one vessel observed in VTR data within one nautical mile (nm; 1.85 kilometers; see Figure 20 for the area referred to as the Wedge Buffer Zone) of the MRA Wedge closure boundary, and the total number of traps fished in the Wedge Buffer Zone increased slightly relative to reported effort in March 2022, but decreased when compared April 2019 and 2021. In 2023, the MRA Wedge was closed by emergency action that extended the 2022

[8] About 40 percent of Massachusetts federal lobster vessels do not have to submit VTR, so the numbers presented here may be an underestimate of use of the MRA Wedge.

emergency closure (88 FR 7362, February 3, 2023) from February 1 to April 30, 2023. There were two vessels observed in the Wedge Buffer Zone in the VTR data in April 2023, similar to previous months. The total number of trips and total number of traps fished increased significantly, but those increased trips were from the same fisherman who had been fishing within the Wedge Buffer Zone. While VTR data represents a subset of effort, comparing VTR data demonstrates some interannual variability, but does not indicate that there was sufficient displaced effort to cause a detectable curtain effect. Additionally, fishermen may choose to use the Wedge Buffer Zone to store their gear, which is a behavior that would not be captured by VTR data and more observational data is needed to evaluate the extent of wet storage use. At this time, the risk of a curtain effect is outweighed by the high entanglement risk during February through April across the MRA Wedge and potential for more gear to remain concentrated in these Federal waters if they remain unrestricted during the MRA closure period.

Figure 20: One nautical mile Wedge Buffer Zone to the east of the MRA Wedge.



Changes in fishing effort distribution data during recent emergency closures of the MRA Wedge would not be captured by the DST, which models gear abundance and distribution based on fishing data before the MRA Wedge was created by Federal and State rulemaking. The 2021 Federal and State restrictions likely pushed more gear into this area than is reflected in the gear data that was incorporated into DST, and therefore the analyses may not capture the additional risk created since the implementation of the State water closure, when fishermen use the MRA Wedge as an area for gear storage and staging, as reported by Massachusetts Division of Marine Fisheries in its letters of concern (See Appendix 3.1).

Definite and possible acoustic detections and definite visual observations of right whales (Figures 14-19) increased each month over time during February through April 2020-2023 and support the need for mitigation measures in the MRA Wedge during February, March, and April to decrease entanglement risk posed by trap/pot fishing gear Massachusetts Bay. Acoustic data collection is an important supplement to the visual sightings data as there have been instances of acoustic detections of vocalizing whales that were undocumented by aerial surveillance (Murray et al. 2022, Davis et al. 2023). Accordingly, it is critical that the MRA includes the MRA Wedge within the boundaries of the existing closure under the Plan to reduce the risk of mortality and serious injury of right whales from entanglements in buoy lines, particularly when gear is more likely to be densely aggregated.

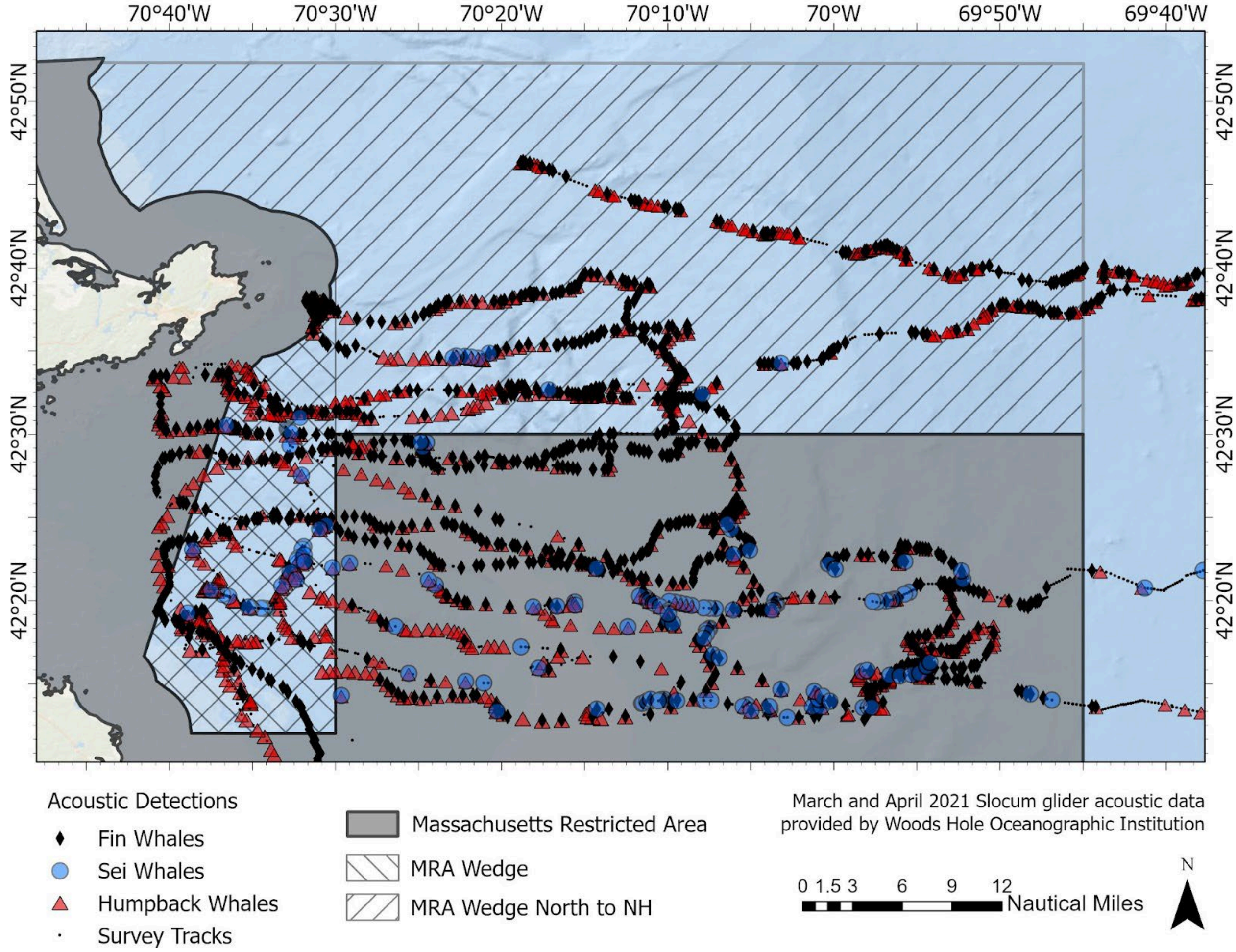
Introducing on-demand fishing (sometimes referred to as ropeless fishing), where fishing occurs without persistent buoy lines, and instead are either stored on the bottom until retrieval or replaced by a lift mechanism directly on the groundline or end trap, is not prohibited by the Plan. If implemented in the action area where right whales aggregate, on-demand fishing may pose a slightly higher threat of entanglement in the short-term compared to a full fishery closure. Gangions and sinking groundline would be present in on-demand fishing gear, 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. Until fishery management plan buoy requirements are modified to allow an alternative to a surface buoy, authorization to exempt fishermen from the buoy requirement must be granted. To reduce potential risks in the short term, an Exempted Fishing Permit (EFP) would include conditions on fishing to reduce the impact of this gear on right whales. The NEFSC gear team reported twelve vessels fishing no more than ten trap trawls each fished with on-demand gear in the MRA State and Federal waters during the closure period under an EFP in 2023 (Eric Matzen, pers. comm. 2023). These vessels fished without persistent buoy lines and with extensive monitoring and reporting to verify that the effort by the experimental fishery added negligible risk above a full closure.

Overall, Alternative 2 would reduce overlap of gear and whales by modifying the MRA to include the MRA Wedge by prohibiting the use of persistent buoy lines by the trap/pot fishery in an area of observed right whale presence. Large whale entanglement risk will likely decline substantially during a critical period when the right whales are likely to be aggregating and transiting to and from Cape Cod Bay if the MRA boundary is expanded to include the MRA Wedge (Alternative 2, Preferred Alternative). While entanglement risk is not completely eliminated, the action does significantly reduce risk in the action area. With the addition of approximately 200 square miles (518 square kilometers) in February, March, and April, there is a decrease in entanglement risk for right whales during those three months. Alternative 2 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 also reduce overlap of minke, humpback, sei, and fin whales with trap/pot buoy lines, but any reduction would be minimal. This modification of the MRA is unlikely to impact minke, humpback, sei, or fin whales substantially, but any impact is expected to have a positive impact, similar to the conclusion in the 2023 emergency rule Environmental Assessment (88 FR 7362, February 3, 2023; NMFS 2023b).

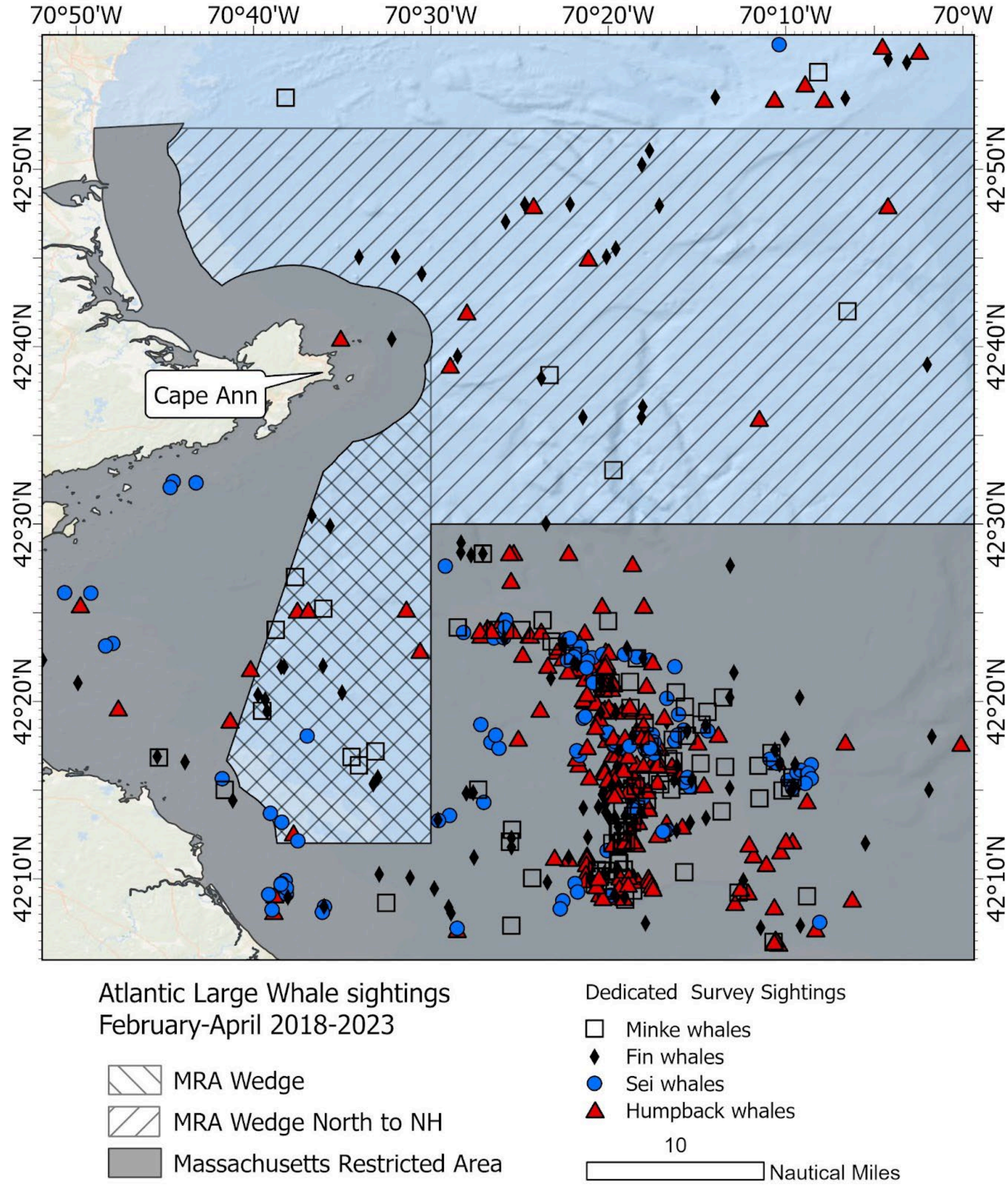
Acoustic detections of other large whale species indicate that whale presence may be higher or more persistent than what is estimated by the Duke University whale density models incorporated in the DST. Acoustic data were collected by Slocum Glider surveys deployed near the Stellwagen Bank National Marine Sanctuary and Gulf of Maine for the purpose of surveying tagged fish and baleen whales, including fin, sei, and humpback whales (Baumgartner 2021; Figure 21). 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 in March and April 2021. 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). Detectability for baleen whales may vary depending on abundance, distance from the glider, whale calling behavior, hydrophone platform characteristics, and environmental conditions affecting interfering noise (Baumgartner et al. 2020, Baumgartner et al. 2021). Acoustic data do not confirm the number of individual whales present nor do these particular data provide exact locations of the animals; however, the acoustic data does confirm continued presence of these species of Atlantic large whales in the Alternative 2 action area during the MRA closure period.

Figure 21: Definite and possible acoustic detections of fin, sei, and humpback whales from March 17, 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).



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

Figure 22: Atlantic large whale (minke, fin, humpback, and sei whales) visual sightings collected during Northeast Fisheries Science Center dedicated aerial surveys conducted in February, March, and April 2018-2023. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



Minke, fin, humpback, and sei whales are present in the Massachusetts portion of LMA 1 and were visually observed by dedicated surveys sightings February, March, and April 2018-2023 (Figure 22). February, March, and April 2018-2023 observation data show low numbers of confirmed visual sightings of sei whales within the action 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 the action area over spring of 2018 through 2023. 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 conducted February, March, and April 2018-2023 reported seven minke whales within the MRA Wedge and ten total minke whales observed in the MRA Wedge North to NH area during that same period (Figure 22). Minke whales were more frequently documented within the MRA on Stellwagen Bank. Nantucket Shoals, and on the continental shelf near Block Canyon. Individual fin whales and groups of up to three were visually observed in the MRA near Stellwagen Bank National Marine Sanctuary, MRA Wedge, surrounding Federal waters of the MRA Wedge North to NH near Tillies Bank, and northward in Jeffreys Ledge. Fin whales were also spotted by surveys conducted near the Outer Cape, Nantucket Shoals, and Block Canyon. Fin whales are common in U.S. waters north of Cape Hatteras, North Carolina, and frequently feed in New England and Gulf of St. Lawrence (Hayes et al. 2022). Sei whales were observed in April 2018 and 2022, and again in March and April of 2023 in Massachusetts Bay, within Stellwagen Bank. Sei whales were frequently sighted in groups up to 10 on the continental shelf north of Block Canyon and individual sei whales were sighted in offshore waters of LMA 3 during the month of April. 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). Six humpback whales were also sighted in the MRA Wedge during April between 2018 and 2023, and 13 humpback whales were sighted in the MRA Wedge North to NH during April of the same period. Individuals and groups of humpback whales were also frequently sighted around Stellwagen Bank, along the Outer Cape, and Nantucket Shoals. In the Gulf of Maine, humpback whale 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).

The aerial survey sightings have not been corrected or analyzed for effort, meaning that not all survey effort is the same across areas, month or year. Therefore, whales may be present in areas not surveys and during times when surveys were not conducted. Survey effort and sightings can vary spatially, monthly, and yearly depending on weather conditions, visibility, available funding, and survey purpose. As previously mentioned, not all whales present in the Federal waters beyond the MRA boundaries may be adequately represented in the aerial survey sightings data. Additionally, whale behavior across these four species may reduce the probability of a sighting from the sea surface, as the dive profiles and time spent at the sea surface differs from species to species, and even may vary by sex within the species.

The evidence available for large whales does not suggest that new entanglement risk hotspots would be created by relocated gear outside of the seasonal closure area. Therefore, the implementation of Alternative 2 is unlikely to further negatively impact protected species. Relative to No Action, 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 large whale entanglement risk in trap/pot gear is reduced. Relative to Alternative 3, Alternative 2 has a negligible to slight negative impact because the modification of MRA to include MRA Wedge under Alternative 2 provides less risk reduction than the expansion of MRA to include MRA Wedge North to NH under Alternative 3. Considered alone, ESA-listed and MMPA protected species would be moderately negative to slightly negatively impacted by Alternative 2 because this action would not eliminate the potential for all interaction risk between fishing gear and marine mammals that could result in takes above the potential biological removal level.

6.2.5 The Relative Impacts of Alternative 3 on Protected Species

Alternative 3 would also modify the spatial extent of the MRA similar to Alternative 2, but would include an area more than six times larger than Alternative 2 (approximately 1,297 square miles/3,359 square kilometers). Alternative 3 would extend the northern MRA boundaries up to the New Hampshire border, an area referred to as the MRA Wedge North to NH, and would remain closed to the use of buoy lines by the trap/pot fishery from February 1 to April 30. The Duke University whale density model incorporated into the DST estimates 3 to 7 whales are likely to be present at any moment in time in the MRA Wedge North to NH between February and April (Table 8). As discussed in the previous Subsections of 6.2, sightings data collected during the months of February through April in the years 2018 through 2023 show that there are at times more right whales in the area than the Duke habitat model estimates and that group size of observed whales increase from February through April (Figures 14, 16, and 18). Surveys north of Cape Ann are conducted less frequently; therefore, similar 2020-2023 empirical sightings data from dedicated surveys conducted northeast of Cape Ann to the New Hampshire border are not available in the same frequency as dedicated surveys conducted south of Cape Ann in Massachusetts and Cape Cod Bay. 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. 2000) suggesting that right whales may be present north of Cape Ann more often than is being reported by dedicated surveys.

The DST estimates that extending the northern MRA boundary up to the New Hampshire border reduces the relative entanglement risk in the MA LMA 1 by 22.6 to 38.3 percent, depending on if gear is relocated outside the seasonal restricted area or removed, respectively (Table 9). Definite and possible acoustic detections and definite visual detections of right whales increase in the MRA Wedge North to NH each month from February, March, and April (Figures 14-19). While the detection rates each month are not directly comparable because the data have not been corrected for differences in survey effort across time, the visual and acoustic detection data indicate that right whales are observed in the presence of fixed-fishing gear. The risk reduction value of this restricted area is likely higher because extending the closure farther northeast is more likely to remove lines rather than move them given the distance from Massachusetts ports. Additionally, the potential for dense concentrations of gear along the closed area border is diluted given the larger offshore border. Removal of gear reduces entanglement risk while also preventing the formation of new hotspots where newly relocated gear and right whales overlap. This is a significant risk reduction relative to this portion of the Northeast trap/pot fishery.

In the Northeast Trap/Pot Management Area, the DST estimates risk reduction to range from 3.1 to 5.3 percent depending on whether gear is relocated or removed from the MRA Wedge North to NH (Table 9). It is unlikely that gear would be relocated outside of this area given the distance from Massachusetts home ports.

Similar to Alternative 2, introducing on-demand fishing may slightly increase the entanglement risk in the groundline in the short-term, compared to a full closure, but the sinking groundline requirements will prevent most of the gear from being in the water column and available for entanglement. The presence of buoy lines in areas where whales are aggregating and transiting will decline during the seasonal closure period. Therefore, this measure would be expected to substantially reduce the potential of a right whale mortality or serious injury as a result of interactions and entanglement with fishing gear.

Removing buoy lines from MRA Wedge North to NH from MA LMA 1 would also decrease the risk of mortality or serious injury for minke, fin, humpback, and sei whales. The DST estimates 2 to 18 humpback whales and 7 or 8 fin whales from February through April within the waters of the MRA Wedge North to NH (Table 8). 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 and detected visually and acoustically within the action area. As discussed in Section 6.2.4, minke, fin, humpback, and sei whales were sighted in MA LMA 1 in the spring surveys conducted in 2018-2023 and visual observations and acoustic detection data indicate they were also present within the waters of MRA Wedge North to NH February through April (Figures 21 and 22). Minke whales were not detected acoustically, but they were observed infrequently through visual surveys. NEFSC aerial surveys reported ten minke whales in the MRA Wedge North to NH in the areas that overlaps with the MRA Wedge and offshore Cape Ann. Fin whales were detected visually more frequently than minke whales, and sightings extended in Massachusetts Bay, Federal waters east of Cape Ann, and Stellwagen Bank. Acoustically, fin whales were detected throughout the action area. Sei whales were observed in April 2018 and 2022, and again in March and April of 2023 in Massachusetts Bay, within Stellwagen Bank. Humpback whales were observed visually in Massachusetts Bay and scattered within MRA Wedge North to NH. However, acoustic detection data strongly indicates that humpback whales are present throughout Federal waters north of MRA to the New Hampshire border. Similarly, the Slocum Glider detected sei whales acoustically in Massachusetts Bay and Federal waters (Baumgartner 2021; Figure 21). The fin and sei whale observations suggest they do feed or travel within the boundaries of the seasonal 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. More information is needed to fully quantify minke, fin, humpback, and sei whale abundance and habitat use in this area. Dedicated aerial surveys conducted by NEFSC focus on Cape Cod Bay. Therefore, the lack of visual sightings appear to be, in part, attributed to insufficient survey effort in the region, as they were detected acoustically in March and April of 2021. The sightings and acoustic data indicate that humpback, fin, minke, and sei whales would not be negatively impacted by the MRA Wedge North to NH.

Reducing lines through a closure may lower entanglement risk for these species during February 1 through April 30. Compared to No Action, Alternative 3 would have a moderate positive impact on protected species because the seasonal closure under Alternative 3, MRA Wedge North to NH, would close a large area to the trap/pot 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 slight positive impact on ESA-listed and MMPA protected species. When considered alone, Alternative 3 would have negligible to slight negative impacts on other 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.

6.2.6 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, but the Alternative 2 seasonal closure achieves more risk reduction per square mile than Alternative 3. Removing the buoy lines from February 1 to April 30 in both of the action areas would reduce entanglement risk for these large whales when they are more likely to occur in high densities.

The impact on ESA-listed (right, fin, and sei whales) and MMPA protected species (humpback and minke whales) is expected to be slightly positive under Alternative 2 and moderately positive under Alternative 3, when compared to No Action. The MRA Wedge North to NH (Alternative 3) is substantially bigger in area (by a magnitude of six) than MRA Wedge (Alternative 2). Alternative 2 provides less overall North Atlantic right whale entanglement risk reduction (an estimated 1.8 to 2.3 percent, relative to all Northeast trap/pot fisheries) compared to Alternative 3 (an estimated 3.1 to 5.3 percent, relative to all Northeast trap/pot fisheries). The difference in impact between the two is even greater when considering local relative risk in MA LMA 1, an area with particularly high entanglement risk during spring (an estimated 13 to 16.5 percent under Alternative 2 compared to an estimated 22.6 to 38.3 percent under Alternative 3).

6.3 Habitat Impacts of the Alternatives

6.3.1 Alternative 1: No Action

The No Action alternative (Alternative 1) would maintain current regulations seasonally closing the Massachusetts Restricted Area (MRA) to trap/pot gear, while continuing to allow access to trap/pot fisheries in the portion of Lobster Management Area 1 (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 Atlantic Large Whale Take Reduction Plan currently requires a minimum of 10 to 25 traps per trawl depending on distance from shore 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.

No Action represents the status quo and will likely continue to have a moderately negative to slightly negative impact on the habitat. Trap/pot fishing will continue at current levels and disturbance of the habitat will not change. Relative to Alternative 2 and Alternative 3, No Action is expected to result in negligible to slight negative impacts because fishing gear will be concentrated within the Massachusetts Restricted Area Wedge (MRA Wedge) during the seasonal closure period.

6.3.2 Alternative 2: Preferred Action

Under Alternative 2, fishing and setting trap/pot gear with persistent buoy lines would be restricted in all waters within the MRA, including the MRA Wedge, from February 1 through April 30. Authorizations for fishing without buoy lines (*i.e.*, using on-demand or ropeless fishing gear) restricted waters must be obtained through an Exempted Fishing Permit (EFP). Seven vessels fishing no more than 10 trawls each fished with on-demand gear in the MRA state and Federal waters under an EFP in 2023. Opportunities for the industry to participate in on-demand fishing could expand widely during the restricted area period, but if it did, the habitat could experience similar levels of disturbance as described under No Action.

Alternative 2 would modify the spatial boundary of the MRA to include the MRA Wedge and close this area to trap/pot fishing February 1 through April 30. 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 seasonal 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. We anticipate that 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 February, March, and April, so it is likely some fishing from these ports may remove their gear while those farther north will move their gear into other areas.[9] However, operational trap/pot gear is not considered to cause long-term benthic impacts and lobster fishing is believed to negligibly impact Essential Fish Habitat (Uhrin 2016, Goode et al. 2021).

Relative to No Action, impacts of Alternative 2 on the habitat are expected to be negligible to slight positive because while fishery operations for the trap/pot fisheries will be prohibited in this area from February 1 through April 30, 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 seasonal closure area under Alternative 3 is larger than the seasonal closure area under Alternative 2, meaning that a much smaller area will be closed to disturbances created by trap/pot fishing operations under Alternative 2. However, given the nature of the seasonal

[9] Personal communication with Massachusetts Division of Marine Fisheries on January 12, 2023.

closure, these habitat impacts are not considered to be significantly different. The closure that would be implemented under either action alternative will be in place for three months of the year, which is not sufficient time to allow the habitat to recover after a previously occurring disturbance. Relocated gear may disturb benthic habitat not previously utilized by the fishery. 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 trap/pot fisheries would continue to operate within the seasonal closure period that may disturb the benthic habitat.

6.3.3 Alternative 3

Alternative 3 would add approximately 1,297 square miles (3,359 square kilometers) to the MRA and extend the northern MRA boundaries up to the New Hampshire border. The expanded MRA would restrict the fishing and setting of trap/pot gear with buoys lines February 1 through April 30. As discussed in Subsection 6.2.4, it is unlikely that gear would be relocated outside of this area given the distance from Massachusetts home ports and the cost of operation and expected landings in February, March, and April. Relocating or 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 on-demand fishing expands widely under Alternative 3, the habitat could experience similar levels of disturbance as described under No Action.

Relative to No Action, impacts of Alternative 3 on the habitat are expected to be negligible to slight positive because the MRA expansion would only 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 be negligible because while Alternative 3 restricts fishing activities in a larger area than the seasonal closure area under Alternative 2, the benefits of suspended fishing activities are limited. Given the nature of the seasonal closure, habitat impacts are not considered to be significantly different. The closure that would be implemented under either Alternative will only be in place for three months of the year, which is not sufficient time to allow the habitat to recover after a previously occurring disturbance. Relocated gear may disturb benthic habitat not previously utilized by the fishery. Alone, Alternative 3 has a negligible to slight negative impact on the habitat because other fisheries will continue to operate in the 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.

6.3.4 Comparison and Summary of the Alternatives

No quantitative criteria are available to formally compare the biological effect of the alternatives on habitat. No Action 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 No Action, Alternative 2 and Alternative 3 are expected to have negligible to slight positive impacts on the Massachusetts' portion of LMA 1 habitat. If on-demand fishing is implemented in restricted areas under Alternative 2 or Alternative 3, the amount of gear that comes into contact with the seafloor is likely to occur at levels less or similar to those prior to the closure. Similarly, Alternative 3 would likely have a negligible impact compared to Alternative 2. Compared to Alternative 2 and Alternative 3, No Action 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 restricted area period.

6.4 Human Community Impacts of the Alternatives

6.4.1 Economic Impacts of the Alternatives

Alternative 1 (No Action) leaves the provisions of the Atlantic Large Whale Take Reduction Plan (Plan) unchanged, and thus there would be no change in economic impacts relative to current regulatory requirements. The No Action alternative (Alternative 1) would maintain current regulations seasonally closing the Massachusetts Restricted Area (MRA) to trap/pot gear, while continuing to allow access to trap/pot fisheries in the portion of Lobster Management Area 1 primarily used by Massachusetts vessels (MA LMA 1). Alternative 2, the Preferred Alternative, expands the MRA to include the Massachusetts Restricted Area Wedge (MRA Wedge) northward to Cape Ann, Massachusetts from February 1 through April 30. It would add approximately 200 square miles (518 square kilometers) to the current MRA and bring slight 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 expands the spatial boundaries of the MRA to include a larger area of approximately 1,297 square miles (3,359 square kilometers) that is bounded landward by the Massachusetts state waters within the MRA, north at 42°52.58′, seaward at 69°45′, and south along the northern border of Federal waters of the MRA. Alternative 3 would impact more vessels, particularly those fishing from Northern Essex County, compared to Alternative 2.

The following subsection gives an overview of the analytic approach and results of economic impacts.

6.4.1.1 Analytic Approach

Vessels that fished within the restricted area have two options to comply with this action: relocate their traps outside of the restricted area boundaries and continue fishing, or remove their traps from the restricted area to suspend fishing activity. This analysis considers the impacts if half of the vessels relocate their traps and the other half removes their gear and stops fishing. Vessel Trip Report (VTR) data from the 2020 and 2021 show that at least half of the vessels fished at the southern portion of the restricted areas in Alternative 2 and Alternative 3. For Alternative 2, we used the 42°30' N line to decide whether vessels relocate or stop-fishing based on locations in VTR data because this line is the northern boundary of the current MRA east to the MRA Wedge. The analysis considers that fishermen fishing south of this line would choose to not relocate as it would not be economically efficient. Similarly we used 42°40' line for Alternative 3 because vessels south of this line are likely too far to move outside of the restricted area (Massachusetts Division of Marine Fisheries pers. comm. January 12, 2023). During the

April 2022 emergency closure, Massachusetts Division of Marine Fisheries (MA DMF) communicated it was likely 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, we split the anticipated reaction of vessels between relocating and suspending fishing in our analysis.

For relocated vessels, the cost differences come from reduced revenue in a different fishing area than their familiar and preferred, and extra operating costs to move gear. For vessels that stop fishing, the cost differences include lost revenue, gear removal costs, and saved operating costs from not fishing. The lower and higher end of cost estimates include 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 alternatives, we first used the VTR data for 2017-2021 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, until vessel tracking data become available, it is the best available data for spatial analysis. We then determined the number of vessels and their landings weight for both lobster and Jonah crab. Finally, we calculated the landings value by multiplying the weight and price. The monthly average prices were calculated from NMFS dealer data for 2017-2021. All final values are adjusted to 2021 U.S. dollars by using GDP deflator from U.S. Bureau of Economic Analysis (BEA 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 2017 to 2021, about 41 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 59 percent.

Another factor that needs to be considered is the operating cost savings from vessels that stop fishing. 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 only occur when the vessel goes on a fishing trip. If a vessel does not fish, then these costs should be considered as savings. We used VTR data to determine the total number of fishing days, and then we applied an average daily operating cost to estimate the total savings.

For the operating costs of transporting gear back to the dock, or to resume fishing outside the restricted area, we assumed that fishermen need three to six days to move all their traps around, and multiplied that by 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.

6.4.1.2 Costs Components

Vessel Lost Revenue

The restricted area would be in place from February 1 through April 30. During these months, few vessels were actively fishing and the landings were relatively low compared to summer/fall season. In Table 10 and 11, we list all lobster and Jonah crab vessels and landing values during February, March, and April from 2017 to 2021 for Alternative 2 and Alternative 3, respectively. We also provide the adjusted value by dividing the average value by 59 percent, as not all vessels were reporting their trips. We estimate that 26 to 31 vessels would be affected by Alternative 2, with a total lobster and Jonah crab landing value of $318,770 (Table 10). Alternative 3 would impact 53 to 66 vessels with a total landings value of $1,052,569 (Table 11).

Table 10: Number of affected vessels and landing values 2017-2021 under Alternative 2 (Preferred) (in 2021 $).

	February		March		April	
Year	Number of vessels	Landing Value	Number of vessels	Landing Value	Number of vessels	Landing Value
2017	18	$44,672	18	$37,343	24	$99,552
2018	25	$130,445	18	$64,155	19	$144,306
2019	16	$46,591	14	$35,915	20	$80,831
2020	19	$47,206	12	$22,222	14	$33,499
2021	13	$61,224	15	$43,883	12	$47,748
Average	18	$66,028	15	$40,704	18	$81,187
Adjusted Average	31	$112,004	26	$69,046	30	$137,719

Notes:
1. Landing values include both lobster and Jonah crab.
2. Both vessel number and landings are from Federal VTR data. Based on Federal vessel permit data, only 59 percent of Massachusetts Federal lobster vessels are required to submit VTR, so the final number is adjusted proportionally to reflect the whole lobster fleet.

Table 11: Number of affected vessels and landing values 2017-2021 under Alternative 3 (in 2021 $).

	February		March		April	
Year	Number of vessels	Landing Value	Number of vessels	Landing Value	Number of vessels	Landing Value
2017	32	$144,973	31	$83,673	39	$163,309
2018	48	$488,671	35	$264,741	39	$391,033
2019	37	$194,738	31	$155,475	35	$179,161
2020	42	$250,343	32	$99,482	31	$102,029
2021	35	$266,417	26	$175,252	26	$143,211
Average	39	$269,028	31	$155,725	34	$195,749
Adjusted Average	66	$456,358	53	$264,159	58	$332,052

Notes:
1. Landing values include both lobster and Jonah crab.
2. Both vessel number and landings are from Federal VTR data. Based on Federal vessel permit data, only 59 percent of Massachusetts Federal lobster vessels are required to submit VTR, so the final number is adjusted proportionally to reflect the whole lobster fleet.

Other Potential Economic Consequences

The extension of the MRA seasonal closure to include the MRA Wedge could worsen current challenges for seasonal vessels to retain qualified fishing crew that would prefer year-round employment. There is insufficient information available to allow a qualitative analysis of the safety or economic impacts of a crew shortage consequence. In the past few seasons, the fishing industry reportedly experienced some significant labor shortages. Based on a research by the Society of Human Resource Management (SHRM 2021), nearly 9 in 10 of the organizations surveyed said they are currently finding it difficult to fill certain open positions (especially entry level positions), and nearly 7 in 10 organizations believe that the expanded COVID-19 unemployment benefits have contributed to their difficulty filling certain open positions.

Crew on lobster boats are usually paid by a certain percentage of the harvest, so their income is very unstable especially during winter/spring season with more severe weather days and lower catch rates. If lobster vessels cannot secure year-round crew at the beginning of the year, they may have to offer higher pay to get mates when peak season starts. Lobster boats without extra crew would likely fish fewer traps and trawls, or may make fewer hauls per trip, therefore although they may have fewer costs, they may also experience catch reduction and lower revenue.

The labor shortage in the fishing industry could also be caused by a number of factors, including macroeconomic conditions, lobster stock conditions, and market prices. NMFS is not aware of a labor shortage to the extent that would affect its evaluation of this rule, and NMFS does not anticipate that this rule will have a substantial impact on the availability of labor. However, NMFS will continue to consider new information that becomes available.

Vessel Operating Cost Savings

Vessels that decide to stop fishing during closure months could save some operating costs. We estimated the 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 that the average annual operating costs for lobster vessels in the Northeast Trap/Pot Management Area is about $50,365 (in 2021 dollars). Table 12 displays the potential cost savings. We calculated the percentage of trips in each month, and then assigned the operating cost to each month based on the trip percentage. Finally, we multiplied the cost per vessel and the affected vessel number to calculate the total annual cost saving for each month.

Table 12: Cost savings for vessels that stop fishing during closure months (in 2021 $).

	Month	Affected vessel number	Annual cost per vessel	Closure month trip %	Monthly cost per vessel	Total cost
Alternative 2	Feb	15	$50,365	4.77%	$2,403	$37,092
	Mar	13	$50,365	3.31%	$1,669	$21,806
	Apr	15	$50,365	4.10%	$2,067	$31,210
Alternative 3	Feb	33	$50,365	4.77%	$2,403	$79,075
	Mar	26	$50,365	3.31%	$1,669	$43,894
	Apr	29	$50,365	4.10%	$2,067	$59,614

Notes:
1. We assume that half of the vessels would stop fishing.
2. Annual cost per vessel is based on Social Science Branch survey results.
3. Closure month trip percentage is from VTR data.

6.4.1.3 Final Results

We estimate that 26 to 31 vessels would be affected by Alternative 2, and 53 to 66 vessels affected by Alternative 3. For Alternative 2, the annual compliance costs including gear transportation cost and lost revenue range from $339,000 to $608,000 for February to April. For vessels moving their gear to new fishing grounds, the costs are around $139,000 to $278,000, about $9,500 to $19,100 per vessel; for vessels that stop fishing, the costs are around $200,000 to $331,000, about $11,000 to $18,000 per vessel (Table 13). For Alternative 3, the annual compliance costs range from $898,000 to $1,453,000. Total costs for vessels moving their gear to new fishing grounds range from $290,000 to $581,000, about $9,900 to $20,000 per vessel. Total costs for vessels that stop fishing are from $608,000 to $872,000, about $11,400 to $20,500 per vessel (Table 14).

Based on the annual compliance costs, we provide the total costs and annualized costs for five years assuming that the costs remain the same every year. The total costs for Alternative 2 are around $1.7 million to $3 million. With a three percent discount rate, the annualized costs would be around $370,000 to $664,000; with a seven percent discount rate, the annualized costs would be around $413,000 to $742,000. For Alternative 3, the total compliance costs for five years are around $4.5 million to $7.3 million. With a three percent discount rate, the annualized costs would be around $981,000 to $1.6 million; with a seven percent discount rate, the annualized costs would be around $1.1 million to $1.8 million.

Table 13: Annual economic impacts of Alternative 2 (Preferred) by month relative to Alternative 1 (No Action) (in 2021$).

	Feb		March		April		Total	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Relocating costs (half vessels)								
Lost revenue	$2,800	$5,600	$1,726	$3,452	$3,443	$6,886	$7,969	$15,938
Gear moving	$46,310	$92,619	$39,185	$78,370	$45,292	$90,583	$130,786	$261,572
Sum	$49,110	$98,219	$40,911	$81,822	$48,735	$97,469	$138,755	$277,511
Stop fishing costs (half vessels)								
Lost revenue	$56,002	$56,002	$34,523	$34,523	$68,860	$68,860	$159,385	$159,385
Gear moving	$46,310	$92,619	$39,185	$78,370	$45,292	$90,583	$130,786	$261,572
(Cost savings)	$37,092	$37,092	$21,806	$21,806	$31,210	$31,210	$90,107	$90,107
Sum	$65,219	$111,529	$51,903	$91,088	$82,942	$128,233	$200,064	$330,850
Total cost	$114,329	$209,748	$92,814	$172,910	$131,676	$225,703	**$338,819**	**$608,361**

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

Table 14: Annual economic impacts of Alternative 3 by month relative to Alternative 1 (No Action) (in 2021 $).

	Feb		March		April		Total	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Relocating costs (half vessels)								
Lost revenue	$11,409	$22,818	$6,604	$13,208	$8,301	$16,603	$26,314	$52,628
Gear moving	$98,726	$197,452	$78,879	$157,758	$86,512	$173,025	$264,117	$528,234
Sum	$110,135	$220,270	$85,483	$170,966	$94,814	$189,627	$290,431	$580,862
Stop fishing costs (half vessels)								
Lost revenue	$228,179	$228,179	$132,079	$132,079	$166,026	$166,026	$526,285	$526,285
Gear moving	$98,726	$197,452	$78,879	$157,758	$86,512	$173,025	$264,117	$528,234
(Cost savings)	$79,075	$79,075	$43,894	$43,894	$59,614	$59,614	$182,584	$182,584
Sum	$247,829	$346,555	$167,064	$245,943	$192,924	$279,437	$607,818	$871,935
Total cost	$357,964	$566,825	$252,547	$416,908	$287,738	$469,064	**$898,249**	**$1,452,797**

Notes:
1 We estimate lost revenue of the relocating vessels to be between 5 and 10 percent of the total landings value.
2. We estimate gear moving costs to take between 3 and 6 days at $1,000/day.

6.4.2 Social Impacts of the Alternatives

Table 15 presents socio-economic data for each county identified as potentially vulnerable to social impacts due to Alternative 2 or Alternative 3. Essex and Plymouth counties have the greatest number of potentially affected vessels and land a large amount of seafood using 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 action 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, trap/pot vessels in Plymouth County could be the community most vulnerable to the implementation of this action. Essex County could also be 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, but the community has more access to alternative jobs than some other counties. Fishermen might be able to make up some lost income from other jobs. Suffolk County might be the least vulnerable to the action.

Table 15: Socio-economic profile of affected communities - Harvest Parameters.

State	County	Major Ports	Top Species by Value	2021 lobster/Jonah Crab Harvest ($)	Lobster/Jonah Crab Value as Percentage of Total Seafood Landing Value	Number of lobster trap/pot Vessels
MA	Essex	Gloucester, Rockport, Marblehead	Lobster, cod, pollock	62,781,295	52%	264
MA	Suffolk	Boston Harbor	Cod, lobster, pollock	2,768,326	14%	20
MA	Norfolk	Cohasset	Lobster, softshell clam, bluefin tuna	1,920,738	91%	17
MA	Plymouth	Plymouth, Scituate, Hingham	Lobster, oysters, cod	22,280,221	60%	164

Data source: NMFS and ACCSP dealer report 2021
Note: Lobster and Jonah crab landings in this table are from all gear types. Essex County landed about $49 million lobster and Jonah crab from trap/pot gear, while all the other three counties were exclusively using trap/pot.

6.4.3 Comparison and Summary of Impacts to Human Communities

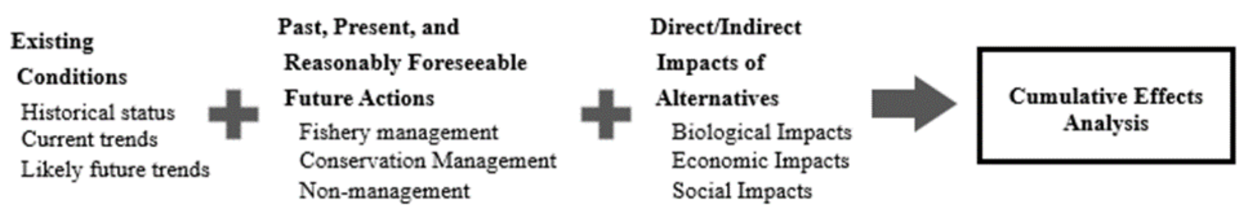
Alternative 1 (No Action) would maintain the status quo, which has a negligible impact on fishing communities in the short term, and might have a slight negative impact in the long term. Without any protection measures, large whale entanglements are more likely to happen in this area, which may cause more restrictive measures in the future. 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 $339,000 to $608,000 with 26 to 31 affected vessels, compared to No Action. 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 action, while Suffolk County might be the least vulnerable. Alternative 3 is expected to have a moderate negative impact on the human community Valued Ecosystem Component, as defined here. Alternative 3 is estimated to impact 53 to 66 vessels for a total estimated cost (including lost revenue) of $898,000 to $1,453,000, compared to No Action. 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.

6.5 Cumulative Impacts of the Alternatives

6.5.1 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 Final Environmental Impact Statement (2021 FEIS; NMFS 2021b) for Amending the Atlantic Large Whale Take Reduction Plan (Plan) and follows the steps depicted in Figure 23. The CEA analysis relies upon the impact designations defined in Subsection 6.1 to determine the cumulative effects of each valued ecosystem component (VEC).

Figure 23: Cumulative effects analysis steps, and how they inform the cumulative effects analysis (adapted from Canter 2012).



6.5.1.1 Geographic and Temporal Scope

The geographic scope of this CEA is focused on the southern portion of Lobster Management Area 1 (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 Atlantic Large Whale Take Reduction Plan (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. This CEA focuses on the lobster and Jonah crab fishery given this is the trap/pot fishery that will most likely be impacted by this action.

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.

6.5.1.2 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.

6.5.2 Summary of Direct and Indirect Impacts of the Alternatives

The direct and indirect impacts of the alternatives on the VECs were discussed in Subsections 6.1 to 6.4 and summarized in Table 16.

Table 16: Direct and indirect impacts of the alternatives on Valued Ecosystem Components. "ESA-listed" refers to species listed as endangered under the Endangered Species Act (ESA), and "MMPA protected species" indicates the species that are protected under the Marine Mammal Protection Act (MMPA).

Alternatives	*Protected Species*	*Habitat*	*Human Communities*
Alternative 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.
Alternative 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.
Alternative 3	**Negligible 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** Catch reduction could be significant.

6.5.3 Status Quo Conditions

The status and trends of each VEC is summarized in Table 17. Additional details can be found in Chapter 5 on the Affected Environment of this document and Chapter 4 in the recent 2021 FEIS (NMFS 2021b).

Table 17: Summary of the current status and trends of the Valued Ecosystem Components.

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.	Under current conditions, right whales are likely to continue declining. Certain protected species may be more resilient to future changes while other populations 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 condition has slowly degraded over time with increasing exposure to anthropogenic stressors.	The habitat condition is rapidly shifting from historical baselines due to 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 the Gulf of Maine (GOM) but depleted in Southern New England (SNE) waters; Jonah crab fishery was a supplement of the lobster fishery.	Total lobster landings peaked in 2015 and started to decrease. GOM represents about 80 percent of all lobster landings; Southern Massachusetts and Rhode Island landed the most Jonah crabs.	GOM lobster landings are trending down and the 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.

6.5.4 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 2021 FEIS prepared for the last substantial modification to the Plan (NMFS 2021b). Much of that information remains applicable, though the temporal scope of the action is limited to the months of February, March, and April. 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.

6.5.4.1 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.

American Lobster and Jonah Crab

There are several additional management actions underway that affect the Northeast American lobster and Jonah crab fishery. In May 2023, the Atlantic States Marine Fisheries Commission (Commission) approved Addendum XXVII to establish a trigger mechanism to implement management measures that increase protection of the Gulf of Maine/Georges Bank spawning lobster stock and address the ongoing decline in stock recruitment. Under Addendum XXVII, changes to gauge and escape vent sizes in Lobster Management Areas (LMAs) 1 (Gulf of Maine), 3 (offshore federal waters) and Outer Cape Cod would be initiated, including the increase in the carapace minimum legal size by 1/8 inches (from ~82 to ~86mm) over a 4-year period. Observed continued decline in recruit abundance for American lobster surpassed the trigger point in 2023. In October 2023, the Commission announced the American Lobster Board's decision to extend the Addendum XXVII implementation date to January 1, 2025 from the previous implementation date of June 2024. On October 2, 2023, NMFS published an interim final rule (88 FR 67667) based on the Commission's recommendations for aggregate ownership caps in LMAs 2 and 3 and a maximum trap cap reduction in LMA 3. The ownership caps and trap cap reduction measures are intended to reduce fishing exploitation and latent effort in the trap fishery by scaling the fishery to the size of the Southern New England lobster stock. The Commission approved Addendum XXIX requiring mandatory coastwide electronic harvester reporting for all federally permitted lobster and crab permit holders. To comply with vessel tracking requirements described in Addendum XXIX, Massachusetts began state-led efforts to roll out the vessel tracking devices on May 1, 2023, and NMFS expects state vessels to be fully in compliance with the addendum by the December 15, 2023 implementation date. The harvester reporting requirement is intended to improve the spatial resolution of harvester data, and improve and expand the collection of fishery effort data.

Groundfish

On February 1, 2022, NMFS approved and implemented fishing years (FYs) 2021 through 2023 small-mesh multispecies specifications. This action contained three items: (1) 2021-2023 specifications for small-mesh multispecies stocks of whiting and red hake; (2) a provision to reset the total allowable landings trigger for northern red hake to the original value of 90 percent; and (3) an adjustment to the whiting possession limit on trips using less than 3-inch (7.6 cm) mesh codends.

On December 9, 2022, NMFS implemented regulations for Amendment 23 to Northeast Multispecies FMP (87 FR 75852) to improve data collection for monitoring and reporting, including measures to approve additional electronic monitoring technologies. The at-sea monitoring coverage should have indirect benefits to protected resources by providing additional information on interactions with fishing gear, which should reduce uncertainty in bycatch estimates.

On August 18, 2023, NMFS published a final rule (88 FR 56527) approving and implementing Framework Adjustment 65 to the Northeast Multispecies FMP. This action revised rebuilding plan for Gulf of Maine cod; set 2023-2024 total allowable catches (TACs) for U.S./Canada shared resources on Georges Bank; set 2023-2024 specifications for Georges Bank yellowtail flounder and Georges Bank cod including a catch target for the recreational fishery; set 2023-2025 specifications for 14 additional groundfish stocks; temporarily removed the sector management uncertainty buffer for Gulf of Maine haddock and white hake; and temporarily modified commercial accountability measures for Georges Bank cod. This action also implemented an emergency action to set FY 2023 catch limits for Gulf of Maine haddock.

In December 2023, New England Fishery Management Council (NEFMC) approved Framework 66 to the Northeast Multispecies FMP. This action would: (1) Update status determination criteria for several stocks; (2) revise the rebuilding plan for white hake; (3) establish FY 2024-2025 TAC for shared U.S./Canada resources on Georges Bank; (4) establish FY 2024-2025 specifications for Georges Bank yellowtail flounder, white hake, and Gulf of Maine haddock; (5) establish FY 2024-2026 specifications for redfish, northern windowpane flounder, and southern windowpane flounder; (6) propose alternatives to address large swings in Canadian halibut catch for U.S. halibut management; and (7) extend the removal of the sector management uncertainty buffer for white hake and Gulf of Maine haddock as contained in Framework 65 until the next specifications cycle for those stocks.

Monkfish

On August 11, 2023, NMFS published a final rule (88 FR 54495) approving and implementing Framework Adjustment 13 to the Monkfish FMP. This action sets monkfish specifications for fishing years 2023 through 2025, adjust annual Days-At-Sea (DAS) allocations, and increase the minimum gillnet mesh size from 10 increase to 12 inches (25.4 to 30.5 cm) for vessels fishing on monkfish DAS beginning in fishing year 2026.

Scallop

On January 12, 2022, NMFS implemented Amendment 21 to the Atlantic Sea Scallop FMP (87 FR 1688). This action addressed several issues: (1) Measures related to the Northern Gulf of Maine (NGOM) Management Area; (2) Limited Access General Category (LAGC) individual fishing quota (IFQ) possession limits; and (3) ability of Limited Access vessels with LAGC IFQ to transfer quota to LAGC IFQ only vessels.

On March 30, 2022, NMFS approved and implemented Framework Adjustment 34 to the Atlantic Sea Scallop FMP (87 FR 18277). This action included specifications for the 2022 FY, default specifications for 2023, incorporating the new specifications-setting methodology and other changes developed in Amendment 21. In addition, Framework 34 included measures to protect small scallops, promote scallop recruitment in the mid-Atlantic, and reduce bycatch of flatfish.

On April 3, 2023, NMFS approved and implemented Framework Adjustment 36 to the Atlantic Sea Scallop FMP (88 FR 19559), as adopted and submitted by the NEFMC. Framework 36 established scallop specifications and other measures for FYs 2023 and 2024 and 36 implemented measures to protect small scallops to support rotational access area trips to the fleet in future years.

In April 2023, the NEFMC initiated Framework Adjustment 37 to the Atlantic Sea Scallop FMP. This action would establish a scallop rotational harvest program within and/or around the Closed Area II Habitat Closure Area (*i.e.,* "habitat management area" or "HMA") that avoids habitats important to juvenile cod, minimizes adverse effects to essential fish habitats, minimizes adverse biological and economic impacts to other managed fisheries, and contributes to optimum yield for the scallop fishery. The fishing gear restrictions associated with the HMA on the Northern Edge are intended to minimize the impacts of fishing on essential fish habitats (EFH) for numerous species. As such, this framework would amend each of the New England Council's FMPs that have a connection to the HMA in terms of designated EFH. The affiliated FMPs include scallops, groundfish, herring, monkfish, and skates.

Herring

In 2019, the NEFMC initiated Framework Adjustment 7 to the Atlantic Herring FMP. This action contains measures to protect spawning adult herring on Georges Bank and remains in development.

On July 19, 2022, NMFS approved and implemented Framework Adjustment 9 to the Atlantic Herring FMP (87 FR 42962). This action included a rebuilding plan for Atlantic herring and adjusted herring accountability measures.

On March 23, 2023, NMFS implemented 2023–2025 Atlantic herring fishery specifications through an interim final rule (88 FR 17397).

In September 2023, the NEFMC initiated Amendment 10 the Atlantic Herring FMP. This action proposes to address spatial and temporal allocation and management of Atlantic herring at the management unit level to minimize user conflicts, contribute to optimum yield, and support rebuilding of the resource.

Skates

On March 17, 2022, NMFS published a final rule (87 FR 15146) approving and implementing 2022 and 2023 skate specifications, as recommended by the NEFMC. All other fishery management measures, such as trip limits, remain unchanged under this action.

On June 24, 2022, NMFS approved Amendment 8 to the Northeast Skate Complex FMP (87 FR 39002; June 30, 2023), as submitted by the NEFMC. This amendment updated the management objectives of the skate FMP.

In December 2023, the NEFMC approved Framework Adjustment 12 to the Northeast Skate Complex. This framework includes: (1) Proposed specifications for the 2024-2025 FYs; (2) removing the partial possession prohibition on barndoor skates, which currently caps barndoor skate landings at 25 percent of total wing landings; and (3) allowing the possession of smooth skates. The framework contains possession limit alternatives for the wing fishery but no changes for the bait fishery.

Spiny Dogfish

On April 7, 2022, NMFS approved and implemented Atlantic spiny dogfish specifications for the 2022 FY, as recommended by the Mid-Atlantic and New England Fishery Management Councils. This action also adjusted the commercial trip limit.

On May 3, 2023, NMFS approved and implemented Atlantic spiny dogfish specifications for the 2023 FY, as recommended by the Mid-Atlantic and New England Fishery Management Councils, including a reduction in the commercial quota.

Protected Species

Atlantic Sturgeon

The 2021 Batched Fisheries Biological Opinion (2021 BiOp; NMFS 2021a) required NMFS to convene a working group to review all the available information on Atlantic sturgeon bycatch in the Federal large mesh gillnet fisheries (mesh size ≥7 inches; 17.8 cm) and to develop an Action Plan by May 27, 2022, to reduce Atlantic sturgeon bycatch in these fisheries by 2024. Additionally, the 2021 BiOp requires that this Action Plan include an evaluation of information available on post-release mortality, identification of data needed to better assess impacts, and a plan, including timeframes, for obtaining and using this information to evaluate impacts. NMFS subsequently convened the Atlantic Sturgeon Bycatch Reduction Working Group which on May 26, 2022 produced the Draft Action Plan to Reduce Atlantic Sturgeon Bycatch in Federal Large Mesh Gillnet Fisheries. On September 26, 2022, after incorporating public feedback, NMFS released the Final Action Plan to Reduce Atlantic Sturgeon Bycatch in Federal Large Mesh Gillnet Fisheries. The Action Plan recommended a series of potential measures for consideration with the New England and Mid-Atlantic Fishery Management Council (Councils) and the Commission. The three measures for consideration include: (1) low-profile gillnet gear through the use of tie-downs; (2) closed or gear restricted areas in regions where Atlantic sturgeon bycatch is common; and (3) soak time limitations for gillnet gear. The Councils have formed a joint Sturgeon Bycatch Fishery Management Action Team/ Plan Development Team, which is working to develop a joint FMP action for the Monkfish and Spiny Dogfish FMPs to address the recommendations made in the Action Plan. This work is expected to be completed in time for measures to be effective for FY 2024.

Protected Species

FMPs and their amendments can mitigate the impact of fishing gear on protected large whale species. The amendments and addenda referenced in this analysis were primarily intended to optimize fishing practices, restrict overfishing, manage bycatch, and gather information to better manage the stock. 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 Large Whale Decision Support Tool 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 are likely to be a slight negative to moderate negative impact on the protected species VEC.

Habitat

The NEFMC adopted the Southern New England Habitat Area of Particular Concern Framework Draft in September 2023. The action considers five alternatives to Habitat of Particular Concern (HAPC) designations in Southern New England in effort to conserve spawning areas and complex habitats in offshore wind lease areas. NMFS has proposed to designate the Council's preferred alternative for the Southern New England HAPC designation, which would identify certain habitats in the area overlapping offshore wind lease sites in southern New England as HAPC, including the area around Cox Ledge. The proposed rule (88 FR 65944) was published on September 26, 2023, and the public comment period closed on October 26, 2023.

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.

6.5.4.2 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.

During the development of an Endangered Species Act (ESA) section 7 consultation on the authorization of Federal fisheries in the Greater Atlantic Region, NFMS identified the need to implement measures to further reduce entanglement of right whales to meet the mandates of the Endangered Species Act (ESA). In May 2021, NMFS published the North Atlantic Right Whale Conservation Framework for Federal Fisheries in the Greater Atlantic Region (Conservation Framework; NMFS 2021c). The Conservation Framework did not specify particular measures but identified the level of reductions in mortalities and serious injuries that NMFS committed to achieve in order to meet its ESA mandates over a ten-year period from 2021 to 2030.

In September 2021, the Atlantic Large Whale Take Reduction Plan (Plan) was amended to reduce entanglement risk for large whales. The 2021 final rule (86 FR 51970, September 17, 2021) implemented a series of management measures in the Northeast Trap/Pot Management Area, including time/area closures, minimum trap per trawl requirements, use of weak buoy line inserts or buoy line, and gear marking requirements implemented on September 17, 2021 and gear modifications went into effect on May 1, 2022. NMFS took emergency action in 2022 and 2023 to address acute entanglement risk presented by trap/pot fisheries in Federal waters of Massachusetts Bay (*i.e.*, MRA Wedge). In 2022, the MRA Wedge was closed to trap/pot fishing with buoy lines from April 1 through April 30, 2022 via the 2022 emergency rule (87 FR 11590, March 2, 2022) following requests for action from Massachusetts Division of Marine Fisheries and non-governmental organizations. On January 31, 2023, NMFS announced an extension of the 2022 emergency rule closing the MRA Wedge to trap/pot fishing with buoy lines while adjacent Federal waters within the MRA were similarly restricted from February 1 through April 30 to address this gap in protections again in 2023 (see Subsection 3.1 for more in-depth information on these development of these actions).

In late 2021, new right whale population information demonstrated a continued decline and higher mortality level than previously anticipated. Accordingly, NMFS announced its intention to begin a rulemaking process to amend the Plan to reduce the risk of mortalities and serious injuries of right whales caused by entanglement in the U.S. East Coast gillnet, Atlantic mixed species trap/pot, and Mid-Atlantic lobster and Jonah crab trap/pot fisheries (86 FR 43996, August 11, 2021). The Atlantic Large Whale Take Reduction Team (Team) met during numerous webinars and meetings in 2022 to review scoping results and develop recommendations. In September, 2022 NMFS expanded the rulemaking to all trap/pot and gillnet fisheries along the U.S. East Coast, including northeast commercial lobster and Jonah crab trap/pot fisheries (87 FR 55405, September 9, 2022). Then, on November 17, 2022, the Court ordered NMFS to promulgate a new Plan rule by December 9, 2024 that was consistent with the Court's decision (*Center for Biological Diversity, et al.,* v. *Raimondo, et al.,* (Civ. No. 18-112 (D.D.C.)).

The Team reconvened for nearly three weeks of discussions between September and early December 2022 to develop recommendations for NMFS to consider that would reduce the coastwide risk that U.S. trap/pot and gillnet commercial fisheries pose to right whales by 88 to 93 percent, the amount estimated necessary to bring mortality and serious injury to a level below the potential biological removal level, following the next rulemaking that would be put in place by the end of 2024. In addition to discussing key measures including time/area closures, minimum trap per trawl requirements, use of weak buoy line inserts or buoy line, and gear marking requirements, the Team spent considerable time discussing the feasibility and management frameworks necessary to expand the use of on-demand gear (sometimes referred to as ropeless gear) in existing and recommended restricted areas. A majority of the Team also voted in favor of recommendations for a Plan amendment that would have included the spatial expansion of the MRA that would address the entanglement risk in the MRA Wedge and waters farther north, including Jeffreys Ledge.[10]

On December 29, 2022, President Biden signed H.R. 2617, the Consolidated Appropriations Act, 2023 (CAA) into law. The CAA establishes that from December 29, 2022, through December 31, 2028, NMFS' September 17, 2021 final rule amending the Plan, Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations, published at 86 FR 51970 (September 17, 2021), "shall be deemed sufficient to ensure that the continued Federal and State authorizations of the American lobster and Jonah crab fisheries are in full compliance" with the MMPA and ESA. H.R. 2617-1631–H.R. 2617-1632 (Division JJ–North Atlantic Right Whales, Title I–North Atlantic Right Whales and Regulations, § 101(a)). During this period, the CAA appropriated funds and directed NMFS to promote the adoption of innovative gear technologies in consultation with states and fishing industry partners.[11] NMFS is also required to promulgate new lobster and Jonah crab regulations, consistent with the MMPA and ESA, to take effect by December 31, 2028. *Id* at § 101(a)(2).

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[10] For a full list of the Team's deliberations and recommendations following the December 2022 meeting, please see the Teams December 2022 Key Outcomes Summary (https://www.fisheries.noaa.gov/s3/2023-03/Nov-Dec2022KeyOutcomes-ALWTRT-v2-GARFO.pdf).

[11] The CAA is a negotiated compromise among members of Congress that delays further rulemaking with respect to the lobster and Jonah crab fisheries to provide funding and time to develop innovative alternatives to closures while also permitting the MRA Wedge closure. That negotiation, in Senator King's words, was made among "the various people interested in this issue." King's statement: "It is one that the Maine delegation, myself and Senator COLLINS, Congresswoman PINGREE, and Congressman GOLDEN have been working on since this decision. And it is a compromise that has been negotiated between the various people interested in this issue and this body that leaves in place all of those protective measures that I mentioned—the weak links, the weaker ropes, the ropes out of the water, the marking of the gear. All of those stay in place. Importantly, it provides funding for two purposes. One is the development of gear that will reduce the risk even further—lobster gear, that is. For example, there is a lot of discussion of something called ropeless fishing, which would be traps on the bottom and a buoy on the bottom that can be released by a radio signal, come to the surface, and then you can pull the traps up. So there is no rope in the water. Now, that is a great idea. The problem is, it is not ready for prime time. It is being tried. There are experiments going on with it. There are some serious problems with it. For example, currently, if you are a lobsterman, you go out and you see other buoys, and that tells you where other traps are, so you don't put yours down on top of theirs. In this ropeless fishing configuration, until we figure that out, we can't have multiple traps laying on top of each other and becoming entangled. The other problem is, it is very expensive. We are talking about tens and hundreds of thousands of dollars for the guy that owns this boat. So what the bill provides is funding for research of how to develop this, whether it is ropeless fishing or some other technology that we don't know right now, to mitigate whatever risk there is even further. So that is one funding in the bill."

Notwithstanding these directions, § 101(b) of the CAA provides that § 101(a) shall not apply to "any action taken to extend or make final an emergency rule that is in place on the date of enactment of this Act, affecting lobster and Jonah crab." *Id*. NMFS will continue forward with analyzing the recommendations put forward by the Team pertaining to other trap/pot and gillnet fisheries in the U.S. Atlantic. NMFS anticipates publishing a proposed rule for other trap/pot and gillnet in 2024. Additionally, NMFS will continue to develop management alternatives to reduce entanglement risk of Northeast lobster and Jonah crab fisheries. This work is expected to be completed in time for measures to be effective according to the CAA's deadline.

Any future rulemaking to amend the Plan will consider measures to reduce the amount of buoy lines in the water through a variety of mechanisms, including the adoption of modifications to FMP requirements for surface buoys so that on-demand gear can be fished without Exempted Fishing Permits of other authorizations, especially as an alternative to closures. The Draft Ropeless Roadmap: A Strategy to Develop On-Demand Fishing was released for public input in July 2022 (Draft Ropeless Roadmap; NMFS 2022a). The Draft Ropeless Roadmap describes the current state of on-demand fishing and outlines a path for increasing adoption of this technology in commercial fisheries in the U.S. Atlantic. Current regulations require the use of surface marking systems (*i.e*., persistent surface buoys attached to vertical end lines) to mark the location of gear for all trap/pot and gillnet fisheries. Removing or modifying the static buoy line requirements is under discussion with the Councils and Commission to permit the use of on-demand gear in current restricted areas and under potential future closures or rope reduction strategies in future amendments to the Plan.

NMFS also published a proposed rule aimed at reducing the risk and severity of vessel strikes to right whales (87 FR 46921, August 30, 2022). In addition to modifying the spatial and temporal boundaries of current speed restriction areas referred to as Seasonal Management Areas, NMFS is proposing to expand these requirements to vessels equal or greater than 35 feet (10.6 meters) in length. Current regulations published on October 10, 2008 (73 FR 60173) apply similar Seasonal Management Area restrictions to vessels equal or greater than 65 feet (19.8 meters) in length. NMFS accepted public comments on the proposed rule until October 31, 2022, and intended to implement a final rule to provide protections by the 2023-2024 calving season.

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 for vessels, on-demand fishing, and on-board 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. The impact of the CAA on protected species remains unclear. The rulemaking timeline under the CAA supersedes the court-ordered 2024 deadline (*Center for Biological Diversity, et al.,* v. *Raimondo, et al.,* (Civ. No. 18-112 (D.D.C.)) by establishing a Congressional deadline at the end of 2028 for new regulations for the lobster and Jonah crab fisheries. As the fisheries fishing the vast majority of buoy lines in U.S. waters, these fisheries pose the majority of entanglement risk to right whales in the U.S. This timeline could uphold the status quo with high to moderate negative impacts on the protected species that experience gear interactions with those fisheries. It is uncertain if there will be any indirect effects from a change in the regulatory timeline on the right whale population or whether the magnitude of measures needed in the next rulemaking to reduce mortality and serious injury incidental to commercial fishing to below the stock's potential biological removal (PBR) will change. For these reasons, we cannot predict exactly how the CAA will directly or indirectly impact protected species. 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.*, the potential biological removal level 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 Trap/Pot Management Area, particularly those related to regulating pollutants. Pollution and climate change can contribute to habitat degradation through chemical and mechanical disruption of habitat structure and negative impacts on the health of organisms (see the next subsection). 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 impact the physical environment. However, continued fishing effort will continue to impact habitats. The net impact of all actions is likely slightly negative to slightly positive.

Human Communities

The CAA is expected to have a moderate positive impact on the lobster and Jonah crab fishing communities in the short-term because it provides more time to secure additional whale and fishery distribution data, develop and field test on-demand and other innovative fishing gear, and prepare for future modifications to the Plan. Negative consequences of the CAA's timeline for Plan modifications could result if mortalities of North Atlantic right whales remain high, and the right whale population decreases which would further reduce the PBR level, or if an unauthorized incidental entanglement is documented in lobster or Jonah crab fisheries. The ultimate consequence may be a more restrictive rulemaking in the future. 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, such as reductions in gear, expensive changes in gear configurations, and exclusion from areas they have fished in the past, 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 on human communities by supporting healthy fisheries.

6.5.4.3 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 (NMFS 2021b) and summarized below.

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. A recent report on the impacts of offshore wind on right whales recommended increased study and monitoring of oceanographic and environmental conditions to understand the impacts of offshore wind arrays on right whale habitat and prey availability (NAS 2024). In January 2024, the Bureau of Ocean Energy Management and NOAA Fisheries jointly published the North Atlantic Right Whale and Offshore Wind Strategy to focus and coordinate efforts related to the North Atlantic right whale and offshore wind development (BOEM and NOAA Fisheries 2024). Changes in prey availability related to climate change are expected to become more pronounced and variable over time. Underwater anthropogenic 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. There are currently no leases for offshore wind farms or oil and gas activities within the specific geographic scope of this EA, although the Gulf of Maine Draft Wind Energy Area defined by the Bureau of Ocean Energy Management overlaps with Lobster Management Areas 1 and 3 of the Northeast Lobster and Jonah crab fisheries. Pollution has a slight negative impact on marine habitats, partly due to past mitigation 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 slightly 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.

6.5.5 Cumulative Effects Analysis

A summary of the cumulative impacts on all VECs for Alternative 2 (Preferred) is summarized in Table 18.

Table 18: Summary table 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 are likely to reduce gear encounters through effort reductions. Additional management actions taken under ESA/MMPA should also help mitigate the risk of gear interactions.
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 due to continued fishing effort. Non-fishery management actions likely improved ocean quality, which benefitted habitats. Anthropogenic and natural stressors have had moderate negative impacts on habitats.	**Negligible to Slight Positive** Continued management is not expected to measurably change habitat quality and existing cumulative impacts.
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.

6.6 Summary

We analyzed the relative impacts of all alternatives on physical habitat, protected species, and human communities. The impacts of Alternative 2 (Preferred) considered on each valued ecosystem component described in the Affected Environment are in Chapter 6 and are summarized here.

When considered in conjunction with all other pressures placed on protected species by past, present, and reasonably foreseeable future actions, the action is expected to slightly reduce the impact of human activities (*i.e.*, entanglement risk) on species listed as endangered under the Endangered Species Act (ESA-listed; right, fin, and sei whales) and protected species under the Marine Mammal Protection Act (MMPA; humpback and minke whales). Considered alone, ESA-listed and MMPA protected species would be moderately negative to slightly negatively impacted because this action does not eliminate the potential for all interaction risk between fishing gear and marine mammals that could result in takes above the Potential Biological Removal level. Considered alone, Alternative 2 has a negligible to slight negative impact on habitat due to continued disturbance from long trawls outside of the closure period. Alternative 2 will have a slight negative impact on fishing communities impacted by this action due to extra traveling costs and reduced revenue.

When Alternative 2 is considered in conjunction with all other impacts from past, present, and reasonably foreseeable future actions, it is not expected to result in any significant impacts, positive or negative. No significant cumulative effects on the human environment are associated with the action.

7 APPLICABLE LAWS AND REGULATIONS

7.1 Endangered Species Act

Section 7 of the Endangered Species Act (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 (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 May 8, 2023 that the proposed rule modifying the Plan falls within the scope of the 2021 consultation and that reinitiation of the existing consultation is not required. As the final rule is unchanged from the proposed rule considered in the consultation that concluded in May 2023, additional consultation is unnecessary.

7.2 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 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 MMPA directs the Agencies to reduce mortalities and serious injuries incidental to fishing activities to levels below the Potential Biological Removal 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 Subsection 6.2. NMFS has reviewed the impacts of this action on marine mammals and concluded that the management actions are consistent with the provisions of the MMPA.

7.3 Paperwork Reduction Act

This action contains no information collection requirements under the Paper Reduction Act of 1995.

7.4 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 (MSA) require the National Marine Fisheries Service 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 April 13, 2023 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.

7.5 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 May 15, 2023. 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 final 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 a 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 the National Environmental Policy Act 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 Environmental Assessment 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, the Northeast Fisheries Science Center, NMFS Headquarters, and the Office of General Council. 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.

7.6 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.

This action was developed in compliance with the requirements of the APA, and these requirements will continue to be followed when the final regulation is published. Section 553 of the APA establishes procedural requirements applicable to informal rulemaking by federal agencies. NMFS is not waving the default rulemaking procedures for this action.

7.7 Coastal Zone Management Act

The Coastal Zone Management Act of 1972 (CZMA) is designed to encourage and assist states in developing coastal management programs, to coordinate state activities, and to safeguard regional and national interests in the coastal zone. Section 307(c)(1) of the CZMA 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 determined that this action is consistent to the maximum extent practicable with the approved coastal management programs of Massachusetts, New Hampshire and Maine. This action's effects on coastal use or resources falls within the scope of the Atlantic Large Whale Take Reduction Plan (Plan) as modified by the 2021 final rule (86 FR 51970, September 17, 2021). On January 18, 2021, NMFS submitted the most recent Plan consistency determination to affected States for review by the responsible state agencies under section 307 of the CZMA. New Hampshire agreed with NMFS' determination. Massachusetts and Maine did not respond; therefore, consistency is inferred.

7.8 Executive Order 13132 Federalism

Executive Order (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.

7.9 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 RFA emphasizes predicting significant adverse impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action. A Final Regulatory Flexibility Analysis has been prepared to accompany the Final Rule that describes the impact of the rule on small entities.

7.10 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." The Final Rule has been determined to be not significant for the purposes of E.O. 12866. The analysis meeting the requirements of the E.O. are found in the Regulatory Impact Review for the Final Rule.

7.11 Consolidated Appropriations Act, 2023

On December 29, 2022, President Biden signed H.R. 2617, the Consolidated Appropriations Act (CAA), into law. The CAA establishes that from December 29, 2022, through December 31, 2028, NMFS' September 17, 2021, rule amending the Plan, Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations, published at 86 FR 51970 (September 17, 2021), "shall be deemed sufficient to ensure that the continued Federal and State authorizations of the American lobster and Jonah crab fisheries are in full compliance" with the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). H.R. 2617-1631–H.R. 2617-1632 (Division JJ–North Atlantic Right Whales, Title I–North Atlantic Right Whales and Regulations, § 101(a)). The CAA requires NMFS to promulgate new lobster and Jonah crab regulations, consistent with the MMPA and ESA, that take effect by December 31, 2028. Id at § 101(a)(2). Notwithstanding these directions, § 101(b) of the CAA provides that § 101(a) shall not apply to "any action taken to extend or make final an emergency rule that is in place on the date of enactment of this Act, affecting lobster and Jonah crab."

7.12 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 (CEQ) 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 Environmental Assessment 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)).

7.12.1 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 Subsection 3.2;
- The alternatives that were considered are in Subsections 4.1, 4.2 and 4.3;
- The environmental impacts of the action are in Subsections 6.2, 6.3, and 6.4;
- The agencies and persons consulted on this action are in Subsection 7.12.3.

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

- Background and purpose are in Subsections 3.1 and 3.2;
- A description of the affected environment is in Subsections 5.1, 5.2, and 5.3;
- Cumulative effects of the action are in Subsection 7.5;
- A list of preparers is in Subsection 7.12.4.

7.12.2 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.

7.12.3 Agencies Consulted

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

- Massachusetts Division of Marine Fisheries
- New England Fisheries Management Council

7.12.4 List of Preparers

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

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ENVIRONMENTAL ASSESSMENT OF MAKING PERMANENT THE MASSACHUSETTS RESTRICTED AREA WEDGE

VOLUME II

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

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Chapter 3 Appendices

Appendix 3.1 Letters of Concern

Following are six letters NMFS received regarding the overlap of North Atlantic right whales and fishing gear in unrestricted federal waters surround by Massachusetts Restricted Area. Also included is an email from Massachusetts Division of Marine Fisheries to commercial lobster permit holders regarding the Massachusetts Restricted Area Wedge emergency closure in 2023.

August 22, 2023

Michael Pentony
Regional Administrator
NOAA Fisheries Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930

RE: Massachusetts Restricted Area Wedge

Dear Mr. Pentony,

In our ongoing cooperative efforts to protect northern right whales, there is an important but currently unresolved conservation measure that deserves our collective attention—the so-called Massachusetts Restricted Area Wedge ("Wedge Area") seasonal closure. From the Division of Marine Fisheries' perspective, the rationale for a federal closure to trap gear or persistent buoy lines in the Wedge Area is strong and unchanged for our prior correspondence. The Wedge Area is adjacent to the largest seasonal aggregation of right whales in the world. Furthermore, aerial surveillance data demonstrate routine use of this area and nearby portions of inshore Massachusetts Bay by right whales from February into May. The gap in the closure between state and federal waters that occurred in 2021 created a refuge for fishers to place their gear, leading to extraordinarily high gear densities in the Wedge Area. DMF believes most gear in this area is infrequently hauled and largely being stored in this location instead of the fishers retrieving the gear and bringing it ashore. The potential for a dense gear field adjacent to a large aggregation of right whales creates a level of entanglement risk that is troubling and begs for a permanent management solution.

I appreciate NOAA's responsiveness over the past two years to enact emergency closures to persistent buoy lines in the Wedge Area. You took these actions in part at the request of the Commonwealth, but the timing of the actions over the past two years has been less than ideal. In 2022, NOAA Fisheries was only able to close the Wedge Area for the month of April, limiting its effectiveness as a risk reduction measure. In 2023, the closure was enacted for February 1, but announced on January 31, giving commercial lobster fishers limited time to comply.

NOAA Fisheries has publicly stated in court filings its intent to permanently close the Wedge Area. In the recent litigation filed by the Massachusetts Lobstermen's Association challenging the 2022 emergency closure of the Wedge Area, your declaration stated, "NMFS intends to issue a notice of proposed rulemaking seeking public comment on a rule that would permanently implement a seasonal closure of the MRA Wedge Area to trap/pot fishing with vertical buoy lines on an annual basis. Based on public comments, the relevant factual circumstances, and the best scientific information available at the time, NMFS will then determine whether to finalize the rule and, if so, the scope of the final rule." DMF supports this and urges you to commence this rulemaking as soon as possible to avoid delays in implementation and maximize the utility of such a closure. DMF is also keenly interested in enhancing the ability for the Commonwealth to enforce all rules designed to protect northern right whales in Massachusetts' waters and adjacent federal waters.

Please let me know how DMF can facilitate the adoption of this surgical seasonal closure that will enhance right whale conservation.

Sincerely,

Daniel J McKiernan

Daniel J. McKiernan, Director
Massachusetts Division of Marine Fisheries

cc:
Massachusetts Marine Fisheries Advisory Commission

Important Updates for Commercial Lobster Permit Holders

1 message

From: **MA Division of Marine Fisheries** <marine.fish@public.govdelivery.com>
Date: Tue, Jan 10, 2023 at 10:23 AM
Subject: Important Updates for Commercial Lobster Permit Holders
To: <jennifer.goebel@noaa.gov>

Having trouble viewing this email? View it as a Web page.

January 10, 2023

Seasonal Commercial Trap Gear Closure Reminder: Massachusetts' seasonal commercial trap gear closure goes into effect on February 1, 2023 (see map). The closure includes all waters under the jurisdiction of the Commonwealth north and east of Cape Cod. The state closure does not extend into those southern state waters in Lobster Conservation Management Area 2. This state closure was extended in 2021 to include state waters north from Scituate to the New Hampshire maritime border. The closure remains in effect until May 15 but may be rescinded before or extend past that date based on the observed presence or absence of right whales in state waters.

The purpose of this closure is to protect seasonal aggregations of right whales from potential entanglements in buoy lines. Compliance with this closure is critically important to the Commonwealth's right whale conservation strategy. DMF will be partnering with the Massachusetts Environmental Police and a small group of commercial trap fishers to remove any lost or abandoned gear remaining in the closure area after this date. To assist us in this, DMF is requesting fishers contact DMF if they observe any lost or abandoned gear and provide us with information regarding the location, i.e., latitudinal/longitudinal coordinates or the TD's (LORAN coordinates) of this gear. Please e-mail any such information to conservationsolutions@mass.gov.

There are also seasonal federal closures to the fishing of lobster and crab trap gear with persistent buoy lines occurring from February 1 – April 30. This includes the Massachusetts' Restricted Area, which contains adjacent federal waters on Stellwagen Bank and within the Outer Cape Cod Lobster Conservation Management Area, as well as the South Island Restricted Area, which is bounded by 41° 20' N to the north, 40°30'N to the south, 69° 30' W to the east, and 71° 19' W to the west**.**

Massachusetts Restricted Area Wedge: The Massachusetts Restricted Area Wedge ("wedge") is an area of federal waters that is not seasonally closed to trap fishing or the use of persistent buoy lines, but is located between the Massachusetts' state waters trap gear closure in Massachusetts Bay to the west and the Massachusetts Restricted Area west of Stellwagen Bank to the east. In 2022, NOAA Fisheries closed this area to traps using persistent buoy lines on an emergency basis from April 1 – April 30 and DMF has received a number of inquires questioning if this area will be closed again in 2023. While NOAA Fisheries has not announced a closure of this area for 2023, the Regional Administrator, Mike Pentony, has informed DMF the federal government intends to implement an emergency closure of this area imminently. Please stay tuned for more information.

Federal lobster trap permit holders are reminded that all buoy lines affixed to trap gear set in federal waters must comply with federal buoy marking requirements. See NOAA Fisheries' gear marking illustration for more information on marking requirements. Please note that Massachusetts' regulations require all red state marks have a corresponding federal green mark when the gear is set in federal waters.

Weak Links: DMF is no longer requiring commercial trap fishers to rig the buoy lines with a weak link at the buoy capable of breaking when exposed to 600-pounds of push-pull pressure. Fishers who continue to want to fish with weak links at the buoy may continue to do so.

This action does not, in any way, alter the continued requirement that commercial trap fishers fish buoy lines that break when exposed to 1,700 pounds of tension. This may be achieved through fishing custom 1,700-pound breaking strength buoy line or inserting contrivances approved by NOAA Fisheries into the buoy line. For Massachusetts state waters, these contrivances are to occur within the top 75% of the buoy line at a frequency of once every 60’.

2023 Trap Tag Order Form Update and Installation Deadline: Trap tag order forms have been mailed. Please note the coastwide trap tag price, negotiated by ASMFC on behalf of the Northeast states, has increased from $.17 to $.18 per tag for 2023. Please place your trap tag orders by February 1st to ensure delivery prior to May 1st. Permit holders are reminded that the deadline for affixing year-specific trap tags on traps is May 1st of the current fishing year.

2022 Commercial Permits Extended Through February 28, 2023: Due to delays in the generation, mailing, and processing of 2023 permit renewal applications, DMF has extended the validity of 2022 commercial, dealer, and special permits through February 28, 2023. Active permit holders will need a valid 2023 permit beginning on March 1, 2023. See original December 1st advisory.

Limited Entry Permit Renewal Deadline Reminder: Renewal applications for limited entry permits or permits that have limited entry endorsements or a striped bass endorsement must be received in our office or postmarked by February 28, 2023.

If you have any questions, please email us at marine.fish@mass.gov.

Massachusetts Division of Marine Fisheries
251 Causeway Street, Suite 400, Boston, MA 02114
(617) 626-1520 | Contact Us | Find a Location

The Commonwealth of Massachusetts
Division of Marine Fisheries

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CHARLES D. BAKER, Governor | KARYN E. POLITO, Lt. Governor | BETHANY A. CARD, Secretary | RONALD S. AMIDON, Commissioner | DANIEL J. MCKIERNAN, Director

January 4, 2023

Michael Pentony
Regional Administrator
NOAA Fisheries Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930

Dear Michael,

On December 12 2022, I made a request to NOAA Fisheries to repeat the seasonal closure enacted last winter to close the Massachusetts Restricted Area Wedge ("wedge")—a spatial gap between the state and federal seasonal trap gear closures in Massachusetts Bay. This area west of Stellwagen Bank is a magnet for trap gear for fishers who opt not to bring their gear home for the season and instead move gear out of the Massachusetts Seasonal Trap Gear Closure and the Massachusetts Restricted Area and into the wedge. The co-occurrence of this gear with the seasonal presence of right whales in the wedge, particularly during the spring months, creates an elevated risk of entanglement.

Your agency's action to close this area was much appreciated by the Commonwealth, although the timing of your 2022 action was delayed and began on April 1—a full two months after the adjacent areas were already closed. A February 1 start date for this closure would have been preferred to rid the area of persistent buoy lines and further reduce entanglement risk when right whales are present.
I had anticipated after last winter's closure of the area that NOAA would be in a position to enact this as a final rule. Unfortunately, due to a variety of circumstances, a permanent closure to the wedge has not transpired and it has become an ephemeral rule necessitating annual renewal.

Much has transpired over the past few weeks with the enactment of the Congressional Omnibus Appropriations action affecting your agency's ability to further regulate the American Lobster and Jonah Crab fisheries through modifications to the Take Reduction Plan. I suspect you and the policy and legal experts are still determining the impacts of the Congressional action on the agency's action plan to conserve right whales. With all this considered, as well as the intense work NOAA Fisheries and DMF have dedicated over the past several years to the development of additional risk reduction measures, I do not want to see this issue fall through the bureaucratic cracks.

DMF believes this closure is still warranted and should be pursued by NOAA Fisheries. In fact, the budgetary language provides authorization for you to continue with this action:

(b) EXCEPTION.—The provisions of subsection (a)shall not apply to an existing emergency rule, or any action taken to extend or make final an emergency rule that is in place on the date of enactment of this Act, affecting lobster and Jonah crab.

You and NOAA Fisheries staff have DMF's full support for a permanent adoption of a closure of the wedge annually from February through May, or as long as the adjacent areas remain closed. Please let me know if you believe this rulemaking is warranted and executable given the circumstances created by the Omnibus Appropriations action. We are already receiving inquiries from lobster fishers who are making business decisions to remove or leave gear in the wedge.

In closing, if you need any assistance on this matter my staff and I are available to assist.

Sincerely,

Daniel J McKiernan

Daniel J. McKiernan, Director

Cc: Janet Coit, Assistant Administrator for Fisheries
Samuel Rauch, Deputy Assistant Administrator
Marine Fisheries Advisory Commission members

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CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

BETHANY A. CARD
Secretary

RONALD S. AMIDON
Commissioner

DANIEL J. MCKIERNAN
Director

December 12, 2022

Michael Pentony
Regional Administrator
NOAA Fisheries Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930

Dear Mr. Pentony,

I am writing you to share two concerns I have regarding the federal coordination of the Atlantic Large Whale Take Reduction Plan (ALWTRP) rule-making to reduce the risk of serious injury and mortality to the North Atlantic right whale ("NARW"). I hope you can consider and address these concerns this winter and as ALWTRP rule making progresses over the course of the next two years.

1. Spatial Gaps Between State and Federal Trap Gear Closures for the Massachusetts Restricted Area

I wrote to you on this subject on January 7, 2022. In this letter, I expressed my concerns regarding the seasonal entanglement risk for the NARW in the EEZ west of Stellwagen Bank and informed NOAA Fisheries there is a portion of federal waters within the Gulf of Maine that remains open to trap fishing and the use of persistent buoy lines and is sandwiched between Massachusetts' February 1 – May 15 Commercial Trap Gear Closure to Protect Right Whales [322 CMR 12.04] and the federal February 1 – April 30 Massachusetts Restricted Area Closure.

This spatial gap between state and federal closures poses a substantial and unnecessary entanglement risk to NARW. Having this near-shore area remain open to trap gear fishing and persistent buoy lines when adjacent state and federal waters are closed creates an opportunity for federally permitted vessels to fish or store buoyed trap gear in the area. Since 2018, sightings data indicate that NARW are being increasingly observed in state and federal waters in Massachusetts Bay and north towards the New Hampshire coastline. The combined effect is a documentable seasonal co-occurrence between NARW and buoyed trap gear, particularly during April and May when right whales begin to seasonally migrate out of Cape Cod Bay (Figure 1). I am concerned this continued overlap of buoyed trap gear with aggregations of NARW could result in an entanglement in waters off Massachusetts' coast that could threaten the viability of Massachusetts' fixed gear fisheries moving forward.

NOAA Fisheries was responsive when I raised this issue back in January and you pursued an emergency rule to close the so-called Massachusetts Restricted Area Wedge from April 1 – April 30 in 2022. The Massachusetts Restricted Area Wedge was inclusive of those federal waters west of 70° 30’ west longitude between 42° 12’ N latitude to the south and 42° 39.77’ N latitude to the north. I commend you for taking this important action.

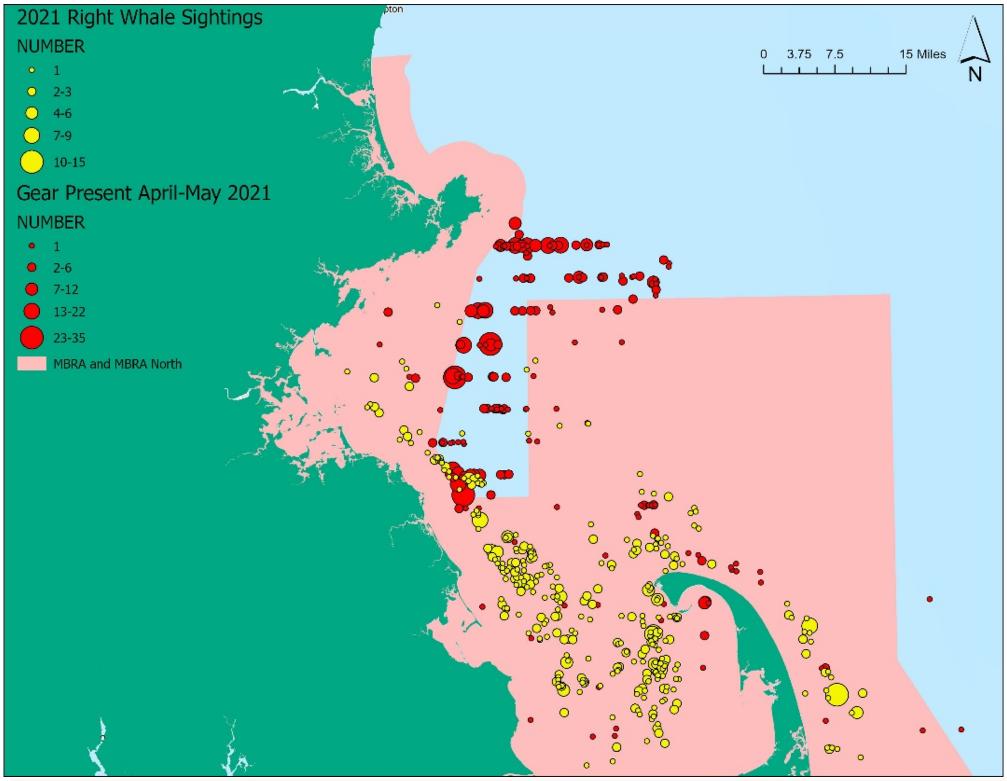

Figure 1. Right whale sightings in 2021 and buoy lines documented in April and May 2021 (CCS data)

During the course of 2022, NOAA Fisheries did not pursue interim rule-making to make permanent the emergency closure of the Massachusetts Restricted Area Wedge. As a result, in 2023, this area will again be open to federally permitted vessels to fish or store buoyed trap gear during the late winter and early spring months. I encourage NOAA Fisheries to consider the entanglement risk posed by spatial gaps in seasonal buoyed trap gear closure coverage. Moreover, I strongly support NOAA Fisheries re-closing the Massachusetts Restricted Area Wedge—similar to this past year—for 2023 and 2024, or until the new ALWTRP rules are implemented.

2. Enhanced Coordination in ALWTRP Rule Making Within NOAA Fisheries and with the Councils

As a result of the recent Boasberg decision, NOAA Fisheries has initiated a two-year rule making process to reduce the risk of NARW entanglements in regulated fisheries by 90% coastwide in order to achieve PBR. This presents a substantial and unprecedented conservation challenge. The breadth of this rule-making endeavor is considerable and it expands across various fisheries and gear types. Moreover, some potential outcomes may have indirect impacts on fisheries not regulated under the ALWTRP. Accordingly, NOAA Fisheries should enhance coordination regarding ALWTRP rule-making efforts between its Protected Resources Division and its Sustainable Fisheries Division and with the New England and Mid-Atlantic Fishery Management Councils.

There is substantial overlap between what the TRT is discussing and considering and the work being conducted by the Sustainable Fisheries Division. In my experience, there can be a disconnect between the two programs. For instance, there are legacy fisheries—where effort and participation is tightly controlled at the state and federal levels (e.g., lobster trap)—that are required to substantially cut how they conduct their fishing activities to address NARW entanglement risk. Meanwhile, there are limited federal controls on the proliferation of new fixed gear fishing effort (e.g., waved whelk pot, black sea bass pot) in the federal zone that increase the presence of persistent buoy lines in the water column and subsequent risk to NARW. This disconnect complicates management and hurts NOAA Fisheries credibility with stakeholders.

To this point, I was encouraged that staff from the Sustainable Fisheries Division attended the recent ALWTRP industry scoping meeting with the southern New England gillnet fleet. There is overlap between the management of the skate, monkfish, and groundfish fisheries in the region and the management of this gillnet fishery with regards to NARW entanglement risk. Having staff from both divisions present made for a more robust and informed dialogue. More deliberate coordination among NOAA Fisheries staff is necessary and appropriate to comprehensively address the robust challenge the TRT currently faces.

Similarly, there should be vigorous coordination between NOAA Fisheries and the New England and Mid-Atlantic Fishery Management Councils. There are certain management measures that may achieve risk reduction that are outside the purview of the TRT and require Council action. For instance, the southern New England monkfish and skate gillnet fleet expressed interest in addressing latent effort as a means of reducing entanglement risk and this would require the Council to amend the relevant fishery management plans.

However, the most important place for coordination between the ALWTRP rule making process and the Councils is with regards to the potential use of on-demand buoy line systems ("ropeless fishing") and or alternatively, using only one buoy line on multi-trap trawls. If these types of trap fishing activities are going to be authorized or mandated in the federal zone, there will be a proliferation of trap gear without surface markings. This substantially increases the likelihood of gear conflicts and poses a significant additional safety risk to commercial fishers whose gear may become hung-up on this unmarked gear. To avoid such gear conflicts, I anticipate the New England and Mid-Atlantic Fishery Management Councils are going to have to take actions across a variety of federally managed fisheries prosecuted by mobile gear to require vessels be equipped with technology to determine the presence unbuoyed trap gear.

On a similar but unrelated matter, the draft Sturgeon Action Plan to reduce bycatch in gillnet fisheries warrants similar coordination across NOAA Fisheries, and with the Councils, as well as the Atlantic States Marine Fisheries Commission.

Thank you for your time reviewing my concerns. Please let me know if there is any way for the Massachusetts Division of Marine Fisheries to further assist NOAA Fisheries in meeting this critical and considerable management challenge.

Best regards,

Daniel J. McKiernan, Director
Massachusetts Division of Marine Fisheries

cc: Massachusetts Marine Fisheries Advisory Commission; Massachusetts Department of Fish and Game; New England Fishery Management Council; Mid-Atlantic Fishery Management Council

Enc: January 7, 2022 letter from DMF to GARFO

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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).

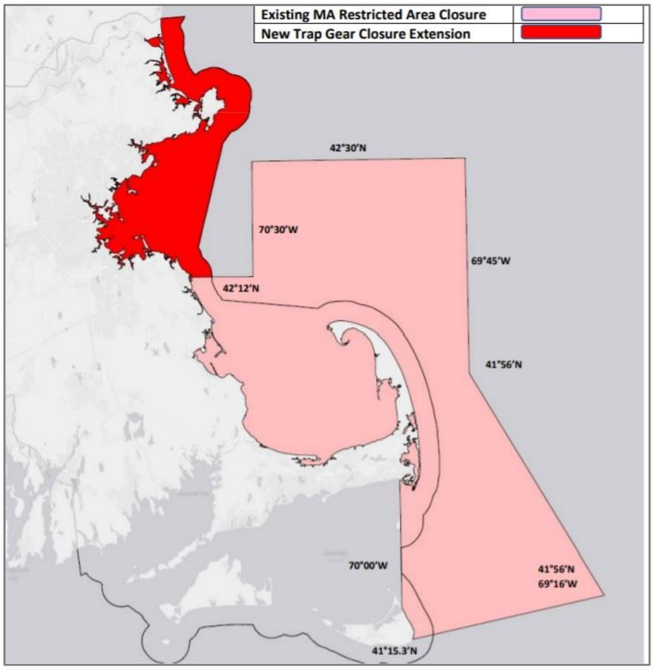


Figure 1. DMF trap/gear closure, February 1 – May 15

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).

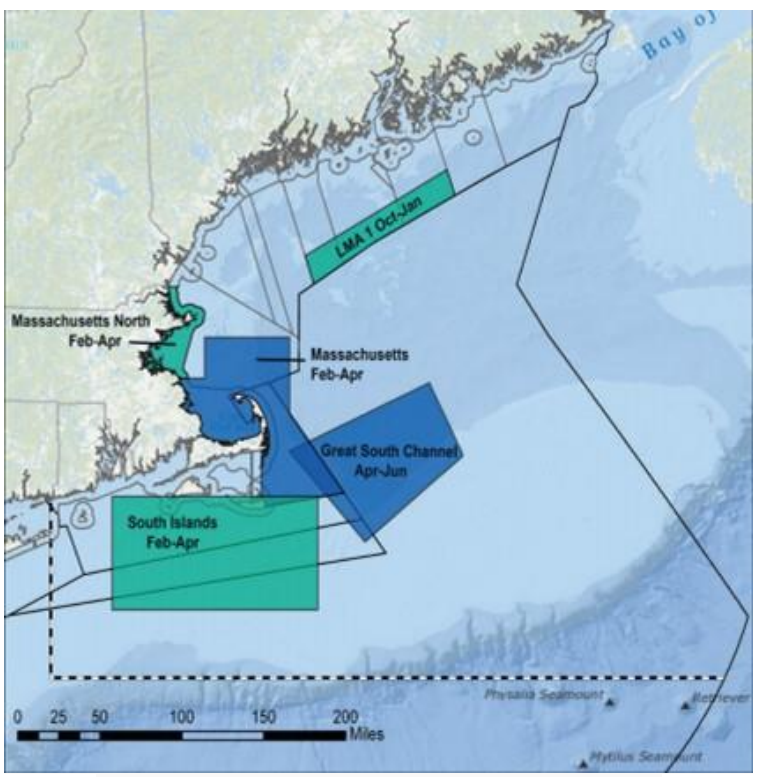


Figure 2. Map of Massachusetts Restricted Area

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).

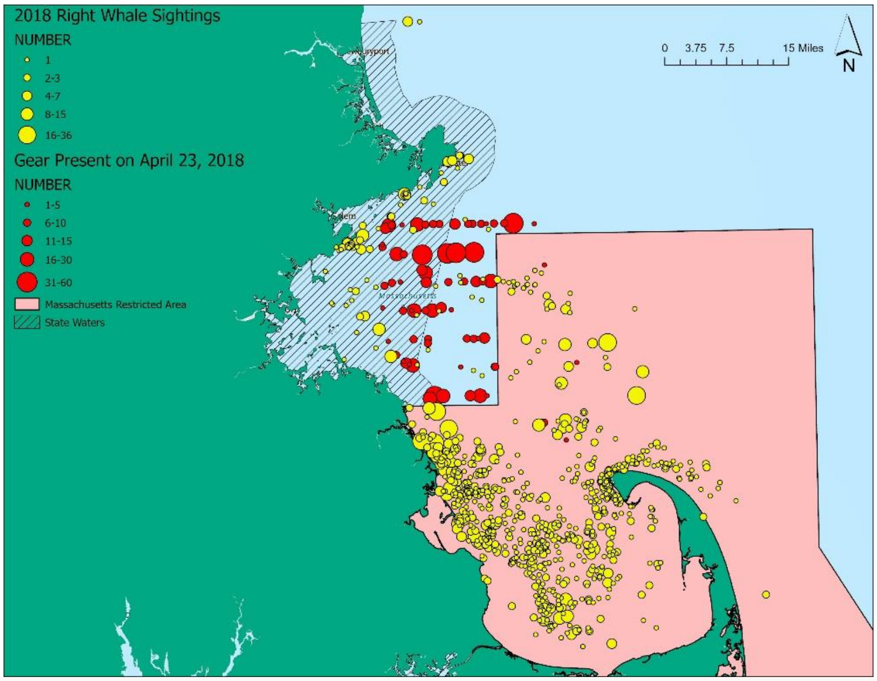


Figure 3. Right whale sightings in 2018 and buoy lines documented on April 23, 2018

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.

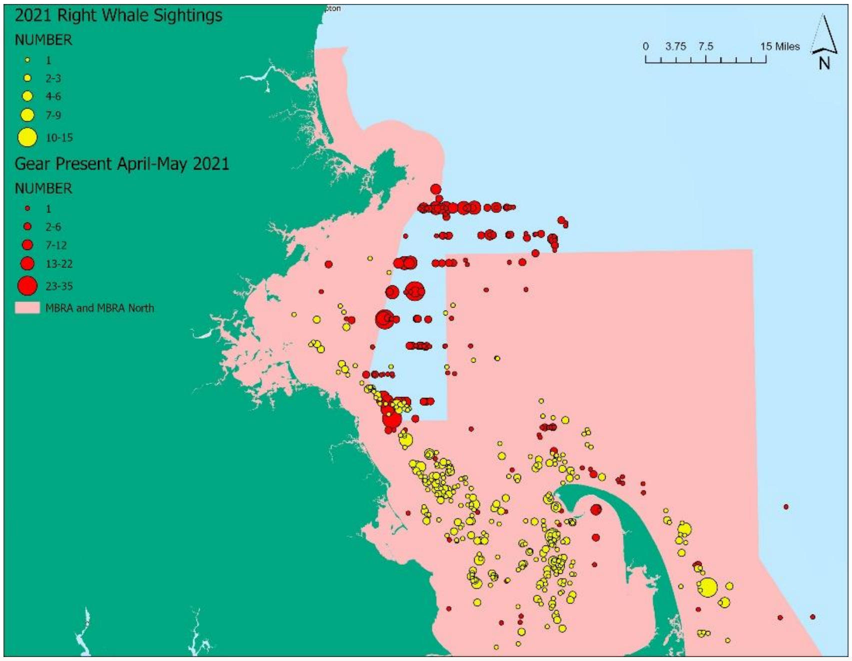


Figure 4. Right whale sightings in 2021 and buoy lines documented in April and May 2021

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

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,

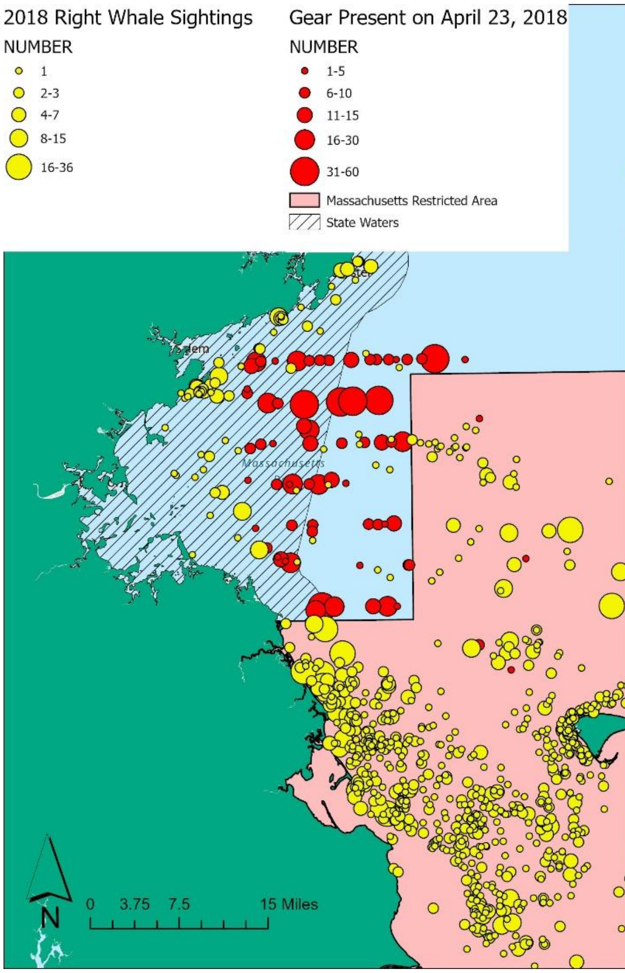
Regina Asmutis-Silvia
Whale and Dolphin Conservation

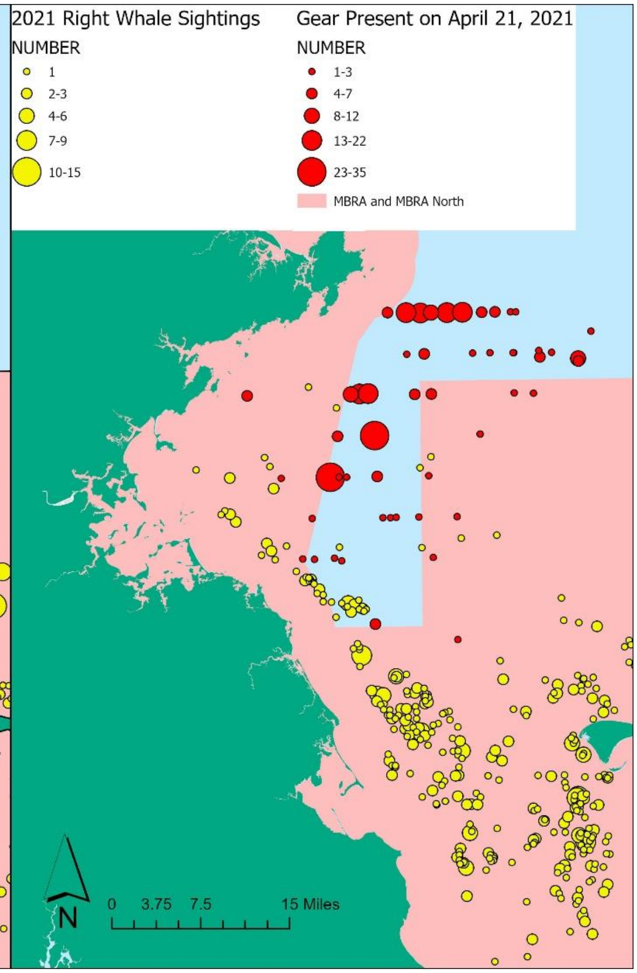
Erica Fuller
Conservation Law Foundation

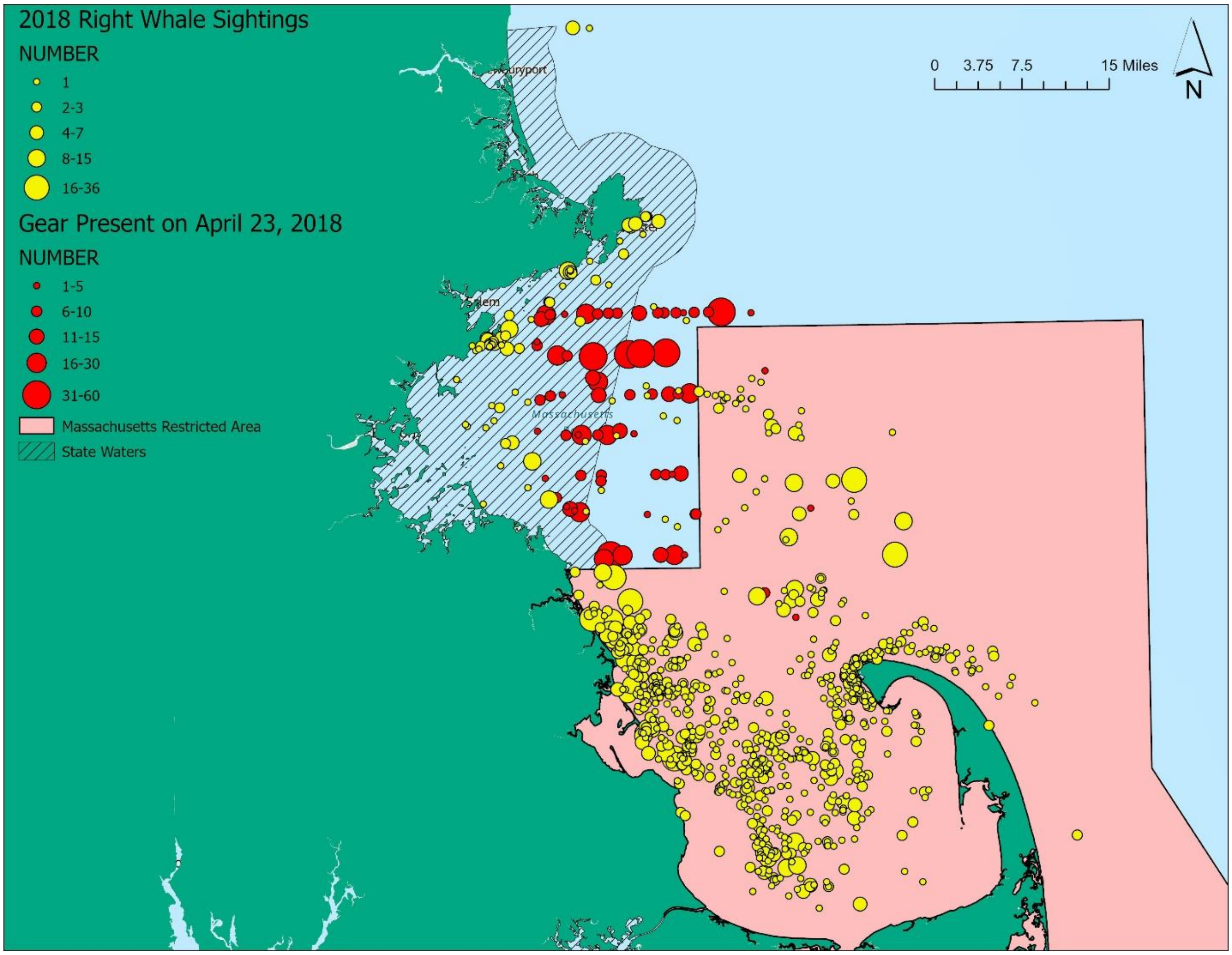
CC:

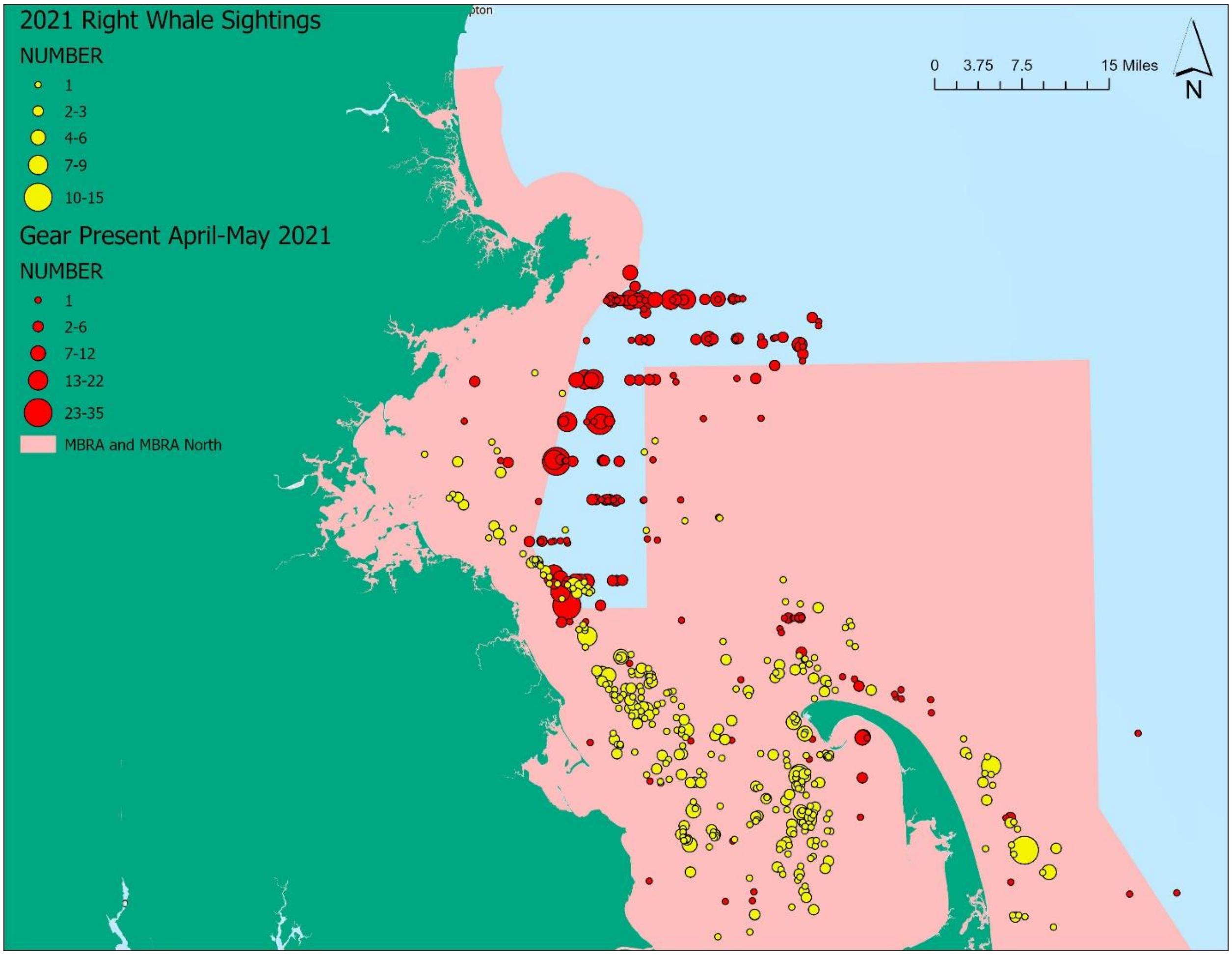
Bob Glen (robert.glenn@mass.gov)
Bennett Brooks (bbrooks@cbi.org)
Marisa Trego (marisa.trego@noaa.gov)

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
0 3.75 7.5 15 Miles
N
Salem
Massachusetts

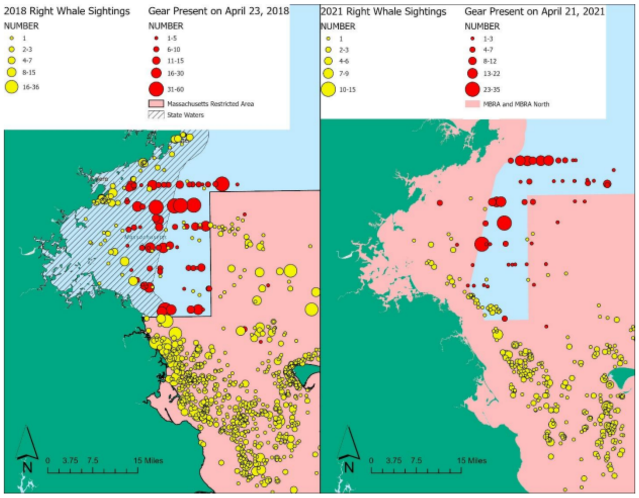

2021 Right Whale Sightings
NUMBER
1
2-3
4-6
7-9
10-15
Gear Present April-May 2021
NUMBER
1
2-6
7-12
13-22
23-35
MBRA and MBRA North
0 3.75 7.5 15 Miles
N

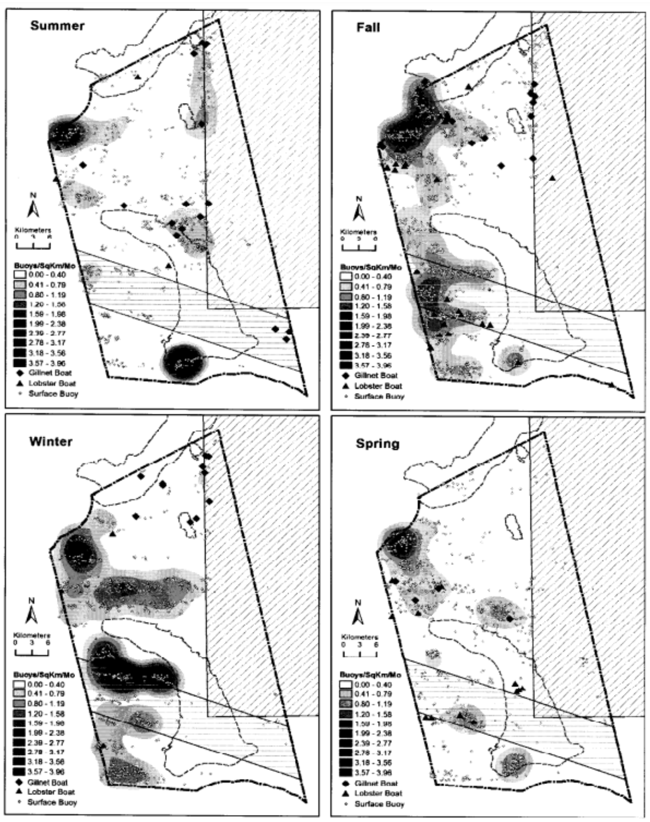
Dear ALWTRT Members,

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
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
N
0 3.75 7.5 15 Miles
N
0 3.75 7.5 15 Miles


Summer
Fall
Winter
Spring
N
Kilometers
0 3 6
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

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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.

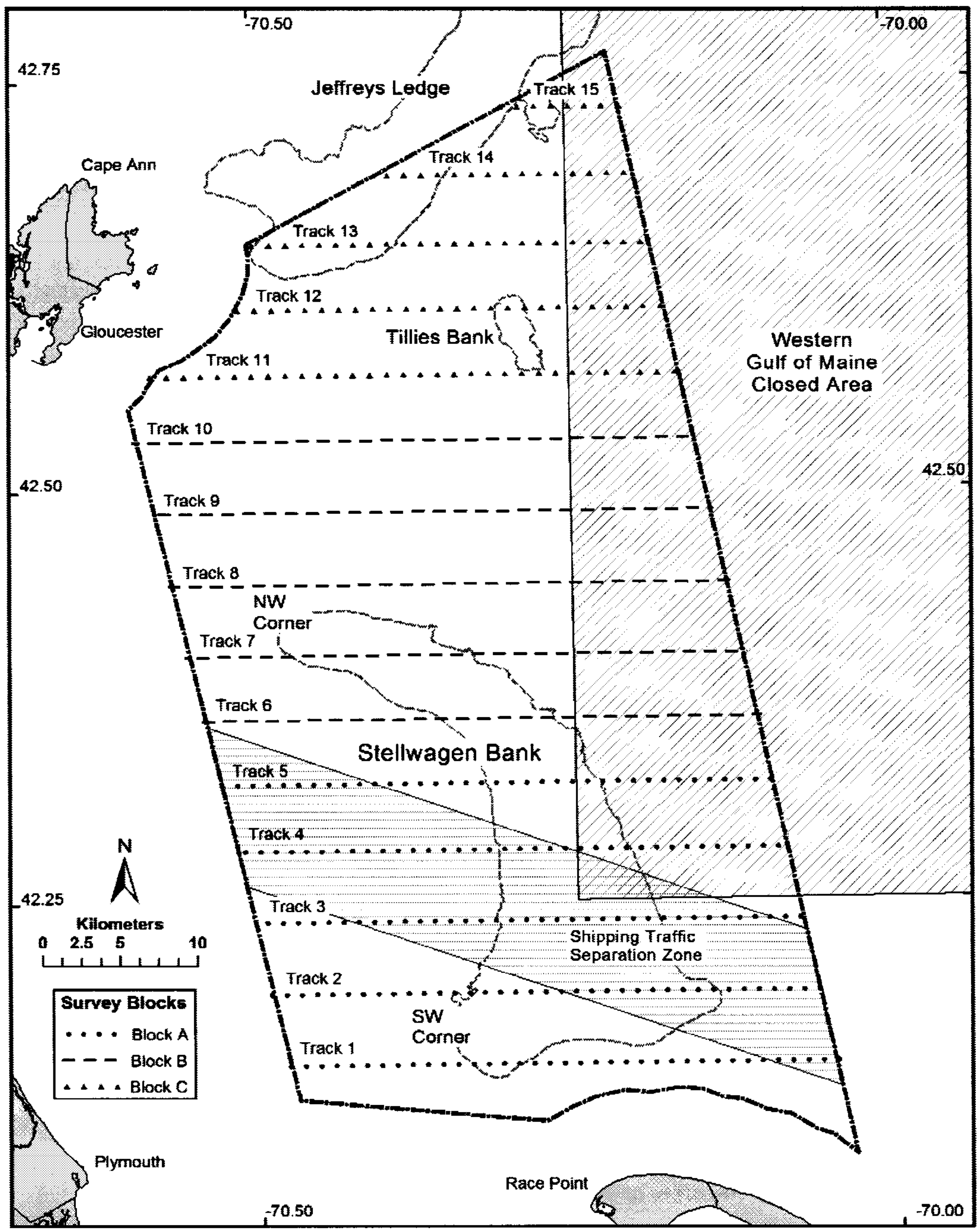
METHODS

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/km²/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/km²/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/km²/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/km^2/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.

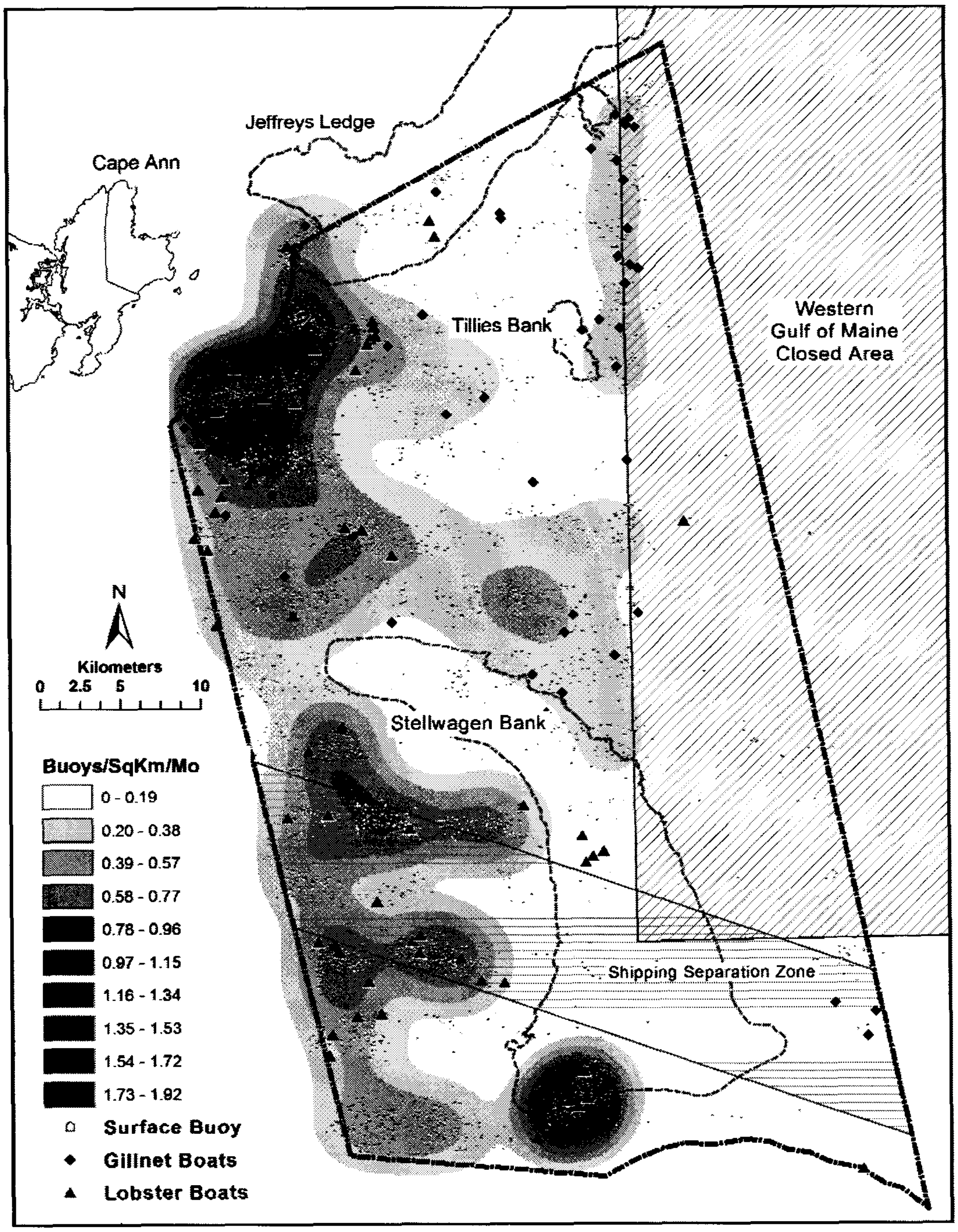
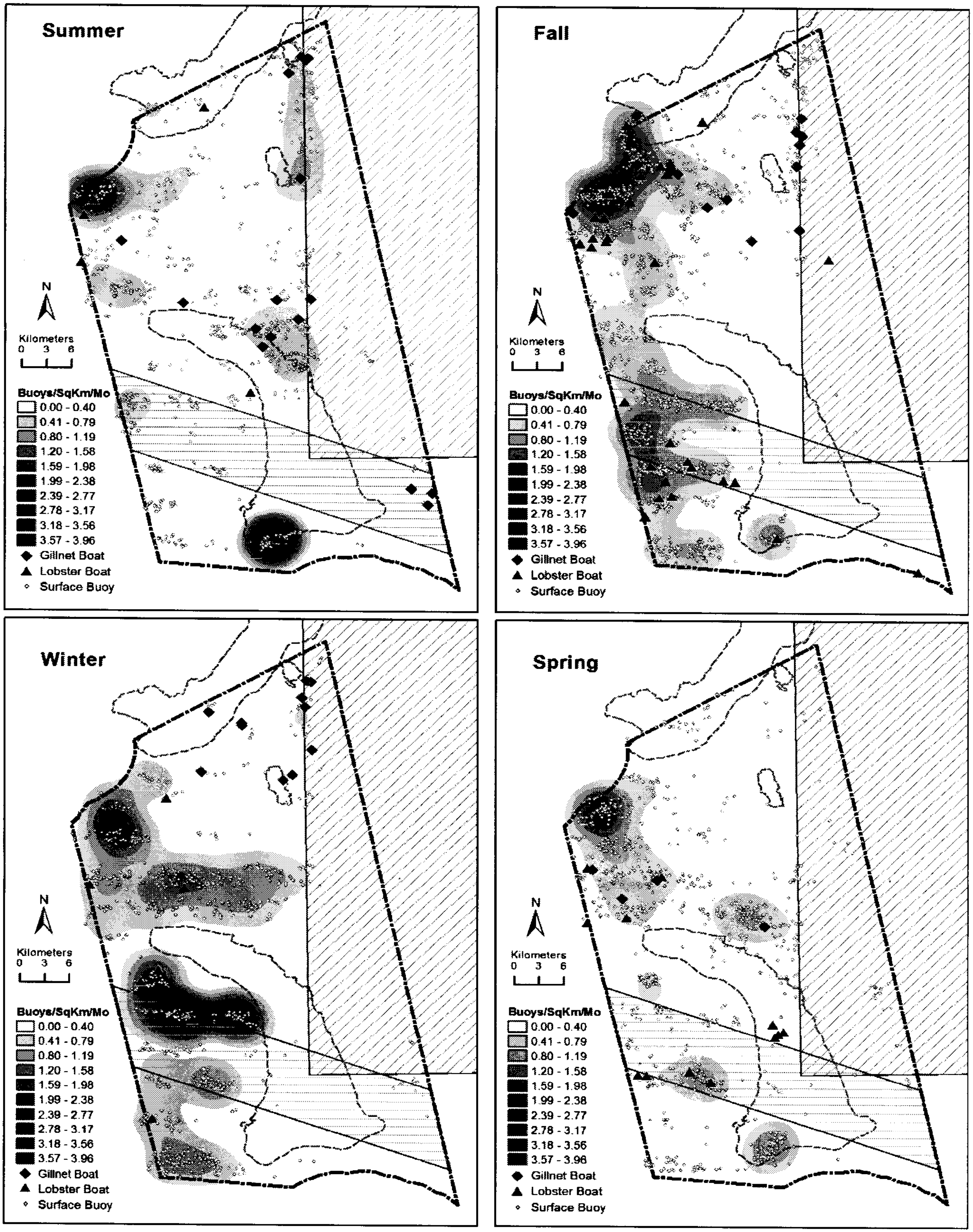


Figure 3. The seasonal density and distribution of surface buoys within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each point represents the sighting of one or more surface buoys. Surface buoys are indicators of fixed fishing gear (trap or gillnet)"sets" that can 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.

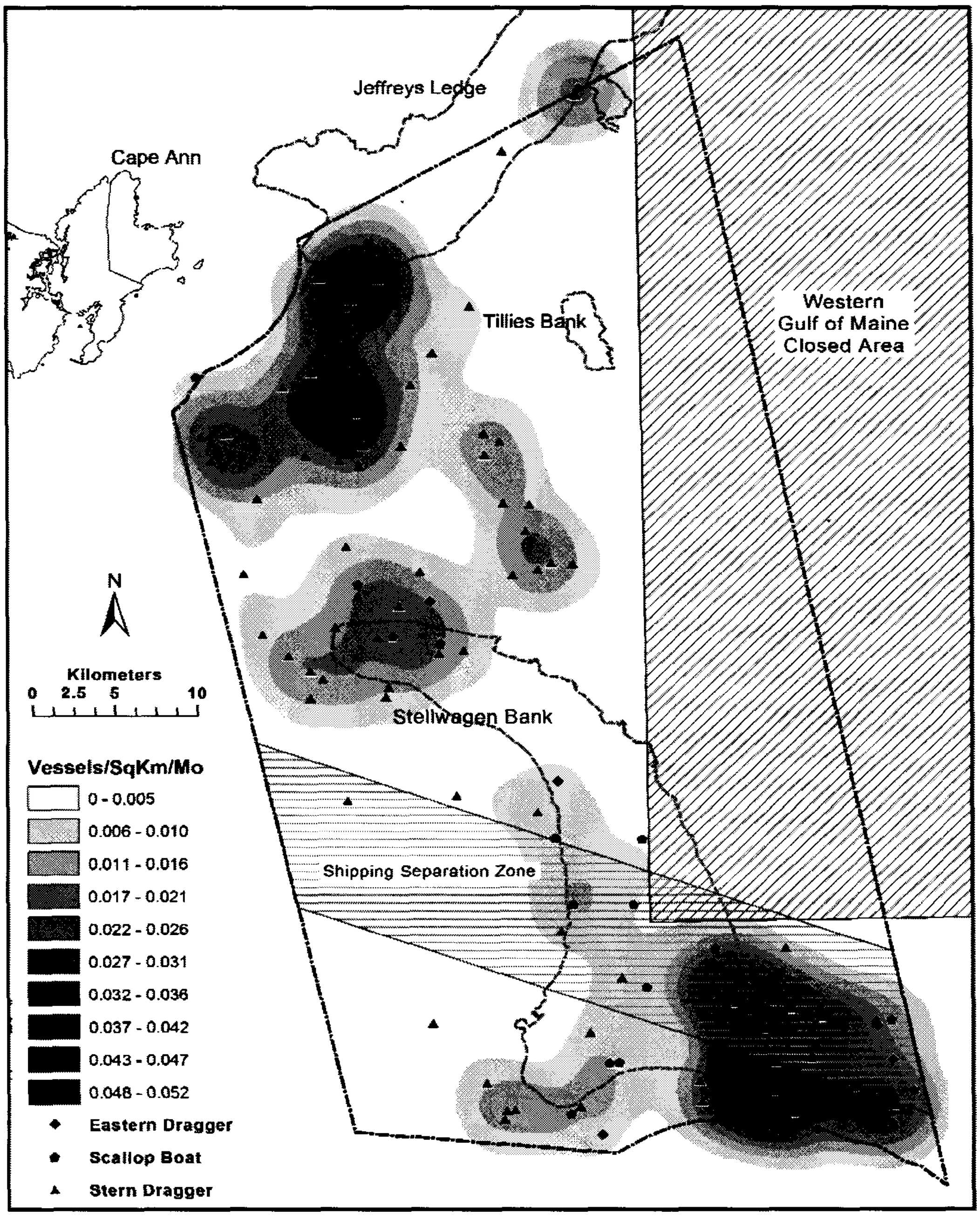


bouys/km²/month), but was absent during the winter months. Another dense seasonal aggregation occurred in the northwest section of the Sanctuary during the spring, winter and fall (~1–2 surface bouys/km²/month). A third concentration occurred during the winter in an area to the west of Stellwagen Bank. 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/km^2/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/km^2/month), followed by the area around Jeffreys Ledge (~0.08–0.09 whale/km^2/month) (Figure 6). Other areas of concentration occurred around the southeast and northwest corners of Stellwagen Bank (0.05–0.06 whale/km^2/month and 0.02 -0.04 whale/km^2/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/km^2/month) and Jeffreys Ledge (0.25–0.28 whale/km^2/month) (Figure 7). Other high use areas by season were: fall; southeast corner of Stellwagen Bank (0.13–0.16 whale/km^2/month), winter; a small area in the Sanctuary's northeast quarter (0.36–0.39 whale/km^2/month)[7] and spring; Jeffreys Ledge (0.13–0.16 whale/km^2/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.

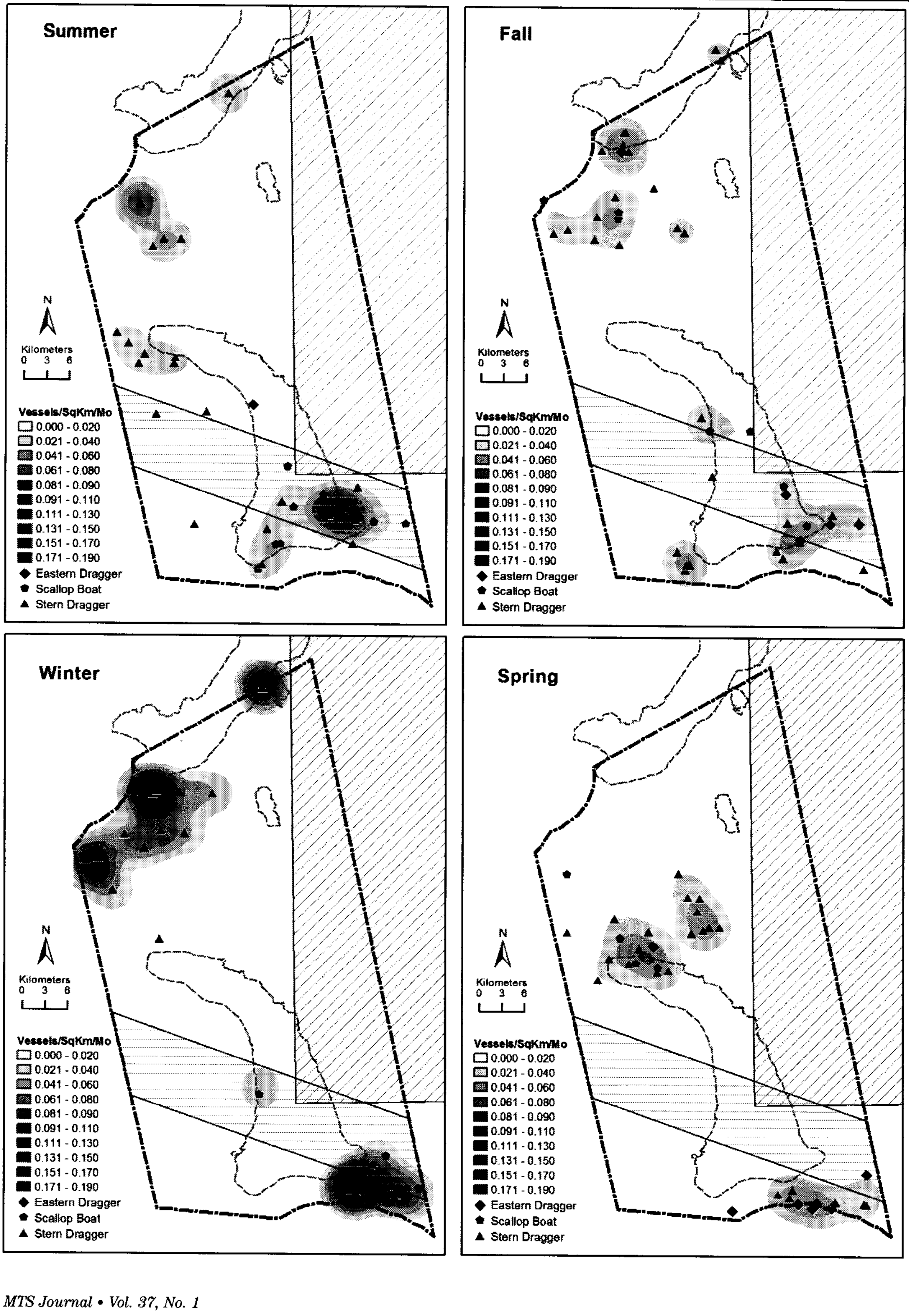
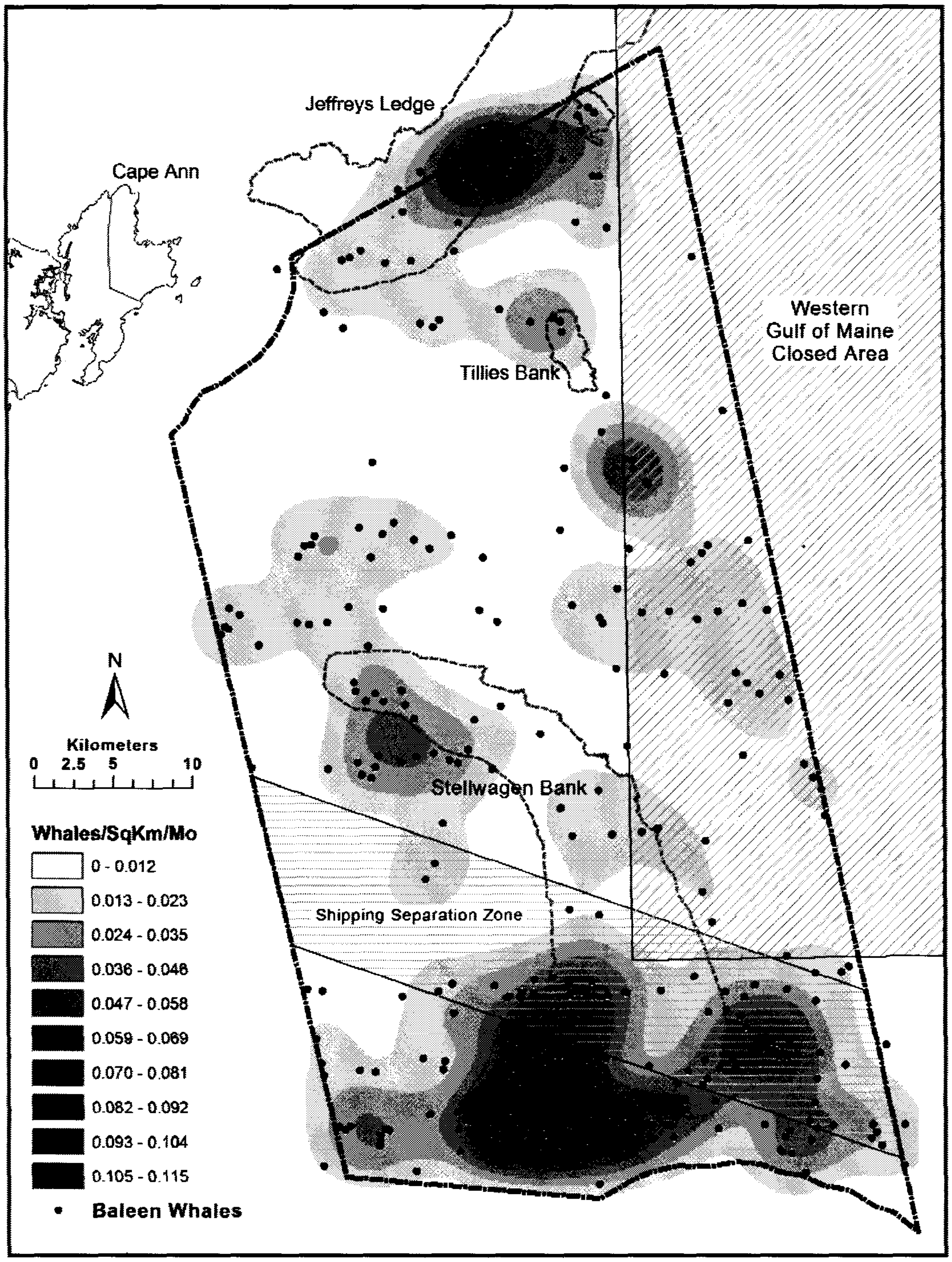


Figure 6. The density and distribution of baleen whales; i.e., humpback *(Megaptera novaeangliae)*, right *(Eubalaena glacialis)*, fin *(Balaenoptera physalus)*, and minke *(Balaenoptera acutorostrata)* whales, within the Stellwagen Bank National Marine Sanctuary from July 2001 through June 2002. Each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

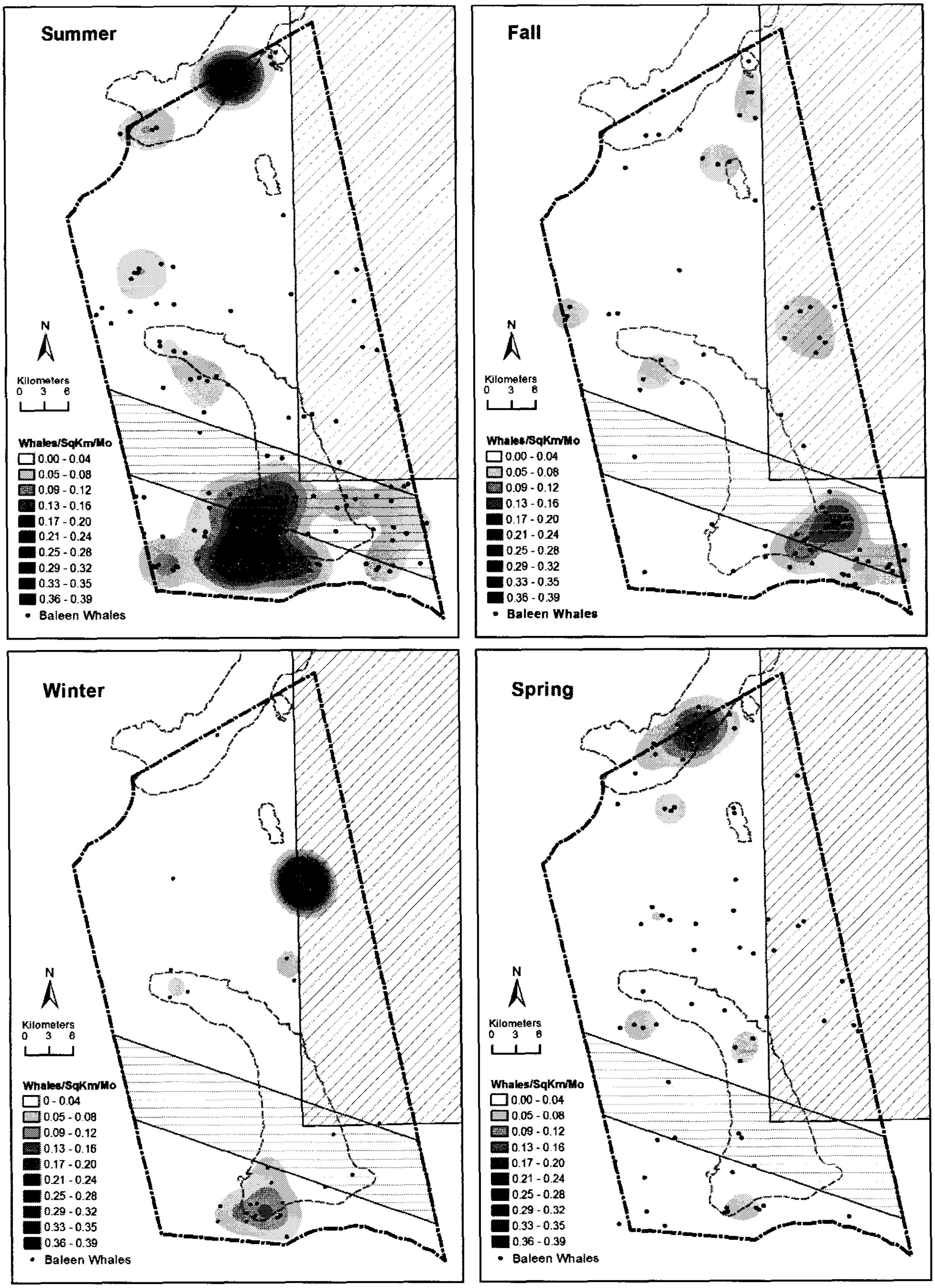
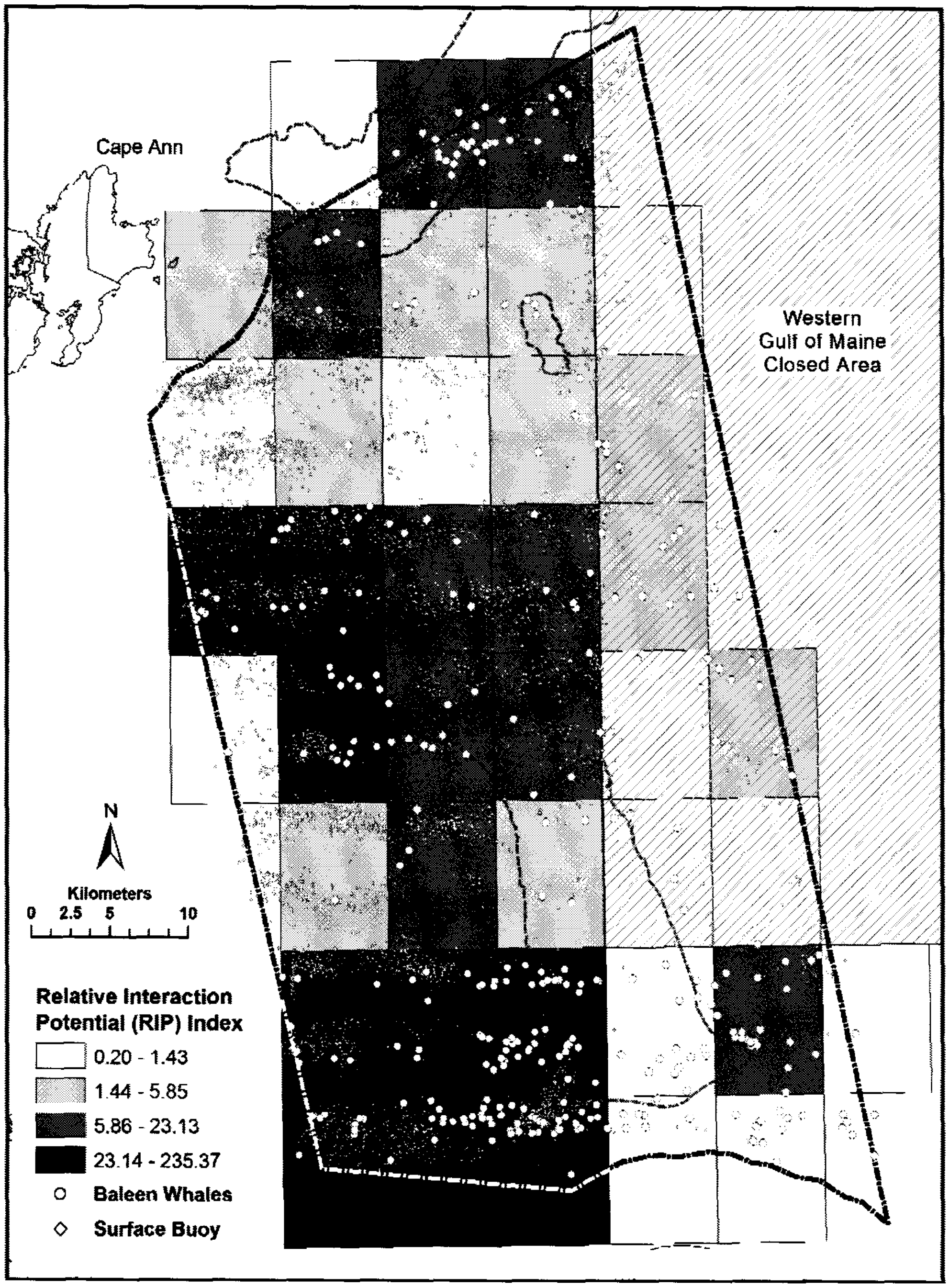


Figure 8. Relative Interaction Potential (RIP) index showing the potential for interaction between baleen whales and fixed fishing gear, by 5-minute square area. The index was calculated by multiplying the total number of fixed gear surface buoys within a 5-minute square by the total number of whales 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.

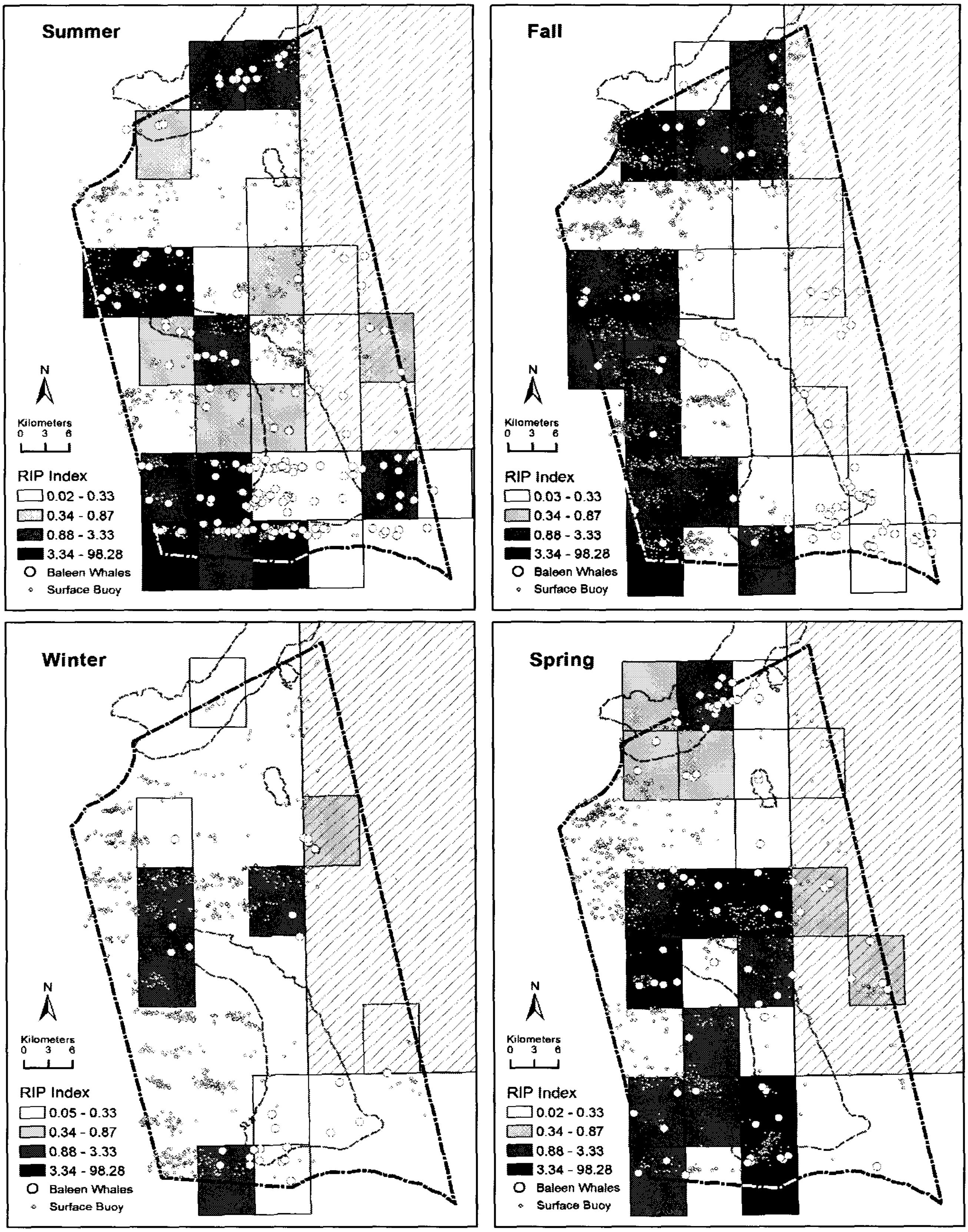


Table 2. Groundfish closures within the Stellwagen Bank National Marine Sanctuary by month. Closures were instituted by the New England Fishery Management Council to recovery depleted groundfish stocks.

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 minimum 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 biodiversity 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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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 5 Appendices
Appendix 5.1 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.

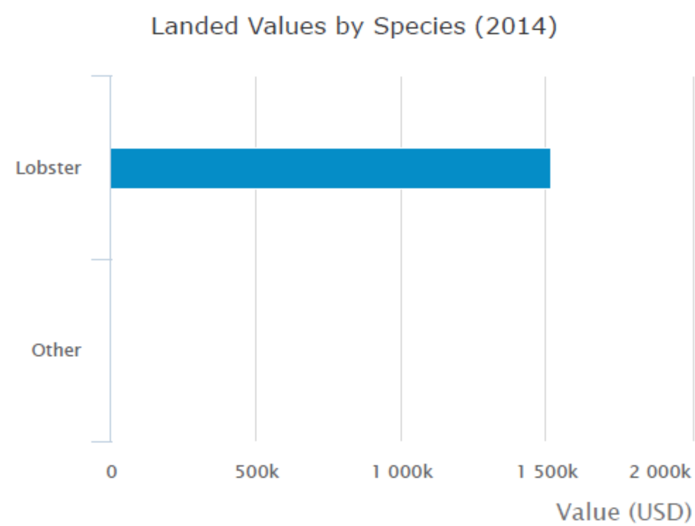
Involvement in Fisheries

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.



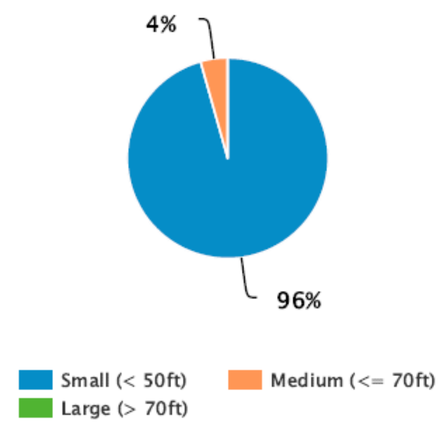
What are the characteristics of the fishing vessels in Rockport?

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.

Number of Vessels by Size (2014)

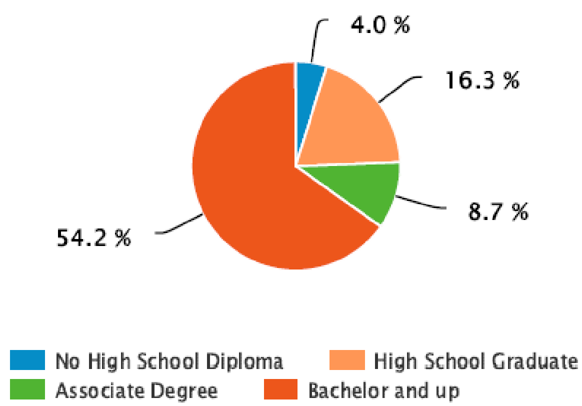


Demographic Attributes

Educational Attainment

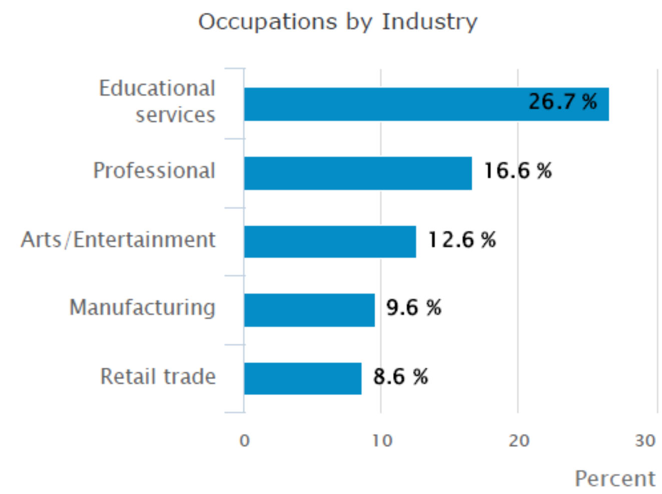
The level of educational attainment in a community is associated with issues important for community development, such as income and poverty levels, unemployment rates, and local participation in community activities.

Educational Attainment



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%**

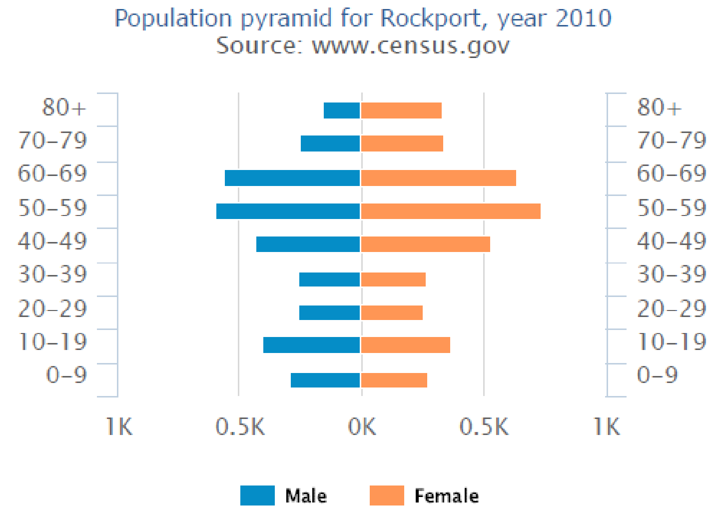
The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

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.

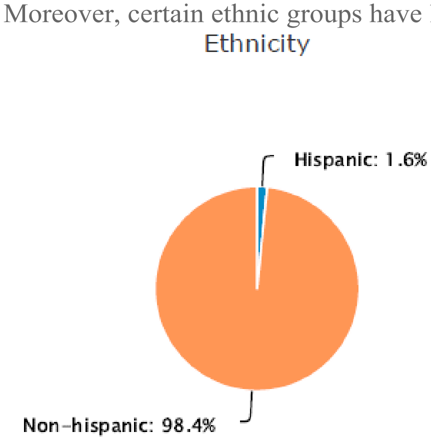
Median age: **51.2**

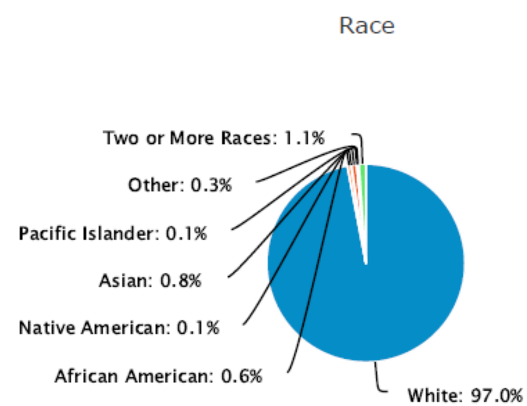
National median: **37.2**



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

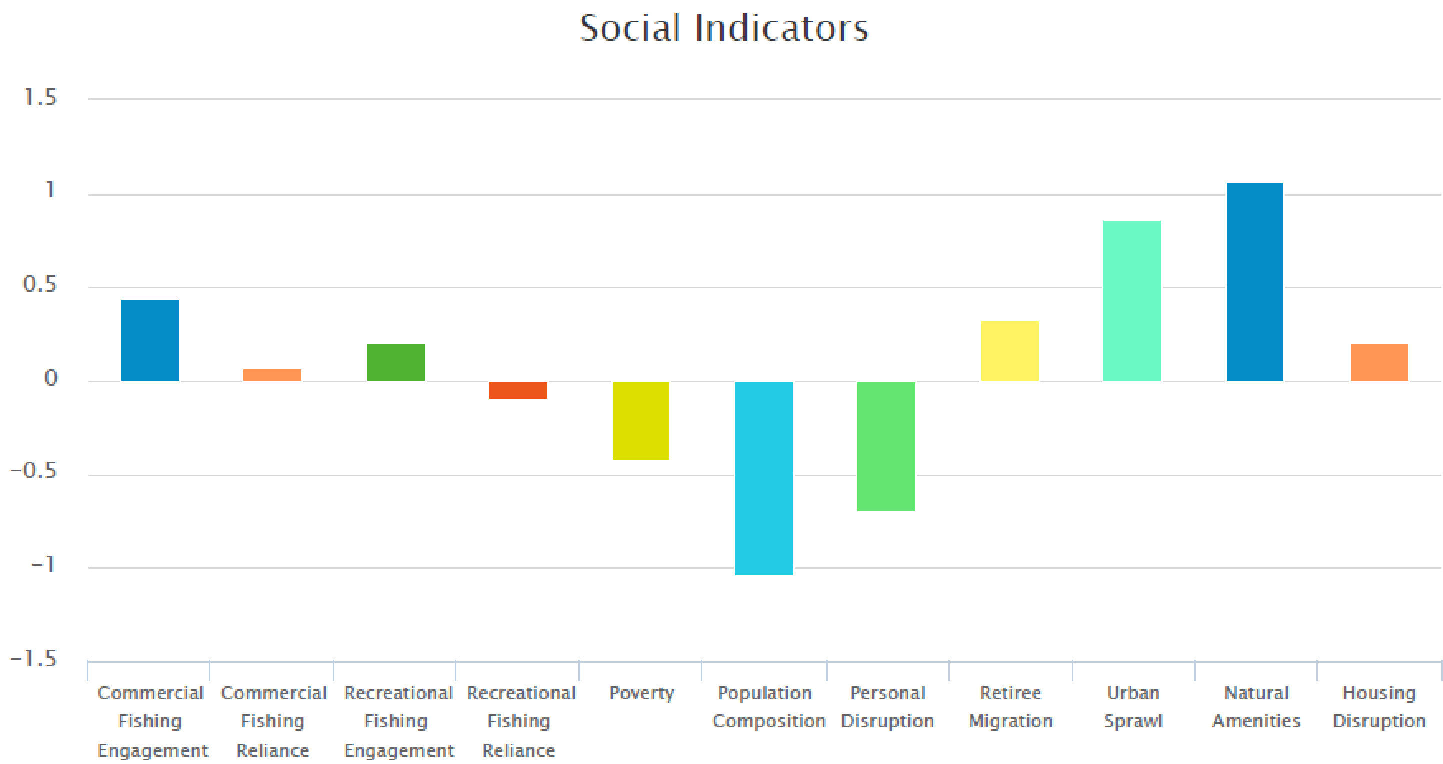
Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Rockport that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of interest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

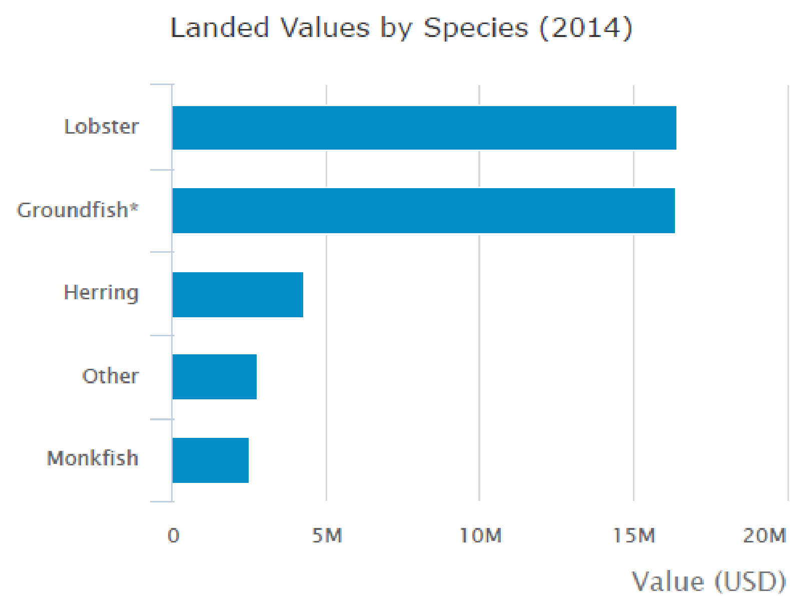
Involvement in Fisheries

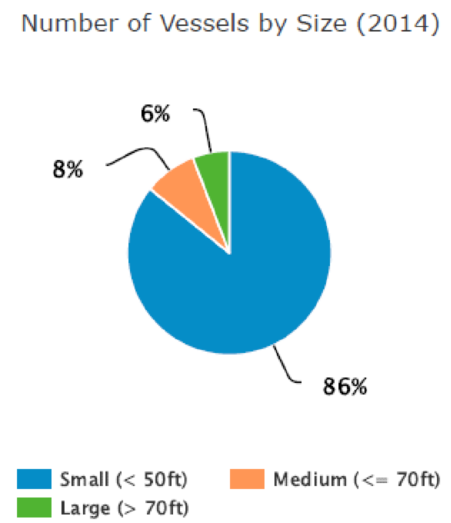
What species are landed in Gloucester?

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.

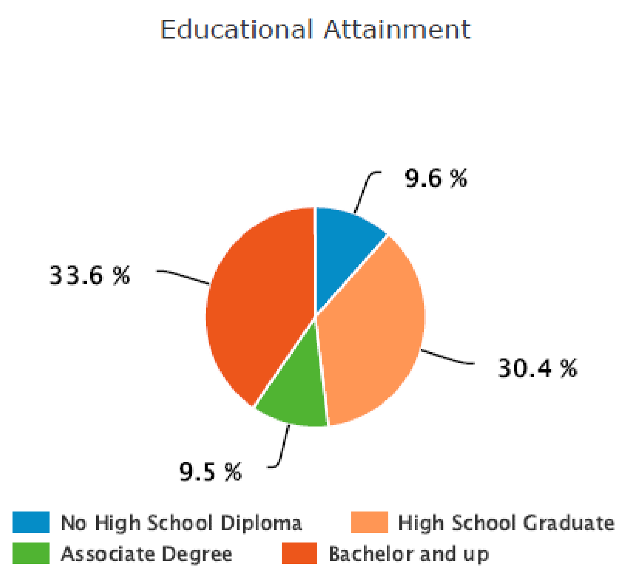
Size also matters. Larger vessels can travel farther offshore and stay out for longer periods more easily than smaller vessels. These differences also affect family life. Smaller dayboat fishermen tend to return home every day whereas fishermen on larger vessels may be away from home for weeks on long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

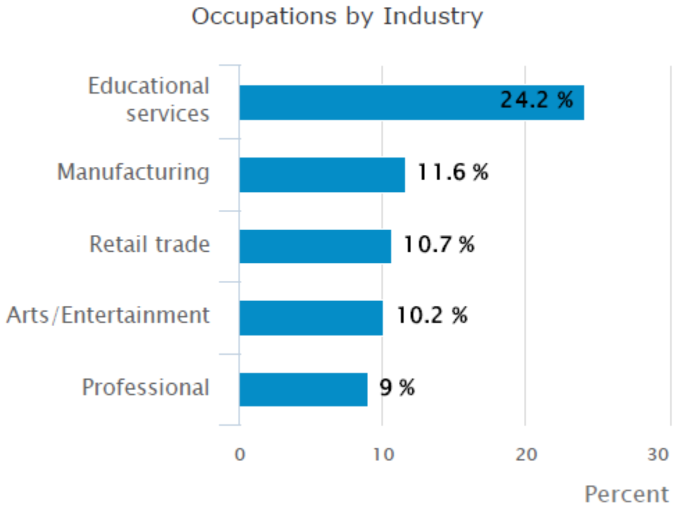
Educational Attainment

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)

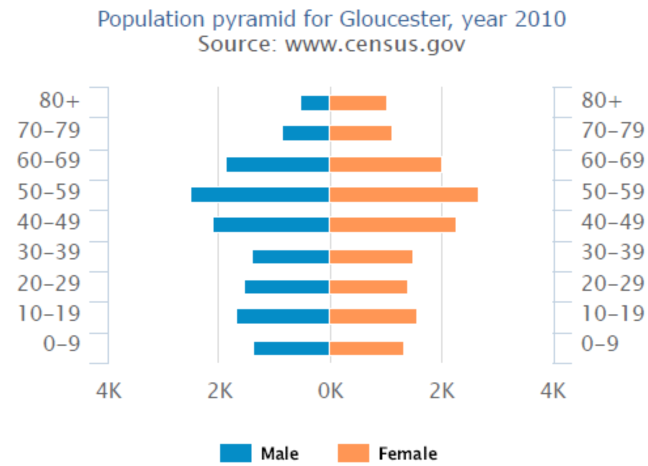
Individuals in Gloucester living in poverty: **7.8%**

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

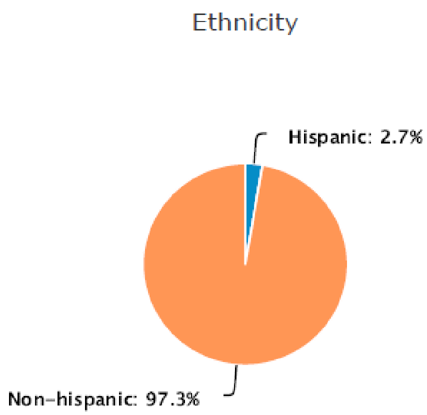
Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process 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.

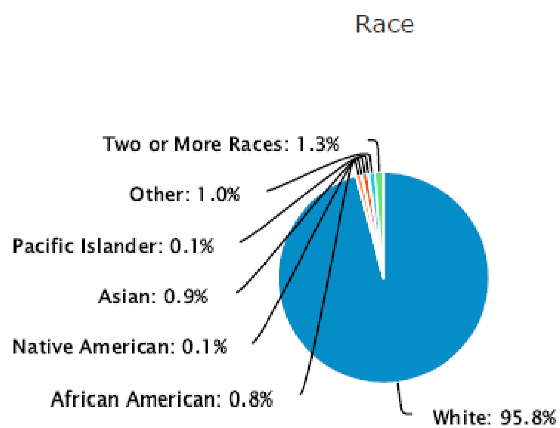
Median age: **46.4**
National median: **37.2**



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

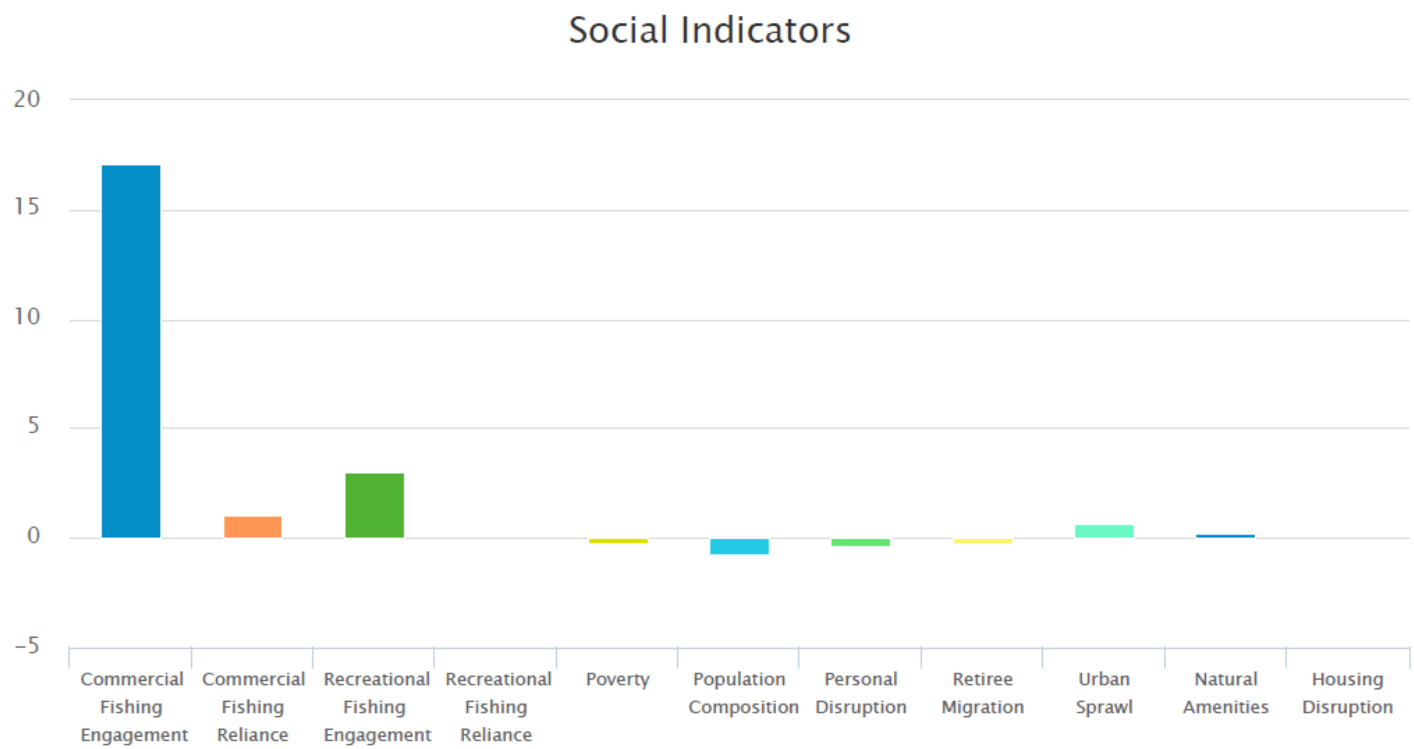
Social indicators are quantitative measures that describe the well-being of communities and are used to describe social phenomena over time. Below are a series of indices for Gloucester that provide measures of fishing engagement and reliance, and social vulnerability. An index combines variables of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

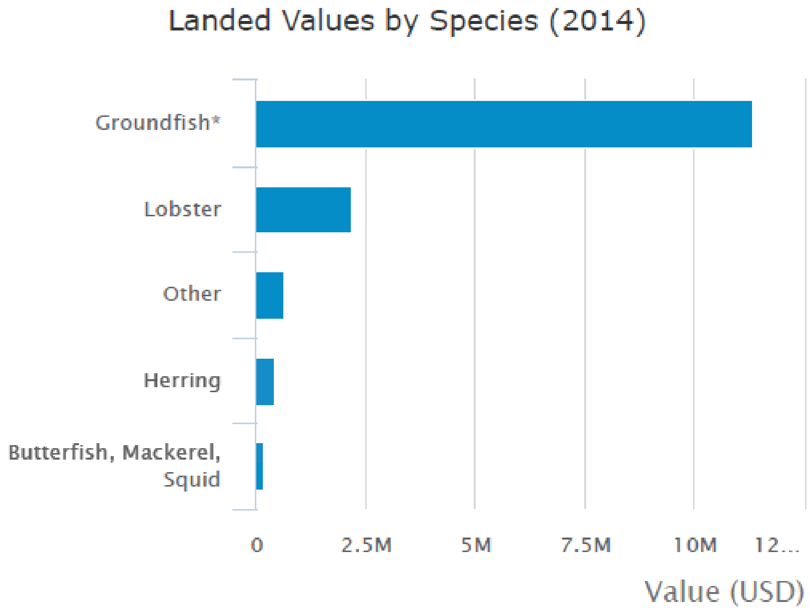
Involvement in Fisheries

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.

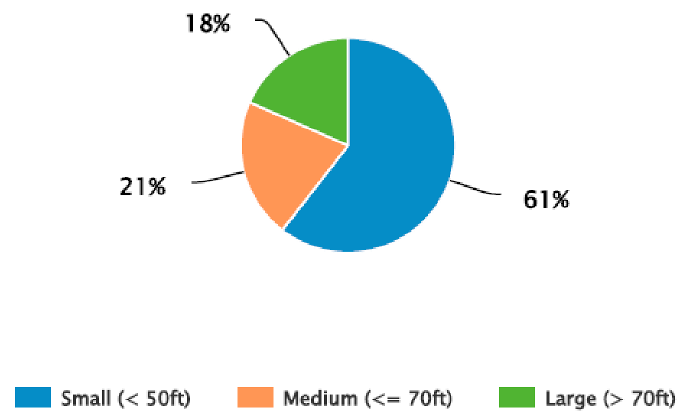
**Whiting includes red hake,ocean pout,black whiting,whiting.



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.

Number of Vessels by Size (2014)



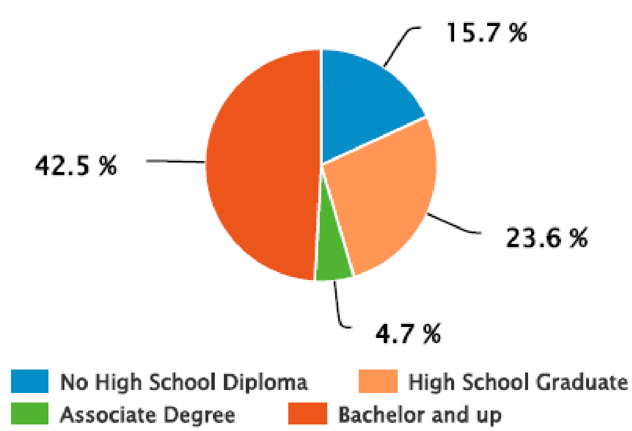
Apart from the lobster fleet, smaller boats also tend to catch a broader range of species where their larger counterparts are more specialized (e.g. limited access scallop boats and herring pair trawlers). All these characteristics help illuminate the potential impacts of regulatory changes on a given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

Demographic Attributes

Educational Attainment

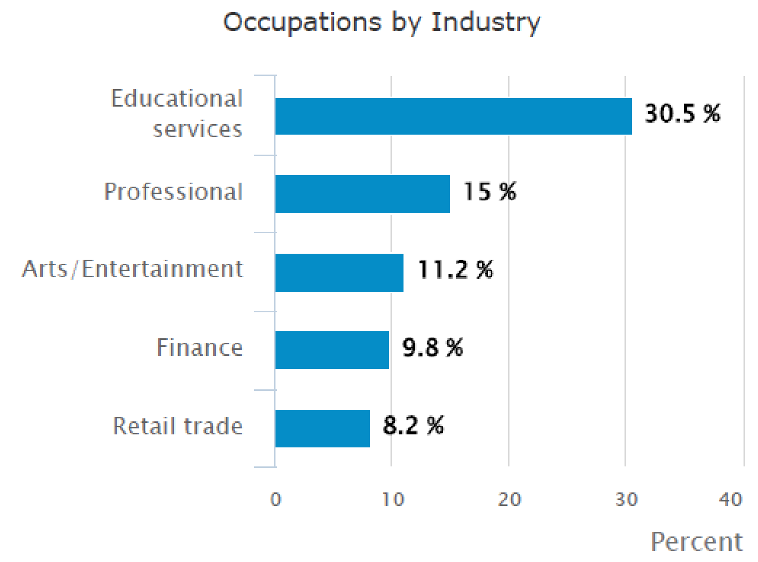
The level of educational attainment in a community is associated with issues important for community development, such as income and poverty levels, unemployment rates, and local participation in community activities.

Educational Attainment



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)

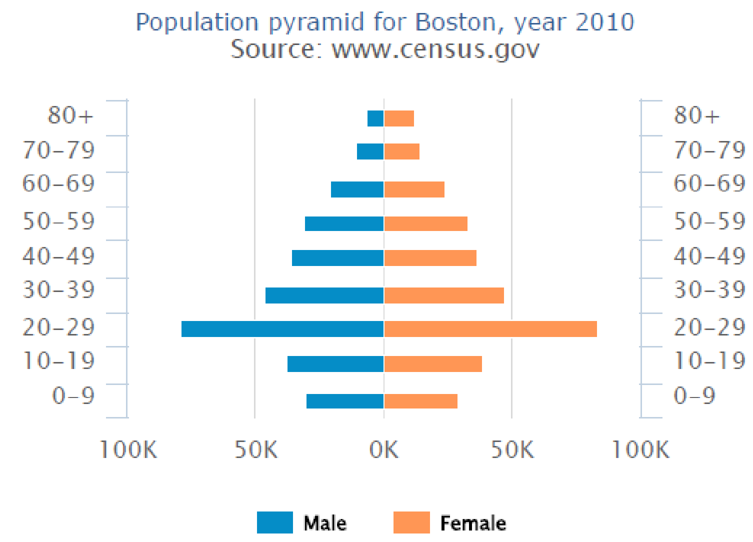
Individuals in Boston living in poverty: **21.2 %** The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities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

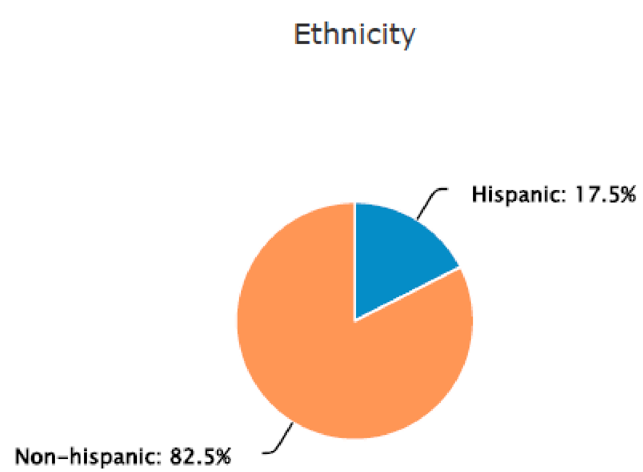
Median age: **30.8**

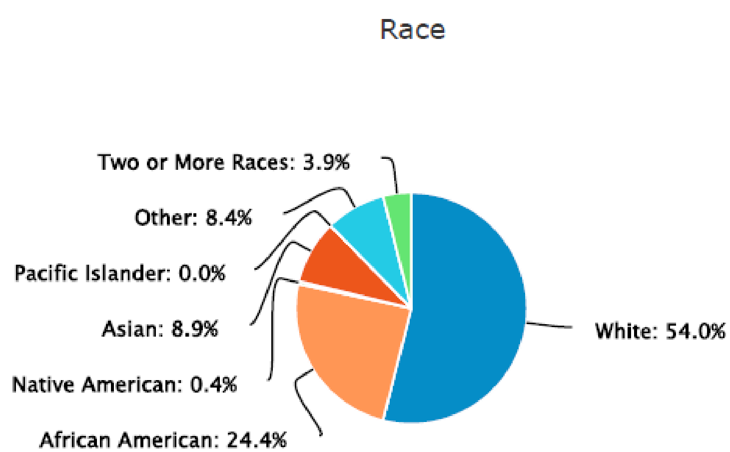
National median: **37.2**



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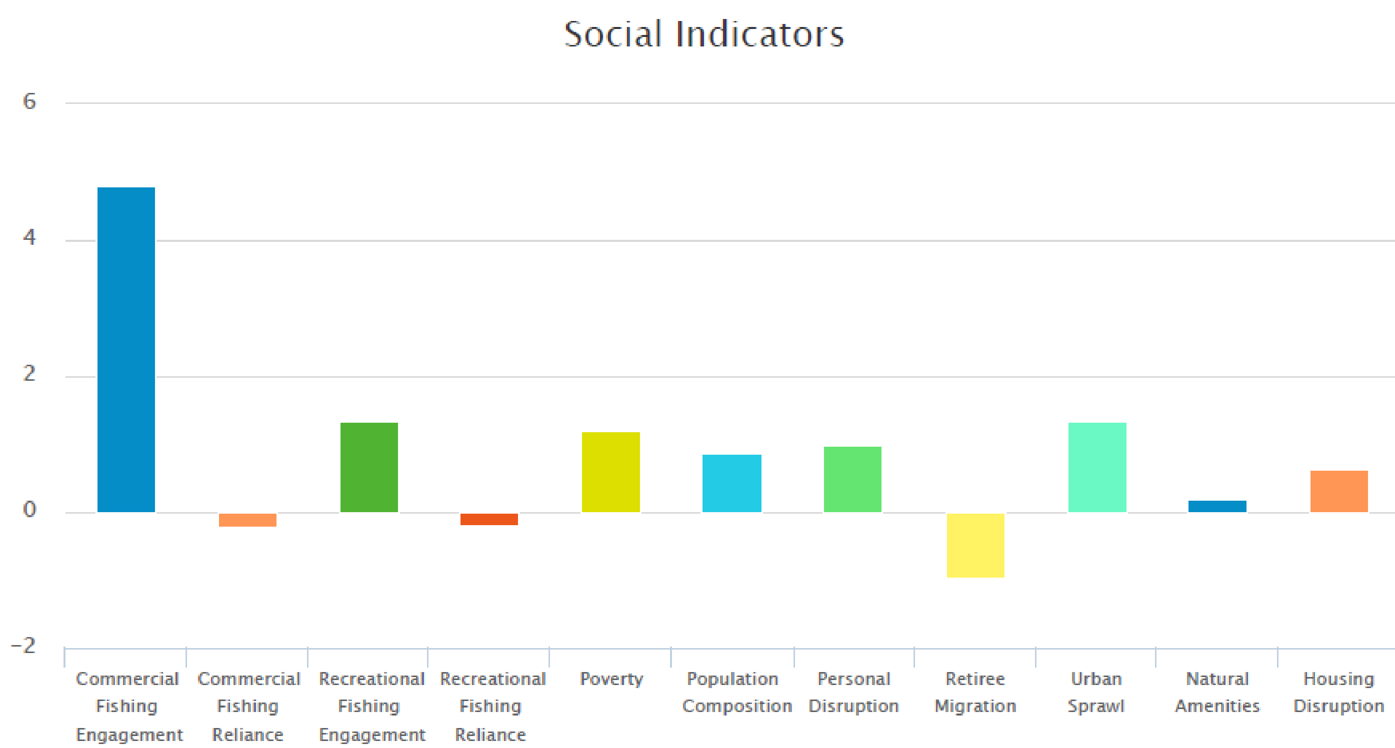
Gentrification Pressure indices characterize those factors that, over time may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure. The indices include: Retire Migration, Urban Sprawl, Natural Amenities and Housing Disruption.
The factor scores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

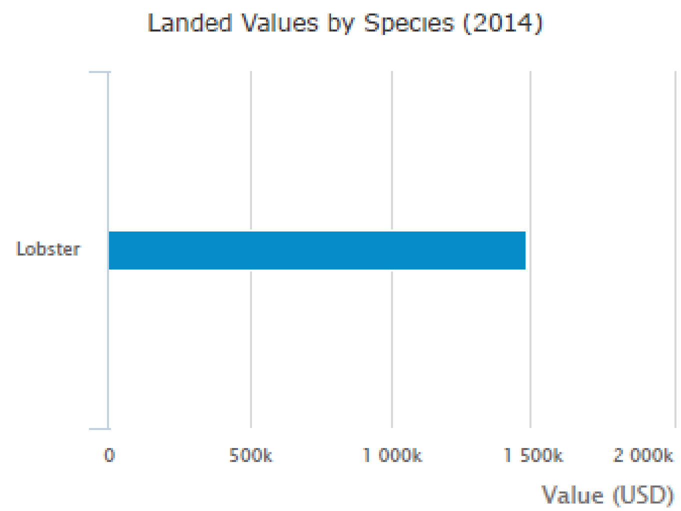
Involvement in Fisheries

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.

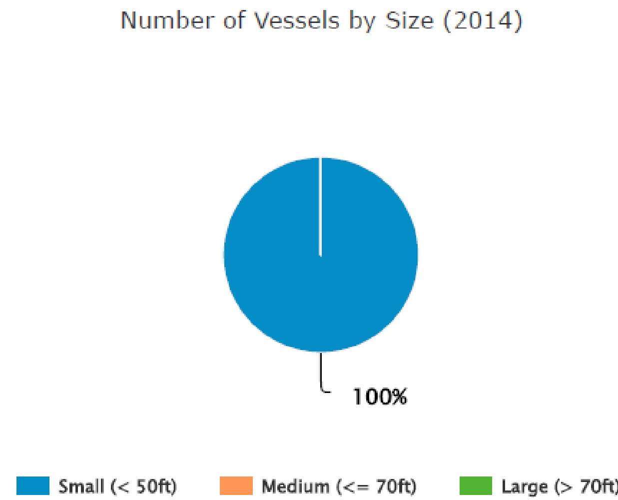
*Groundfish includes cod, winter fl.,witch fl.,yellowtail fl., am.plaice, haddock, white hake,redfish, pollock.

**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?



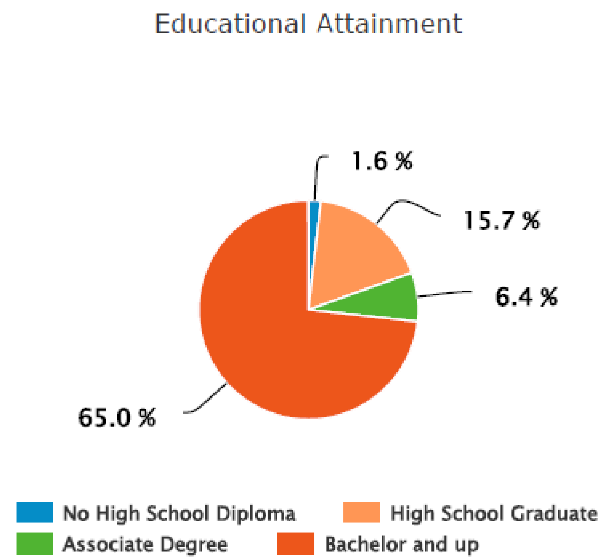
The number of fishing vessels in a given port provides a sense of the scale of fishing in that port. Where a large port may serve as the homeport for hundreds of vessels, a smaller one may only have a handful. The number of vessels also may provide a rough sense of the number of fishing-related jobs (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). Al[illegible] impacts of regulatory changes on a given community.

Demographic Attributes

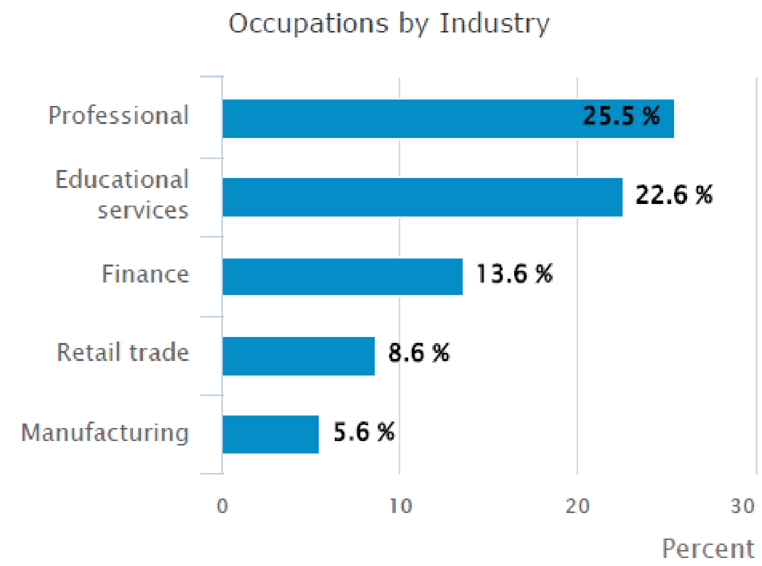
Educational Attainment



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 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 %**

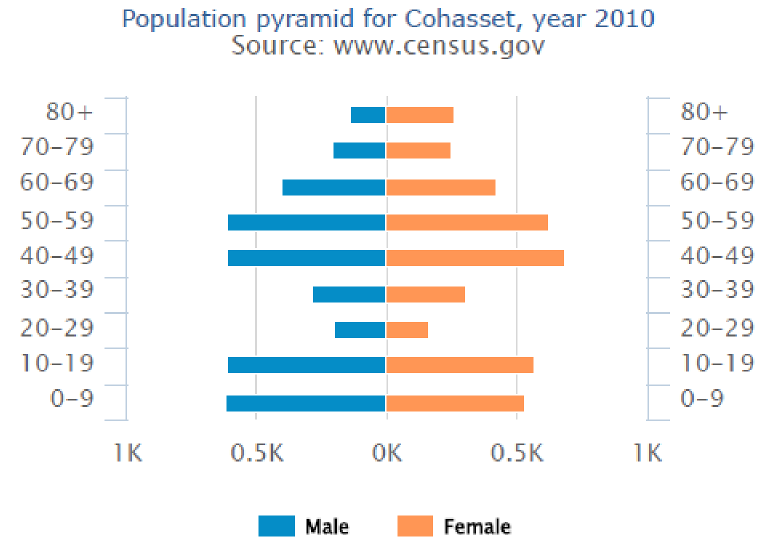
The poverty threshold for an individual is defined by the US Census for 2010 as $11,139. The percentage of a town's population living under this economic threshold is an indicator of the residents' ability to adjust to loss of income and job opportunities in fishing-related and other local industries.

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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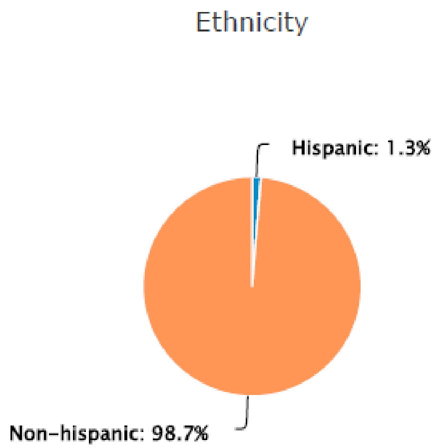

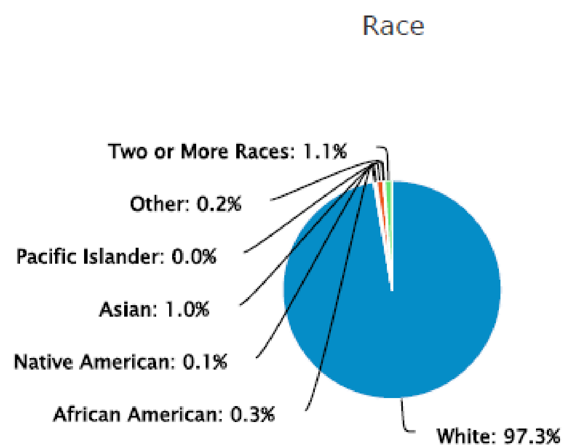

Language and Marginalization

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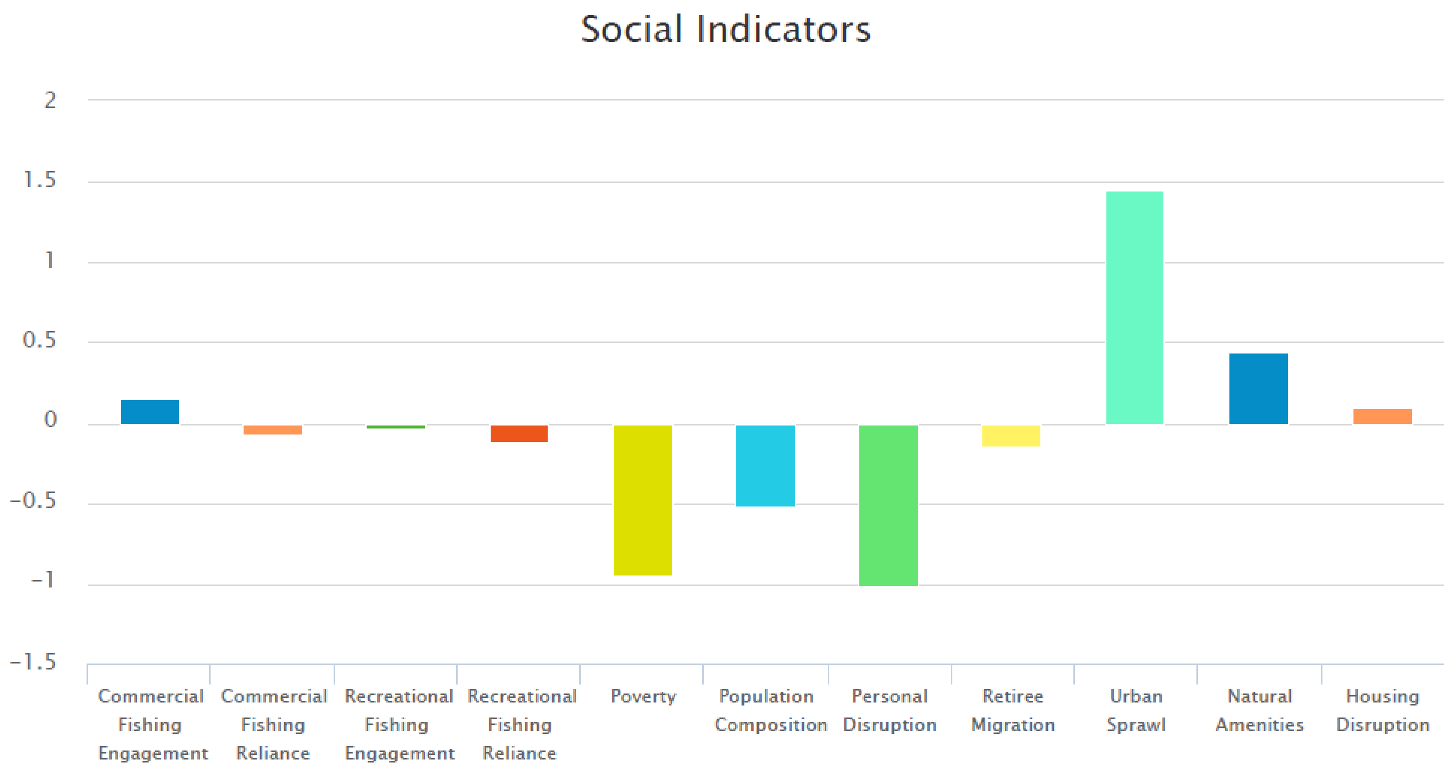
Social vulnerability indices represent social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing. The indices include: Poverty, Population Composition, and Personal Disruption.
Gentrification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

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.

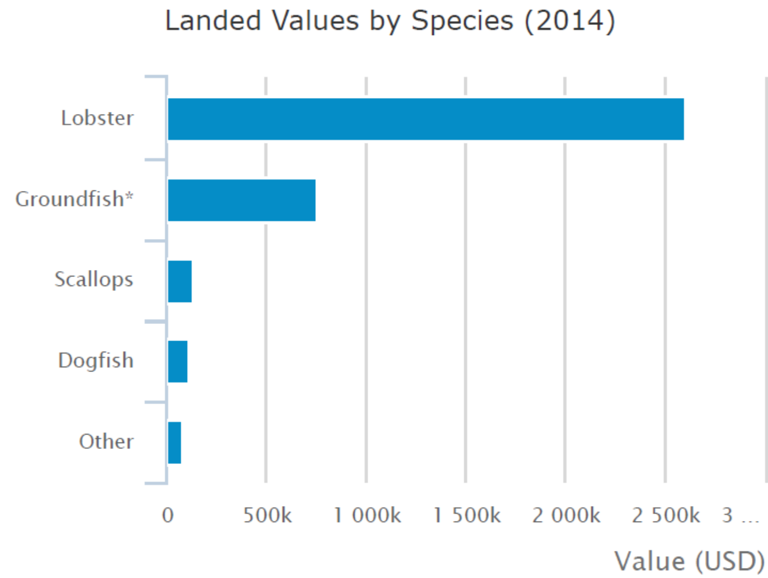
Involvement in Fisheries

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.

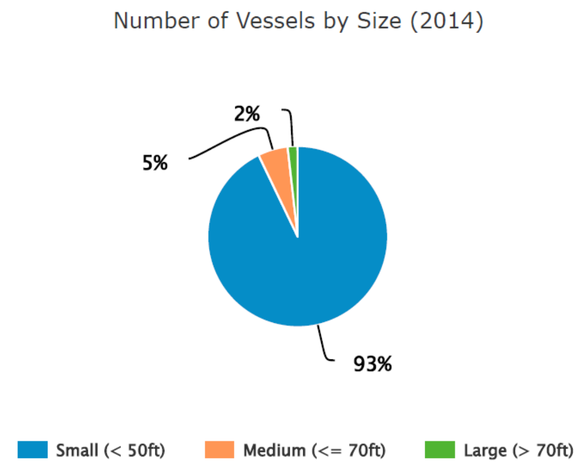
**Whiting includes red hake,ocean pout,black whiting,whiting.



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.

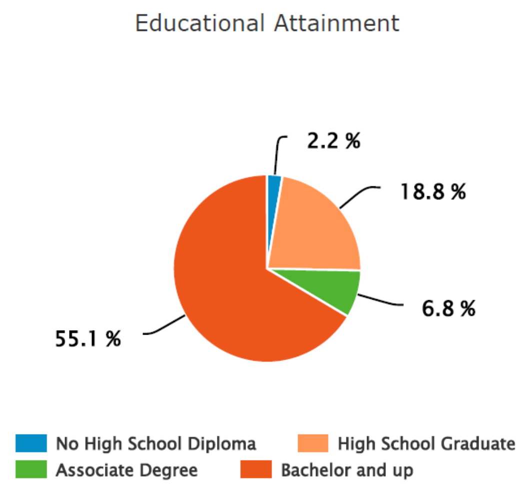


Apart from the lobster fleet, smaller boats also tend to catch a broader range of species where their larger counterparts are more specialized (e.g. limited access scallop boats and herring pair trawlers). All these characteristics help illuminate the potential impacts of regulatory changes on a given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

Demographic Attributes

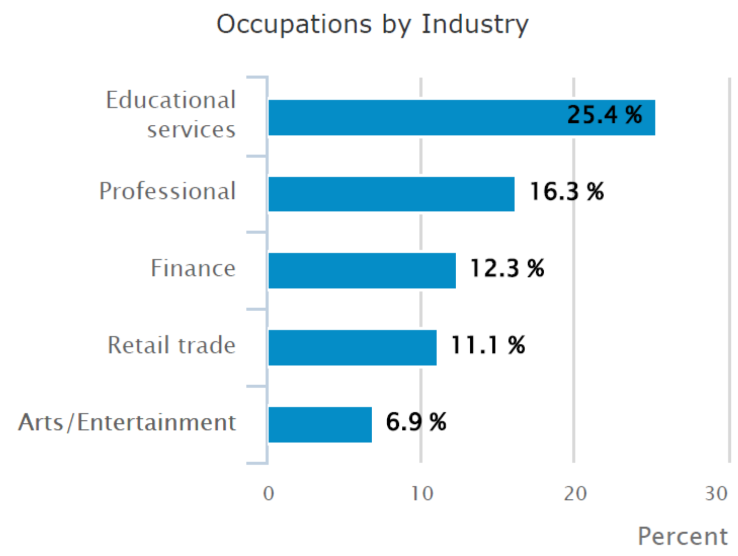
Educational Attainment

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.

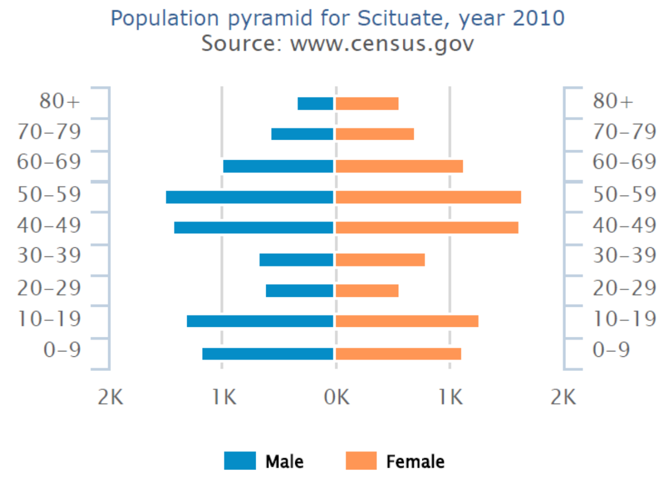
*Source: U.S. Department of Labor, **Bureau of Labor Statistics**

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

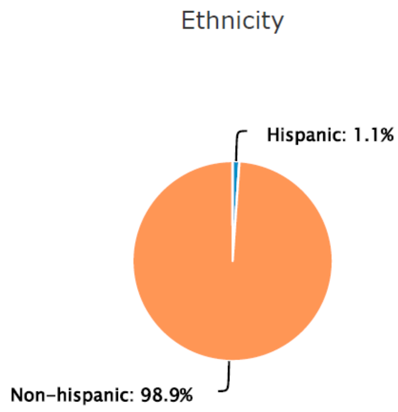
Age structure provides potential indications of many broader community issues and institutions. A large number of older residents may be associated with a retirement community or an out-migration of young people. For many fishing communities, an aging population can indicate gentrification, a process 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.

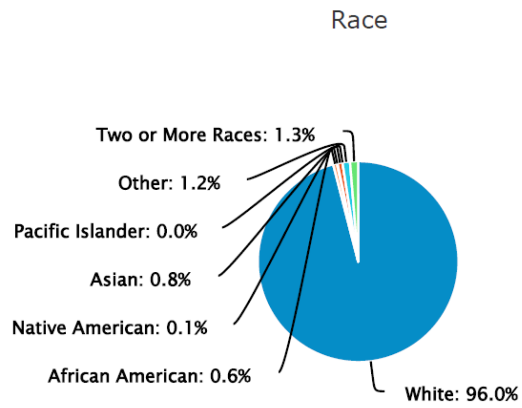
Median age: **45.1**

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.
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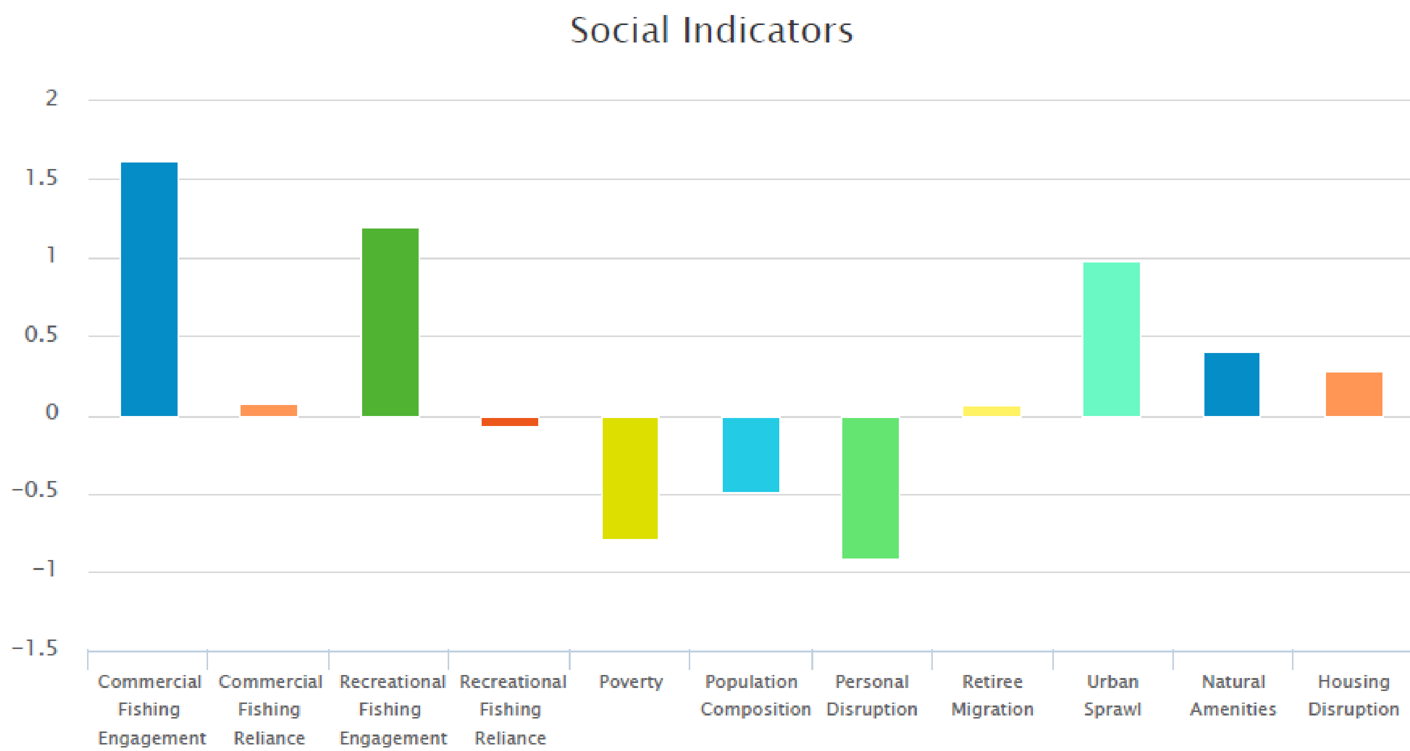

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Commercial Fishing Reliance
Recreational Fishing Engagement
Recreational Fishing Reliance
Poverty
Population Composition
Personal Disruption
Retiree Migration
Urban Sprawl
Natural Amenities
Housing Disruption

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.

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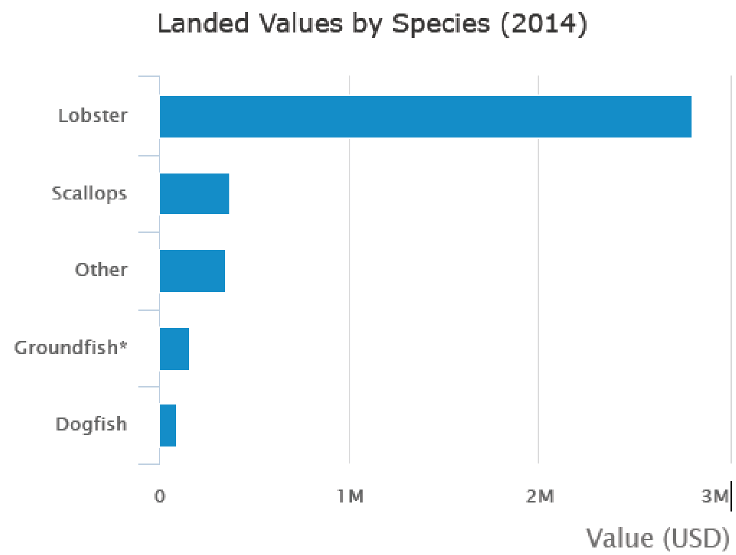
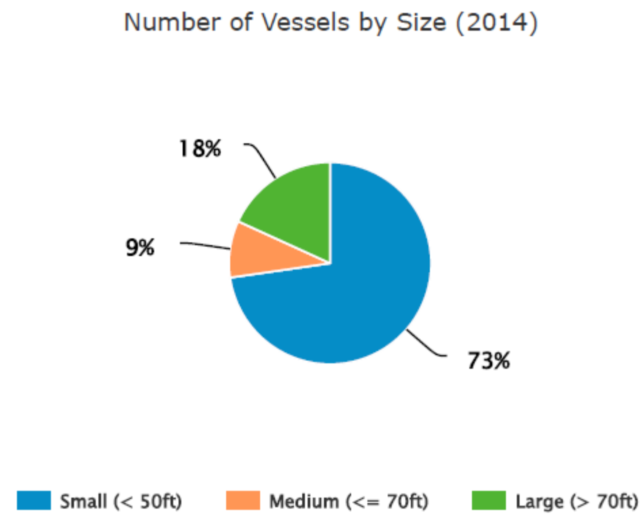


What are the characteristics of the fishing vessels in Plymouth?

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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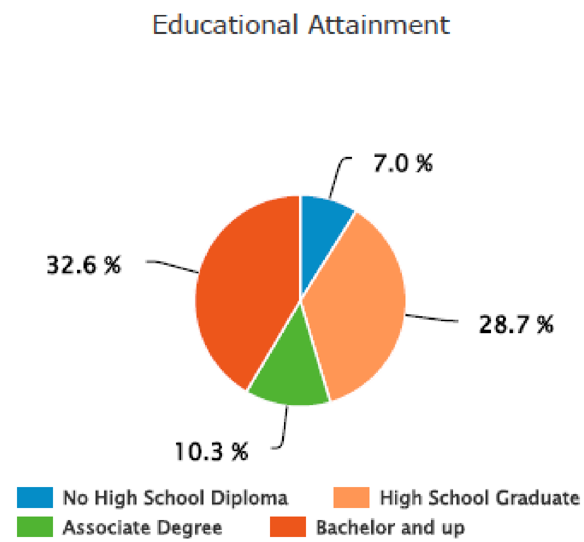

How do people make a living in Plymouth?

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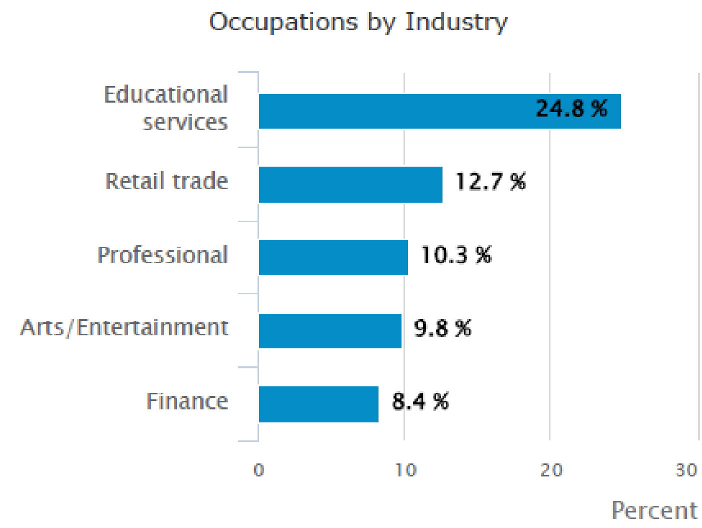

Unemployment Rate: **5.8%**

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**

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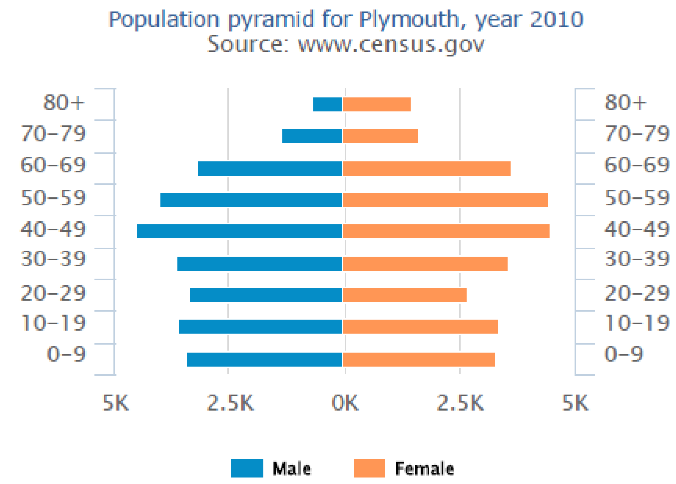

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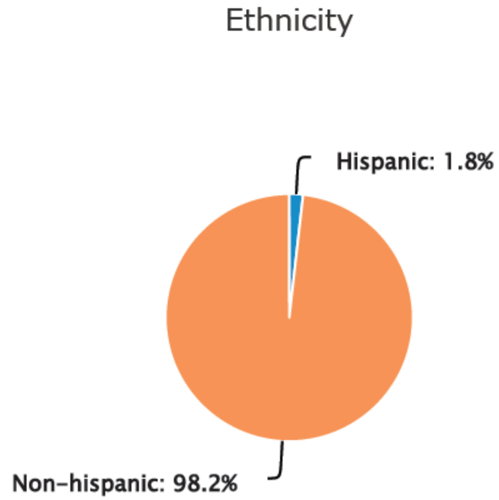

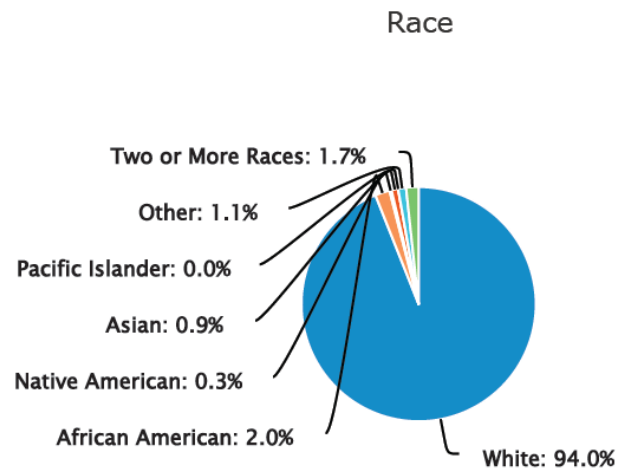

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National Average: **8.7%**

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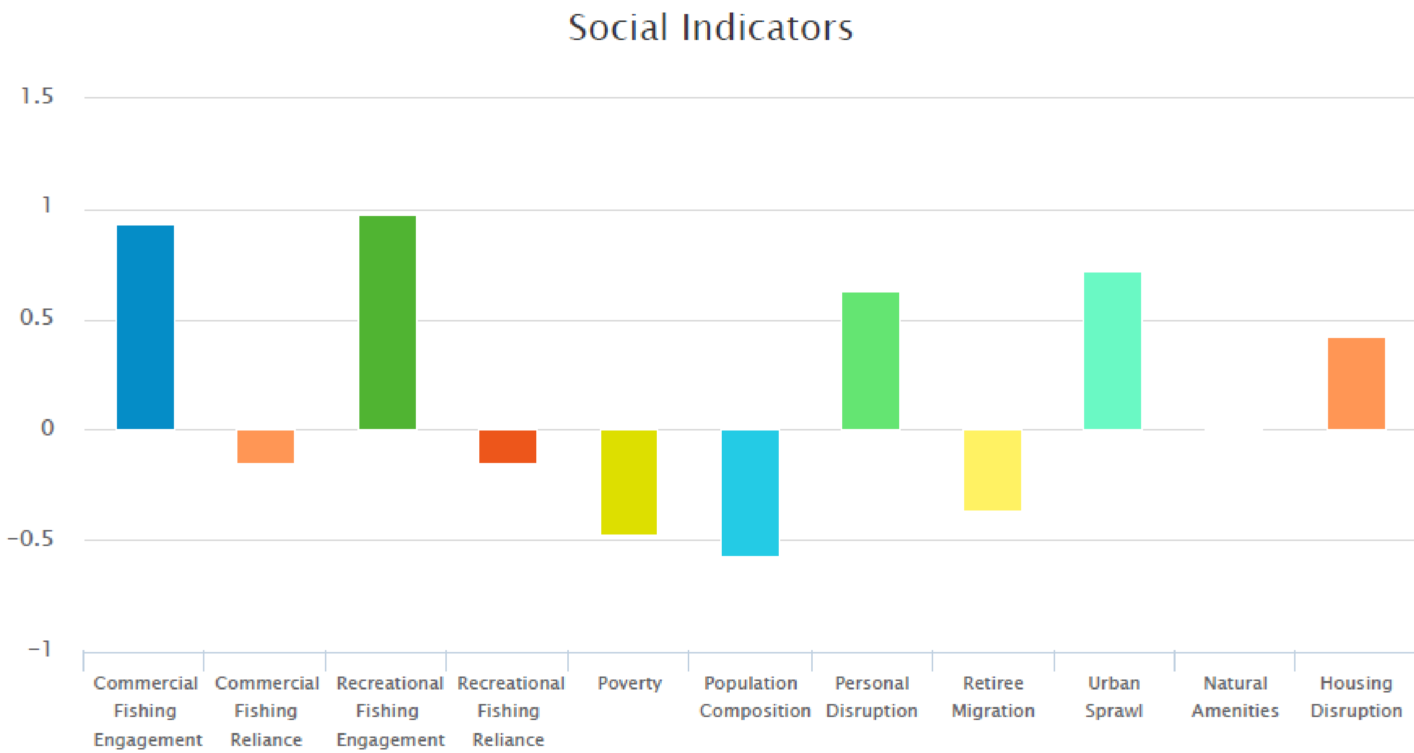

Northeast Fisheries Science Center

Social Sciences Branch

Chapter 6 Appendices
Appendix 6.2 Decision Support Tool Model Runs

Appendix 6.2.1 Baseline Information

The baseline information on right whale habitat density and trap/pot risk within Massachusetts portion of Lobster Management Area 1following the 2021 Final Rule (86 FR 51970, September 17, 2021).

	ModelConfiguration
1	Model Start Time: 2023-10-11 18:06:12.1671; End Time: 2023-10-11 18:09:23.919637; Duration 00:03:12
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Phase1_DSTv4.1_TP_MA_LMA1.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e-05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= TRUE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	27.81	27.81	0 %
2	WhaleDensity	2	34.02	34.02	0 %
3	WhaleDensity	3	64.22	64.22	0 %
4	WhaleDensity	4	90.21	90.21	0 %
5	WhaleDensity	5	21.41	21.41	0 %
6	WhaleDensity	6	0.36	0.36	0 %
7	WhaleDensity	7	0.47	0.47	0 %
8	WhaleDensity	8	0.12	0.12	0 %
9	WhaleDensity	9	0.06	0.06	0 %
10	WhaleDensity	10	0.21	0.21	0 %
11	WhaleDensity	11	1.88	1.88	0 %
12	WhaleDensity	12	7.17	7.17	0 %
13	WhaleDensity	Total	247.95	247.95	0 %

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	2,362.10	1,613.66	31.7 %
2	RelativeRisk_Threat	2	918.22	603.54	34.3 %
3	RelativeRisk_Threat	3	1,890.60	403.79	78.6 %
4	RelativeRisk_Threat	4	6,258.69	1,024.37	83.6 %
5	RelativeRisk_Threat	5	8,687.93	567.07	93.5 %
6	RelativeRisk_Threat	6	62.25	40.93	34.2 %
7	RelativeRisk_Threat	7	92.14	59.59	35.3 %
8	RelativeRisk_Threat	8	27.65	17.85	35.4 %
9	RelativeRisk_Threat	9	17.54	11.53	34.3 %
10	RelativeRisk_Threat	10	80.84	52.58	35 %
11	RelativeRisk_Threat	11	736.28	487.79	33.8 %
12	RelativeRisk_Threat	12	2,205.09	1,495.54	32.2 %
13	RelativeRisk_Threat	Total	23,339.34	6,378.23	72.7 %

The baseline information on right whale habitat density and trap/pot risk within the Northeast Trap/Pot Management Region following the 2021 Final Rule (86 FR 51970, September 17, 2021).

	ModelConfiguration
1	Model Start Time: 2023−10−11 18:27:52.704294; End Time: 2023−10−11 18:47:11.22392; Duration 00:19:18.6
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Phase1_DSTv4.1_TP_NE.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
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30	WriteMapSources= TRUE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	270.09	270.09	0 %
2	WhaleDensity	2	257.14	257.14	0 %
3	WhaleDensity	3	275.28	275.28	0 %
4	WhaleDensity	4	331.29	331.29	0 %
5	WhaleDensity	5	340.52	340.52	0 %
6	WhaleDensity	6	160.01	160.01	0 %
7	WhaleDensity	7	115.27	115.27	0 %
8	WhaleDensity	8	13.42	13.42	0 %
9	WhaleDensity	9	15.43	15.43	0 %
10	WhaleDensity	10	43.76	43.76	0 %
11	WhaleDensity	11	115.18	115.18	0 %
12	WhaleDensity	12	152.92	152.92	0 %
13	WhaleDensity	Total	2,090.31	2,090.31	0 %

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	13,652.55	6,879.53	49.6 %
2	RelativeRisk_Threat	2	6,477.53	4,029.96	37.8 %
3	RelativeRisk_Threat	3	6,571.51	3,256.57	50.4 %
4	RelativeRisk_Threat	4	12,402.14	4,076.90	67.1 %
5	RelativeRisk_Threat	5	15,374.68	4,372.46	71.6 %
6	RelativeRisk_Threat	6	8,333.52	5,326.64	36.1 %
7	RelativeRisk_Threat	7	9,647.50	6,083.45	36.9 %
8	RelativeRisk_Threat	8	1,845.10	1,138.30	38.3 %
9	RelativeRisk_Threat	9	1,192.19	723.04	39.4 %
10	RelativeRisk_Threat	10	4,089.79	2,068.88	49.4 %
11	RelativeRisk_Threat	11	7,567.54	3,861.08	49 %
12	RelativeRisk_Threat	12	7,350.71	4,192.41	43 %
13	RelativeRisk_Threat	Total	94,504.76	46,009.21	51.3 %

The baseline information on right whale habitat density and trap/pot risk coast-wide along the U.S Atlantic following the 2021 Final Rule (86 FR 51970, September 17, 2021).

	ModelConfiguration
1	Model Start Time: 2023−10−17 15:55:36.984594; End Time: 2023−10−17 16:17:15.87012; Duration 00:21:39
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3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Phase1_DSTv4.1_WeakRopeRevision_Pot.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
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23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	355.39	355.39	0 %
2	WhaleDensity	2	366.43	366.43	0 %
3	WhaleDensity	3	375.20	375.20	0 %
4	WhaleDensity	4	407.70	407.70	0 %
5	WhaleDensity	5	364.81	364.81	0 %
6	WhaleDensity	6	166.28	166.28	0 %
7	WhaleDensity	7	117.82	117.82	0 %
8	WhaleDensity	8	15.73	15.73	0 %
9	WhaleDensity	9	19.10	19.10	0 %
10	WhaleDensity	10	54.94	54.94	0 %
11	WhaleDensity	11	132.80	132.80	0 %
12	WhaleDensity	12	201.97	201.97	0 %
13	WhaleDensity	Total	2,578.18	2,578.18	0 %

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	48,242.65	50.2 %

The baseline information on right whale habitat density and trap/pot risk within the MRA Wedge, Alternative 2 proposed expansion of the Massachusetts Restricted Area.

	ModelConfiguration
1	Model Start Time: 2023−10−12 16:33:18.251515; End Time: 2023−10−12 16:34:17.966019; Duration 00:00:59.71
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Alt2_Baseline_RW.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	0.04	0.04	0 %
2	WhaleDensity	2	0.04	0.04	0 %
3	WhaleDensity	3	1.43	1.43	0 %
4	WhaleDensity	4	3.30	3.30	0 %
5	WhaleDensity	5	0.13	0.13	0 %
6	WhaleDensity	6	0.00	0.00	0 %
7	WhaleDensity	7	0.00	0.00	0 %
8	WhaleDensity	8	0.00	0.00	0 %
9	WhaleDensity	9	0.00	0.00	0 %
10	WhaleDensity	10	0.00	0.00	0 %
11	WhaleDensity	11	0.00	0.00	0 %
12	WhaleDensity	12	0.00	0.00	0 %
13	WhaleDensity	Total	4.94	4.94	0 %

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	8.23	8.23	0 %
2	RelativeRisk_Threat	2	9.32	9.32	0 %
3	RelativeRisk_Threat	3	346.10	346.10	0 %
4	RelativeRisk_Threat	4	1,029.94	1,029.94	0 %
5	RelativeRisk_Threat	5	25.91	25.91	0 %
6	RelativeRisk_Threat	6	0.32	0.32	0 %
7	RelativeRisk_Threat	7	0.39	0.39	0 %
8	RelativeRisk_Threat	8	0.20	0.20	0 %
9	RelativeRisk_Threat	9	0.17	0.17	0 %
10	RelativeRisk_Threat	10	0.00	0.00	−0.2 %
11	RelativeRisk_Threat	11	0.18	0.18	0 %
12	RelativeRisk_Threat	12	1.29	1.29	0 %
13	RelativeRisk_Threat	Total	1,422.05	1,422.05	0 %

The baseline information on humpback whale habitat density and trap/pot risk within MRA Wedge, Alternative 2 (Preferred Alternative)

	ModelConfiguration
1	Model Start Time: 2023−01−12 12:43:48; End Time: 2023−01−12 12:44:23; Duration 00:00:34.71
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_Beta_V4.1.0.R
4	InputActions: EmergencyRule2023/PrefConst_Baseline_hback.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty_WithZero.Rdata
8	Whale Habitat Model: Duke_HumpbackWhaleModel_v11_0919.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: TRUE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= FALSE, FALSE
26	PrintScenarioMaps= TRUE, FALSE
27	PrintRedistributionMaps= TRUE
28	PrintMapsInHighResolution= FALSE
29	TruncateMaps= 0.995
30	WriteMapSources= TRUE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	0.21	0.21	0 %
2	WhaleDensity	2	0.15	0.15	0 %
3	WhaleDensity	3	0.20	0.20	0 %
4	WhaleDensity	4	0.89	0.89	0 %
5	WhaleDensity	5	0.97	0.97	0 %
6	WhaleDensity	6	0.86	0.86	0 %
7	WhaleDensity	7	1.08	1.08	0 %
8	WhaleDensity	8	0.86	0.86	0 %
9	WhaleDensity	9	0.93	0.93	0 %
10	WhaleDensity	10	1.07	1.07	0 %
11	WhaleDensity	11	1.32	1.32	0 %
12	WhaleDensity	12	0.48	0.48	0 %
13	WhaleDensity	Total	9.01	9.01	0 %

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	44.36	44.36	0 %
2	RelativeRisk_Threat	2	36.44	36.44	0 %
3	RelativeRisk_Threat	3	49.22	49.22	0 %
4	RelativeRisk_Threat	4	277.50	277.50	0 %
5	RelativeRisk_Threat	5	194.94	194.94	0 %
6	RelativeRisk_Threat	6	150.13	150.13	0 %
7	RelativeRisk_Threat	7	184.79	184.79	0 %
8	RelativeRisk_Threat	8	194.27	194.27	0 %
9	RelativeRisk_Threat	9	274.15	274.15	0 %
10	RelativeRisk_Threat	10	415.96	415.96	0 %
11	RelativeRisk_Threat	11	544.54	544.54	0 %
12	RelativeRisk_Threat	12	161.08	161.08	0 %
13	RelativeRisk_Threat	Total	2,527.39	2,527.39	0 %

The baseline information on fin whale habitat density and trap/pot co-occurrence (i.e. overlap between whales and gear within MRA Wedge, Alternative 2 (Preferred Alternative)

	ModelConfiguration
1	Model Start Time: 2023−01−12 12:49:52; End Time: 2023−01−12 12:50:22; Duration 00:00:30.25
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_Beta_V4.1.0.R
4	InputActions: EmergencyRule2023/PrefConst_Baseline_fin.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty_WithZero.Rdata
8	Whale Habitat Model: Duke_FinWhaleModel_v12.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: TRUE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= FALSE, FALSE
26	PrintScenarioMaps= TRUE, FALSE
27	PrintRedistributionMaps= TRUE
28	PrintMapsInHighResolution= FALSE
29	TruncateMaps= 0.995
30	WriteMapSources= TRUE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	0.81	0.81	0 %
2	WhaleDensity	2	0.38	0.38	0 %
3	WhaleDensity	3	0.34	0.34	0 %
4	WhaleDensity	4	0.76	0.76	0 %
5	WhaleDensity	5	1.11	1.11	0 %
6	WhaleDensity	6	1.13	1.13	0 %
7	WhaleDensity	7	0.96	0.96	0 %
8	WhaleDensity	8	1.46	1.46	0 %
9	WhaleDensity	9	0.55	0.55	0 %
10	WhaleDensity	10	0.29	0.29	0 %
11	WhaleDensity	11	0.48	0.48	0 %
12	WhaleDensity	12	0.79	0.79	0 %
13	WhaleDensity	Total	9.06	9.06	0 %

Final Relative Risk Scores − CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	1,220.68	1,220.68	0 %
2	RelativeRisk_CoOccurrence	2	676.10	676.10	0 %
3	RelativeRisk_CoOccurrence	3	599.07	599.07	0 %
4	RelativeRisk_CoOccurrence	4	1,751.18	1,751.18	0 %
5	RelativeRisk_CoOccurrence	5	1,647.36	1,647.36	0 %
6	RelativeRisk_CoOccurrence	6	1,460.96	1,460.96	0 %
7	RelativeRisk_CoOccurrence	7	1,237.72	1,237.72	0 %
8	RelativeRisk_CoOccurrence	8	2,472.55	2,472.55	0 %
9	RelativeRisk_CoOccurrence	9	1,210.72	1,210.72	0 %
10	RelativeRisk_CoOccurrence	10	825.89	825.89	0 %
11	RelativeRisk_CoOccurrence	11	1,460.47	1,460.47	0 %
12	RelativeRisk_CoOccurrence	12	1,946.38	1,946.38	0 %
13	RelativeRisk_CoOccurrence	Total	16,509.06	16,509.06	0 %

The baseline information on right whale habitat density and trap/pot risk within the MRA Wedge North to New Hampshire, Alternative 3.

	ModelConfiguration
1	Model Start Time: 2023−10−12 16:36:52.545777; End Time: 2023−10−12 16:37:30.343095; Duration 00:00:37.8
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Alt3_Baseline_RW.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	6.16	6.16	0 %
2	WhaleDensity	2	6.66	6.66	0 %
3	WhaleDensity	3	2.42	2.42	0 %
4	WhaleDensity	4	4.62	4.62	0 %
5	WhaleDensity	5	3.05	3.05	0 %
6	WhaleDensity	6	0.37	0.37	0 %
7	WhaleDensity	7	0.60	0.60	0 %
8	WhaleDensity	8	0.07	0.07	0 %
9	WhaleDensity	9	0.03	0.03	0 %
10	WhaleDensity	10	1.00	1.00	0 %
11	WhaleDensity	11	4.38	4.38	0 %
12	WhaleDensity	12	1.90	1.90	0 %
13	WhaleDensity	Total	31.27	31.27	0 %

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	1,313.89	1,313.89	0 %
2	RelativeRisk_Threat	2	1,424.45	1,424.45	0 %
3	RelativeRisk_Threat	3	553.68	553.68	0 %
4	RelativeRisk_Threat	4	1,386.82	1,386.82	0 %
5	RelativeRisk_Threat	5	364.88	364.88	0 %
6	RelativeRisk_Threat	6	31.64	31.64	0 %
7	RelativeRisk_Threat	7	41.84	41.84	0 %
8	RelativeRisk_Threat	8	12.44	12.44	0 %
9	RelativeRisk_Threat	9	7.00	7.00	0 %
10	RelativeRisk_Threat	10	198.41	198.41	0 %
11	RelativeRisk_Threat	11	953.48	953.48	0 %
12	RelativeRisk_Threat	12	449.45	449.45	0 %
13	RelativeRisk_Threat	Total	6,737.99	6,737.99	0 %

The baseline information on humpback whale habitat density and trap/pot risk within MRA Wedge North to New Hampshire under Alternative 3.

	ModelConfiguration
1	Model Start Time: 2023−01−12 12:46:17; End Time: 2023−01−12 12:47:09; Duration 00:00:52.54
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_Beta_V4.1.0.R
4	InputActions: EmergencyRule2023/NonPrefConst_Baseline_hback.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty_WithZero.Rdata
8	Whale Habitat Model: Duke_HumpbackWhaleModel_v11_0919.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: TRUE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= FALSE, FALSE
26	PrintScenarioMaps= TRUE, FALSE
27	PrintRedistributionMaps= TRUE
28	PrintMapsInHighResolution= FALSE
29	TruncateMaps= 0.995
30	WriteMapSources= TRUE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	3.25	3.25	0 %
2	WhaleDensity	2	2.01	2.01	0 %
3	WhaleDensity	3	2.39	2.39	0 %
4	WhaleDensity	4	17.60	17.60	0 %
5	WhaleDensity	5	32.44	32.44	0 %
6	WhaleDensity	6	29.88	29.88	0 %
7	WhaleDensity	7	32.89	32.89	0 %
8	WhaleDensity	8	27.67	27.67	0 %
9	WhaleDensity	9	31.25	31.25	0 %
10	WhaleDensity	10	32.93	32.93	0 %
11	WhaleDensity	11	18.99	18.99	0 %
12	WhaleDensity	12	8.12	8.12	0 %
13	WhaleDensity	Total	239.39	239.39	0 %

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	623.80	623.80	0 %
2	RelativeRisk_Threat	2	408.19	408.19	0 %
3	RelativeRisk_Threat	3	499.93	499.93	0 %
4	RelativeRisk_Threat	4	5,269.32	5,269.32	0 %
5	RelativeRisk_Threat	5	6,670.04	6,670.04	0 %
6	RelativeRisk_Threat	6	6,792.26	6,792.26	0 %
7	RelativeRisk_Threat	7	6,725.08	6,725.08	0 %
8	RelativeRisk_Threat	8	6,619.17	6,619.17	0 %
9	RelativeRisk_Threat	9	9,019.26	9,019.26	0 %
10	RelativeRisk_Threat	10	11,788.48	11,788.48	0 %
11	RelativeRisk_Threat	11	6,730.38	6,730.38	0 %
12	RelativeRisk_Threat	12	2,107.65	2,107.65	0 %
13	RelativeRisk_Threat	Total	63,253.56	63,253.56	0 %

The baseline information on fin whale habitat density and trap/pot co-occurrence (i.e. overlap between whales and gear within MRA Wedge North to New Hampshire under Alternative 3.

	ModelConfiguration
1	Model Start Time: 2023−01−12 12:47:42; End Time: 2023−01−12 12:48:31; Duration 00:00:49.18
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_Beta_V4.1.0.R
4	InputActions: EmergencyRule2023/NonPrefConst_Baseline_fin.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty_WithZero.Rdata
8	Whale Habitat Model: Duke_FinWhaleModel_v12.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: TRUE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= FALSE, FALSE
26	PrintScenarioMaps= TRUE, FALSE
27	PrintRedistributionMaps= TRUE
28	PrintMapsInHighResolution= FALSE
29	TruncateMaps= 0.995
30	WriteMapSources= TRUE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Total Whale Density

	Variable	Month	Default	Scenario	Reduction
1	WhaleDensity	1	12.12	12.12	0 %
2	WhaleDensity	2	8.33	8.33	0 %
3	WhaleDensity	3	7.06	7.06	0 %
4	WhaleDensity	4	7.64	7.64	0 %
5	WhaleDensity	5	15.05	15.05	0 %
6	WhaleDensity	6	17.85	17.85	0 %
7	WhaleDensity	7	25.19	25.19	0 %
8	WhaleDensity	8	28.01	28.01	0 %
9	WhaleDensity	9	17.31	17.31	0 %
10	WhaleDensity	10	13.67	13.67	0 %
11	WhaleDensity	11	10.63	10.63	0 %
12	WhaleDensity	12	14.05	14.05	0 %
13	WhaleDensity	Total	176.91	176.91	0 %

Final Relative Risk Scores − CoOccurrence

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_CoOccurrence	1	16,219.49	16,219.49	0 %
2	RelativeRisk_CoOccurrence	2	12,356.23	12,356.23	0 %
3	RelativeRisk_CoOccurrence	3	10,563.65	10,563.65	0 %
4	RelativeRisk_CoOccurrence	4	15,885.27	15,885.27	0 %
5	RelativeRisk_CoOccurrence	5	19,163.61	19,163.61	0 %
6	RelativeRisk_CoOccurrence	6	24,095.25	24,095.25	0 %
7	RelativeRisk_CoOccurrence	7	29,118.48	29,118.48	0 %
8	RelativeRisk_CoOccurrence	8	40,916.99	40,916.99	0 %
9	RelativeRisk_CoOccurrence	9	31,003.52	31,003.52	0 %
10	RelativeRisk_CoOccurrence	10	31,246.91	31,246.91	0 %
11	RelativeRisk_CoOccurrence	11	23,440.77	23,440.77	0 %
12	RelativeRisk_CoOccurrence	12	25,584.09	25,584.09	0 %
13	RelativeRisk_CoOccurrence	Total	279,594.26	279,594.26	0 %

Appendix 6.2.2 Alternative 2 Model Runs

Model scenarios presented in this section were run with a constraint for coast-wide trap/pot fisheries. For Subsection 6.2 of the accompanying Environmental Assessment, the risk outcomes were calculated relative to different baselines (either the Massachusetts Portion of Lobster Management Area 1 or the Northeast Management Region for lobster and Jonah crab) based on the data presented in Subsection 6.1.1 of this Appendix. This allows for relative risk evaluations for the two baselines and allows for the comparison of risk reduction comparisons for the Phase 1 2021 Rule (86 FR 51970, September 17, 2021).

<u>Gear Reduction (i.e. all lines removed)</u>

Gear reduction scenario in the MRA Wedge during February under Alternative 2 (Preferred). Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 12:24:53.337323; End Time: 2023−10−17 12:48:15.93426; Duration 00:23:22.8
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt2_EC_GR_Feb.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,293.52	36.6 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	48,235.55	50.2 %

Gear reduction scenario in the MRA Wedge during March under Alternative 2 (Preferred). Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 15:10:19.554773; End Time: 2023−10−17 15:43:29.415762; Duration 00:33:09.6
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt2_EC_GR_Mar.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

E

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,158.51	53.3 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	47,980.85	50.4 %

Gear reduction scenario in the MRA Wedge during April under Alternative 2 (Preferred). Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 12:53:17.354967; End Time: 2023−10−17 13:16:21.358191; Duration 00:23:04.2
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt2_EC_GR_Apr.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	3,577.65	71.9 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	47,458.62	51 %

Closure (i.e. all lines relocated)

Closure scenario in the MRA Wedge during February under Alternative 2 (Preferred). Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 12:15:17.815856; End Time: 2023−10−17 12:37:34.199541; Duration 00:22:16.2
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt2_EC_Closure_Feb.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,425.25	34.6 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	48,367.29	50 %

Closure scenario in the MRA Wedge during March under Alternative 2 (Preferred). Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 12:15:46.686947; End Time: 2023−10−17 12:38:45.336942; Duration 00:22:58.8
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt2_EC_Closure_Mar.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,192.41	52.8 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	48,014.74	50.4 %

Closure scenario in the MRA Wedge during April under Alternative 2 (Preferred). Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 12:16:24.199755; End Time: 2023−10−17 12:38:50.079771; Duration 00:22:25.8
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt2_EC_Closure_Apr.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	3,637.83	71.4 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	47,518.80	50.9 %

Appendix 6.2.3 Alternative 3 Model Runs

Risk reduction presented in this section were run with a constraint for coast-wide trap/pot fisheries. For Subsection 6.2 of this Final EA, the risk outcomes were then calculated relative to different baselines (either the Massachusetts Portion of Lobster Management Area 1 or the Northeast Management Region for lobster and Jonah crab) based on the data presented in Subsection 6.1.1 of this Appendix. This allows for relative risk evaluations for the two baselines and allows for the comparison of risk reduction comparisons for the Phase 1 2021 Rule (86 FR 51970, September 17, 2021).

Gear Reduction (i.e. all lines removed)

Gear reduction scenario in the MRA Wedge North to New Hampshire during February under Alternative 3. Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 14:22:30.256821; End Time: 2023−10−17 14:55:15.666342; Duration 00:32:45.6
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt3_EC_GR_Feb.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	3,290.30	51.4 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	47,232.33	51.2 %

Gear reduction scenario in the MRA Wedge North to New Hampshire during March under Alternative 3. Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023-10-17 14:22:45.019189; End Time: 2023-10-17 14:55:33.357962; Duration 00:32:48.6
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt3_EC_GR_Mar.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e-05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores – Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,011.49	55.4 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	47,833.82	50.6 %

Gear reduction scenario in the MRA Wedge North to New Hampshire during April under Alternative 3. Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 15:54:28.24216; End Time: 2023−10−17 16:15:41.410677; Duration 00:21:13.2
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt3_EC_GR_Apr.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	3,332.11	73.8 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	47,213.07	51.2 %

Closure (i.e. all lines relocated)

Closure scenario in the MRA Wedge North to New Hampshire during February under Alternative 3. Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 15:10:45.800054; End Time: 2023−10−17 15:44:15.029888; Duration 00:33:29.4
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt3_EC_Closure_Feb.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	3,670.65	45.8 %
3	RelativeRisk_Threat	3	6,759.06	3,420.32	49.4 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	47,612.68	50.8 %

Closure scenario in the MRA Wedge North to New Hampshire during March under Alternative 3. Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 13:32:35.320052; End Time: 2023−10−17 13:54:30.959289; Duration 00:21:55.8
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt3_EC_Closure_Mar.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Final Relative Risk Scores − Mean Threat

	Variable	Month	Default	Scenario	Reduction
1	RelativeRisk_Threat	1	14,095.75	7,325.40	48 %
2	RelativeRisk_Threat	2	6,767.33	4,300.62	36.5 %
3	RelativeRisk_Threat	3	6,759.06	3,252.90	51.9 %
4	RelativeRisk_Threat	4	12,722.55	4,361.69	65.7 %
5	RelativeRisk_Threat	5	15,487.03	4,486.26	71 %
6	RelativeRisk_Threat	6	8,382.55	5,376.22	35.9 %
7	RelativeRisk_Threat	7	9,668.92	6,105.23	36.9 %
8	RelativeRisk_Threat	8	1,862.60	1,156.04	37.9 %
9	RelativeRisk_Threat	9	1,215.45	746.45	38.6 %
10	RelativeRisk_Threat	10	4,156.58	2,135.91	48.6 %
11	RelativeRisk_Threat	11	7,782.03	4,076.19	47.6 %
12	RelativeRisk_Threat	12	7,908.71	4,752.33	39.9 %
13	RelativeRisk_Threat	Total	96,808.56	48,075.24	50.3 %

Closure scenario in the MRA Wedge North to New Hampshire during April under Alternative 3. Model run is constrained to all trap/pot fisheries coast-wide.

	ModelConfiguration
1	Model Start Time: 2023−10−17 15:54:28.24216; End Time: 2023−10−17 16:15:41.410677; Duration 00:21:13.2
2	Home Directory: //net/work4/LobsterGroup/Management/RightWhales/DecisionSupportTool
3	Model Version: DST_V4.1.05.R
4	InputActions: CrystalsSubfolder/2023_OctWedgeRule/Coastwide_WRAlternatives/Alt3_EC_GR_Apr.csv
5	MapRefDomain: MapRef_3.9.2.Rdata
6	GearMap: FisheryInputs_AllEastCoast_v4.0.1.Rdata
7	Threat Model: ThreatMod_RW_Selectivity_Uncertainty.Rdata
8	Whale Habitat Model: Duke_RightWhaleModel_v12_1019.Rdata
9	Whale Vertical Dist File: RightWhaleVerticalDistribution_CSA_V1.1.Rdata
10	Whale Vertical Dist Model: Ensemble
11	Whale Dimensions: WhaleDimensions_AdHoc.Rdata
12	
13	Comment:
14	CoOccurrence: FALSE
15	Run Test Scenario: TRUE
16	Include Ground Gear: TRUE
17	AggregateStrings: FALSE
18	HighResolution: TRUE
19	RelocationCostExp: 1
20	ExpressRedistribution: FALSE
21	RopeStrengthResolution: 500
22	MinGearDensity: 1e−05
23	
24	PrintTables= TRUE
25	PrintDefaultMaps= TRUE, TRUE
26	PrintScenarioMaps= TRUE, TRUE
27	PrintRedistributionMaps= FALSE
28	PrintMapsInHighResolution= TRUE
29	TruncateMaps= 1
30	WriteMapSources= FALSE
31	WriteOutputCsv= TRUE
32	WriteDetailedOutput= FALSE
33	PrintSummary= TRUE
34	ArchiveInputSpreadsheet: FALSE

Appendix 6.2.4 North Atlantic Right Whale Sightings

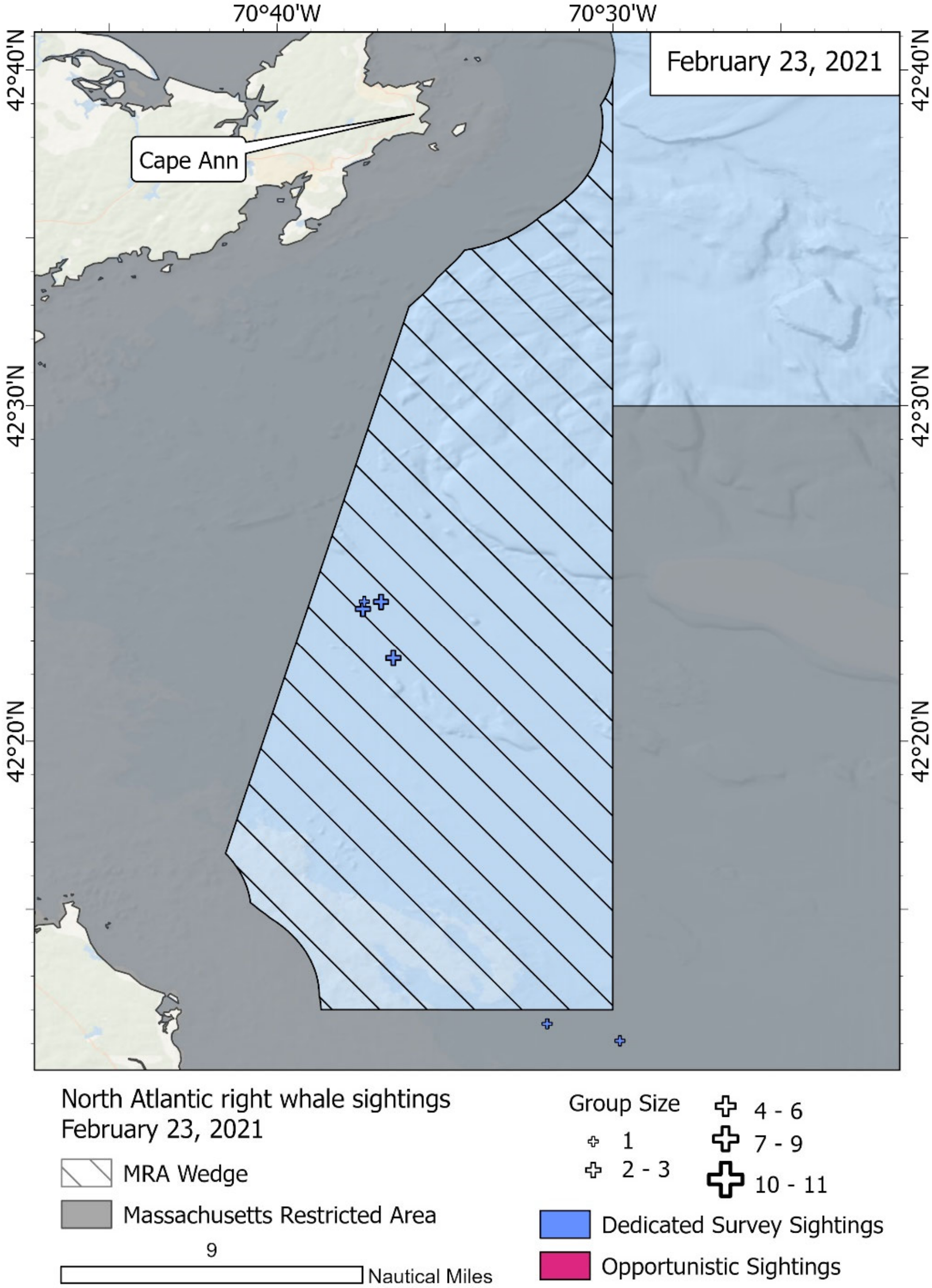
As noted in Subsection 6.2.2 of Volume I the accompanying Environmental Assessment (EA), North Atlantic right whale (right whale) sightings data demonstrate a higher concentration of right whales than is estimated by the right whale habitat-based density model built by researchers at Duke University's Marine Geospatial Ecology Laboratory in the Nicholas School of the Environment and that has been incorporated into the Large Whale Decision Support Tool developed by the Northeast Fisheries Science Center. Not only were more whales sighted each passing month from February to March, they were sighted in larger groups over time from February, March, and April.

As noted above in Table 8 in Subsection 6.2.3 of the EA, the Duke University whale density model estimates that approximately 0.04 right whales are likely present at any given time in the MRA Wedge throughout the month in February; approximately 1.4 in March; and approximately 3.3 in April. The recent right whale sightings data, not yet incorporated in the model, demonstrate a higher concentration of right whales than the Duke University whale density model incorporated within the DST. For example, on February 23, 2021, the NEFSC aerial survey team observed seven right whales inside the MRA Wedge. On April 8, 2021, a dedicated NEFSC aerial survey team observed 40 right whales in groups of up to 3 within the MRA Wedge. Later the same month, on April 28, 2021, the Center for Coastal Studies aerial survey team observed 19 right whales in the MRA Wedge. On March 7, 2022, NEFSC reported sighting three groups of three right whales (nine whales total) in the middle portion of the MRA Wedge around 42°20′ North latitude. On April 14, 2023, five right whales (a group of four and one individual) were sighted in the southernmost portion of the MRA Wedge. Opportunistic sightings were also reported. On March 14, 2020, two groups of two and three right whales (five whales total) were reported in the middle portion of the MRA Wedge around 42°20′ North latitude. On April 25, 2022, an opportunistic sighting of a group of seven right whales was reported in the southern portion of the MRA Wedge, off of North Scituate. These visual sightings dates are only a subset of reported sightings in the MRA Wedge, as shown in Figure 10 and Figures 14, 16, and 18 in Volume I of the EA. These figures also illustrate a high density of right whale sightings around the MRA Wedge, and these whales likely enter or transit through the MRA Wedge.

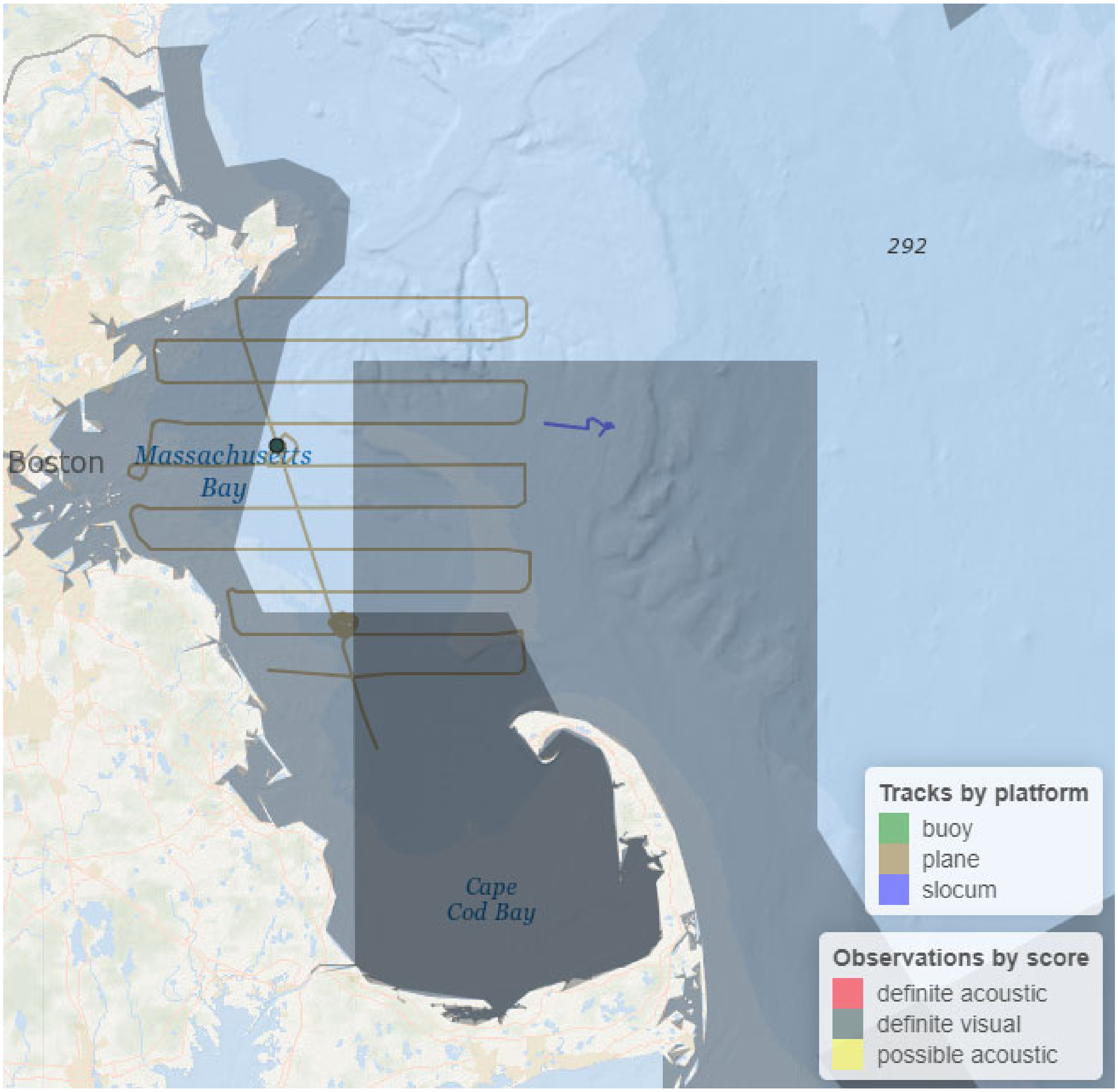
The survey sightings have not been corrected or analyzed for effort, meaning that not all survey effort is the same across areas, month or year. Therefore, right whales may be present in areas not surveyed and/or during times when surveys were not conducted. Survey effort and sightings can vary spatially, monthly, and yearly depending on weather conditions, visibility, available funding, and survey purpose. Historically, survey efforts have focused on Cape Cod Bay, Stellwagen Bank, Nantucket Shoals, and the continental shelf near Block Canyon. Other habitats utilized by right whales such as Massachusetts Bay, Federal waters north and east of Cape Ann, and Lobster Management Area 3 have not been as frequently surveyed. Additionally, surveys surrounding the action area and surrounding Federal waters were conducted with more frequency beginning in 2021, following the increase in the proportion of the right whale population utilizing Cape Cod Bay over time (Mayo et al. 2018, Ganley et al. 2019, Meyer-Gutbrod et al. 2022). We have included maps from WhaleMap.org (Johnson et al. 2021), when possible, because these maps illustrate survey track lines that help determine when detection may be related to the presence or lack of survey effort. Consequently, the current proportion of the right whale population feeding and transiting through the MRA Wedge (Alternative 2, Preferred) and MRA Wedge North to New Hampshire (Alternative 3) may still be underrepresented by the sightings data and opportunistic reports.

Right whale presence often goes undetected, and detectability can be dependent on behavioral states (transiting, feeding, socializing; Hain et al. 1999, Pendleton et al. 2009, Clark et al. 2010, Ganley et al. 2019, Ceballos et al. 2022), and on survey conditions including weather, visibility, personnel experience, and survey frequency. Additionally, whale behavior across these months may reduce the probability of a sighting from the sea surface, as the dive profiles and time spent at the sea surface differs depending on behavior and even may vary by sex within the species (Dombroski et al. 2021).

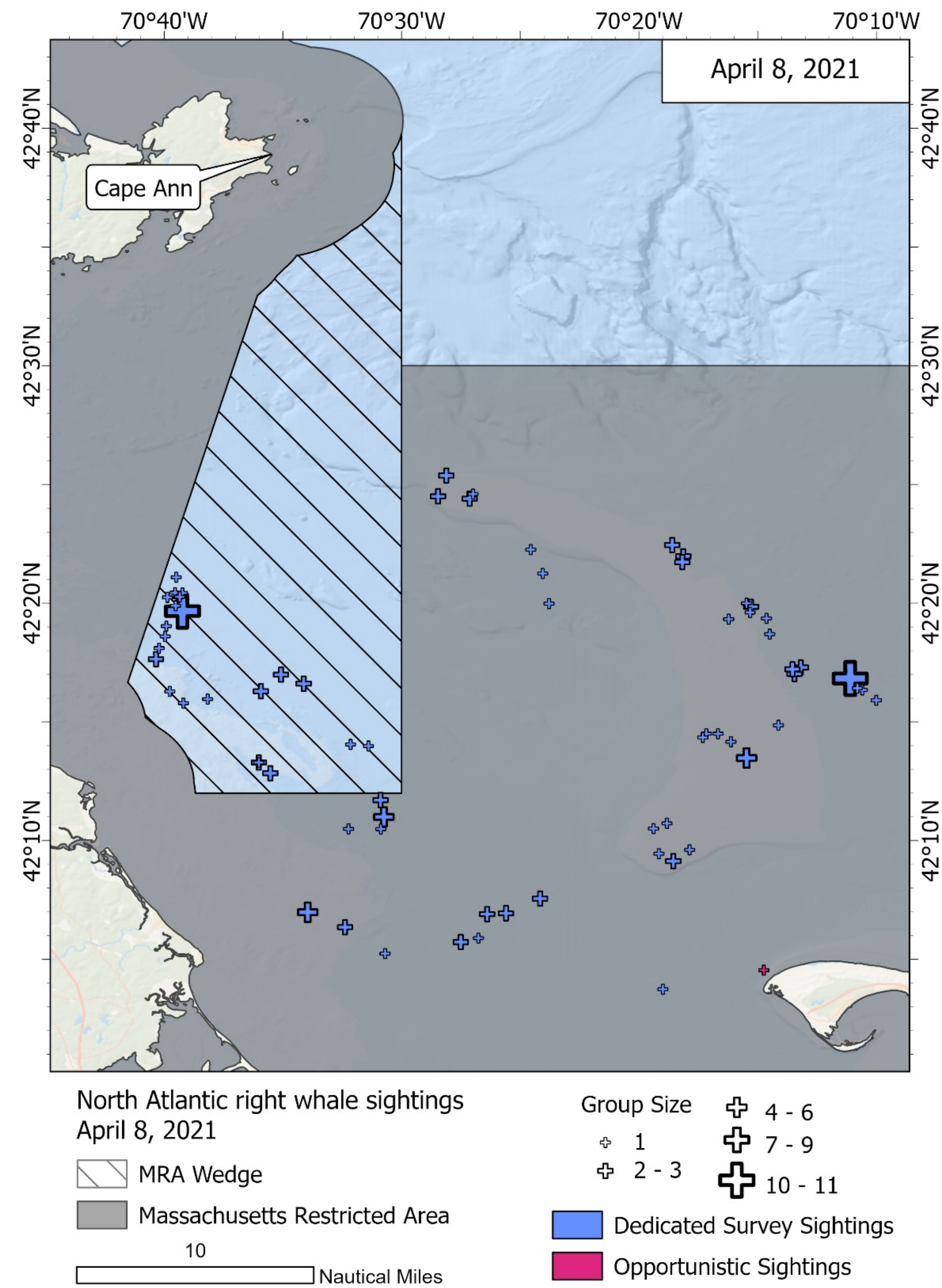
A-1: North Atlantic right whale sightings collected on February 23, 2021 in the Massachusetts Restricted Area (MRA), MRA Wedge, and adjacent waters. The Northeast Fishery Science Center aerial survey team observed 7 right whales (three groups of 2, and 1 individual right whale) inside the MRA Wedge. The survey team also noted 2 individual right whales outside of the southern border of the MRA Wedge within the MRA. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



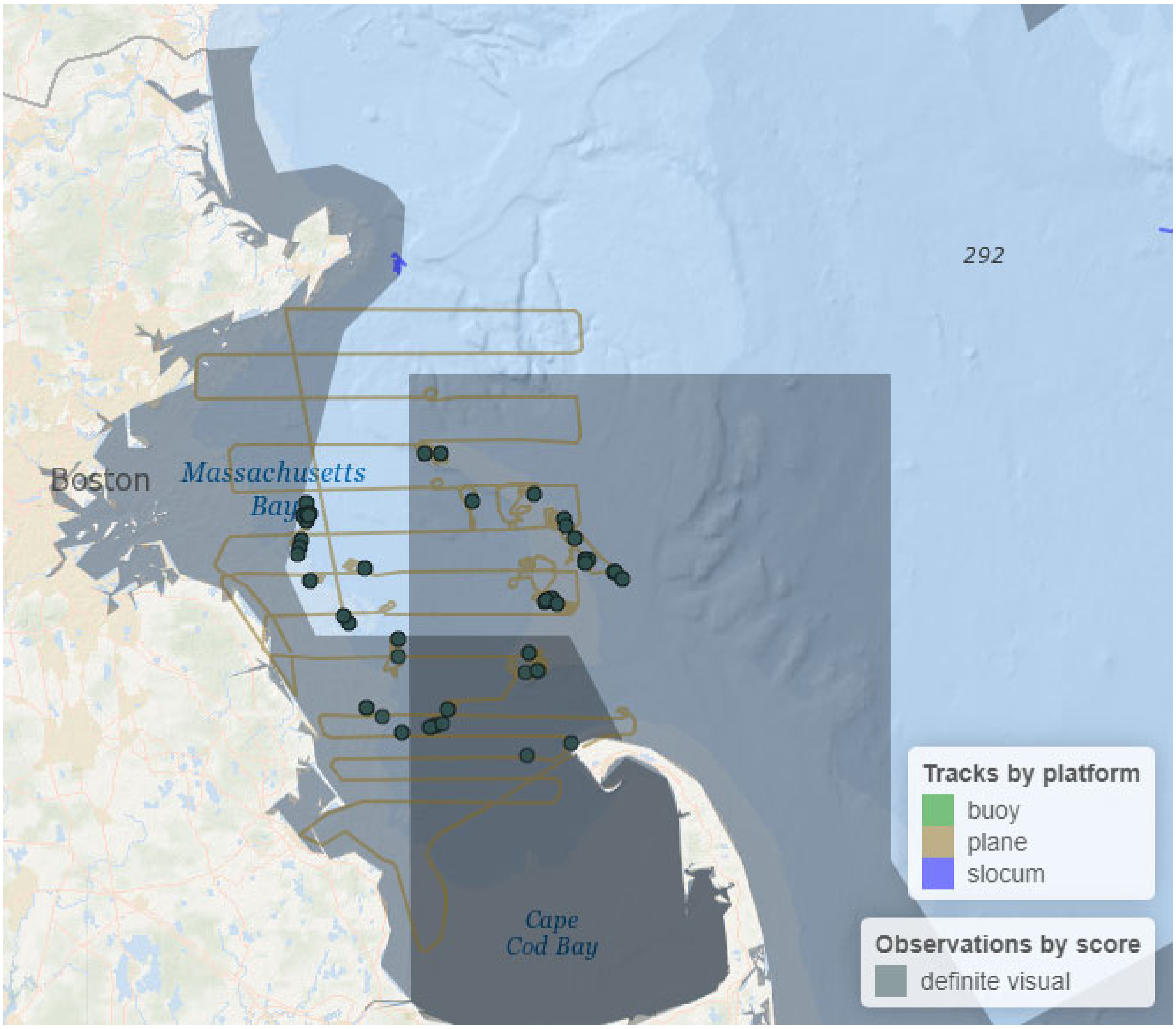
A-2: Definite visual (dark gray) detections of two North Atlantic right whales on February 23, 2021. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed January 26, 2024; https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



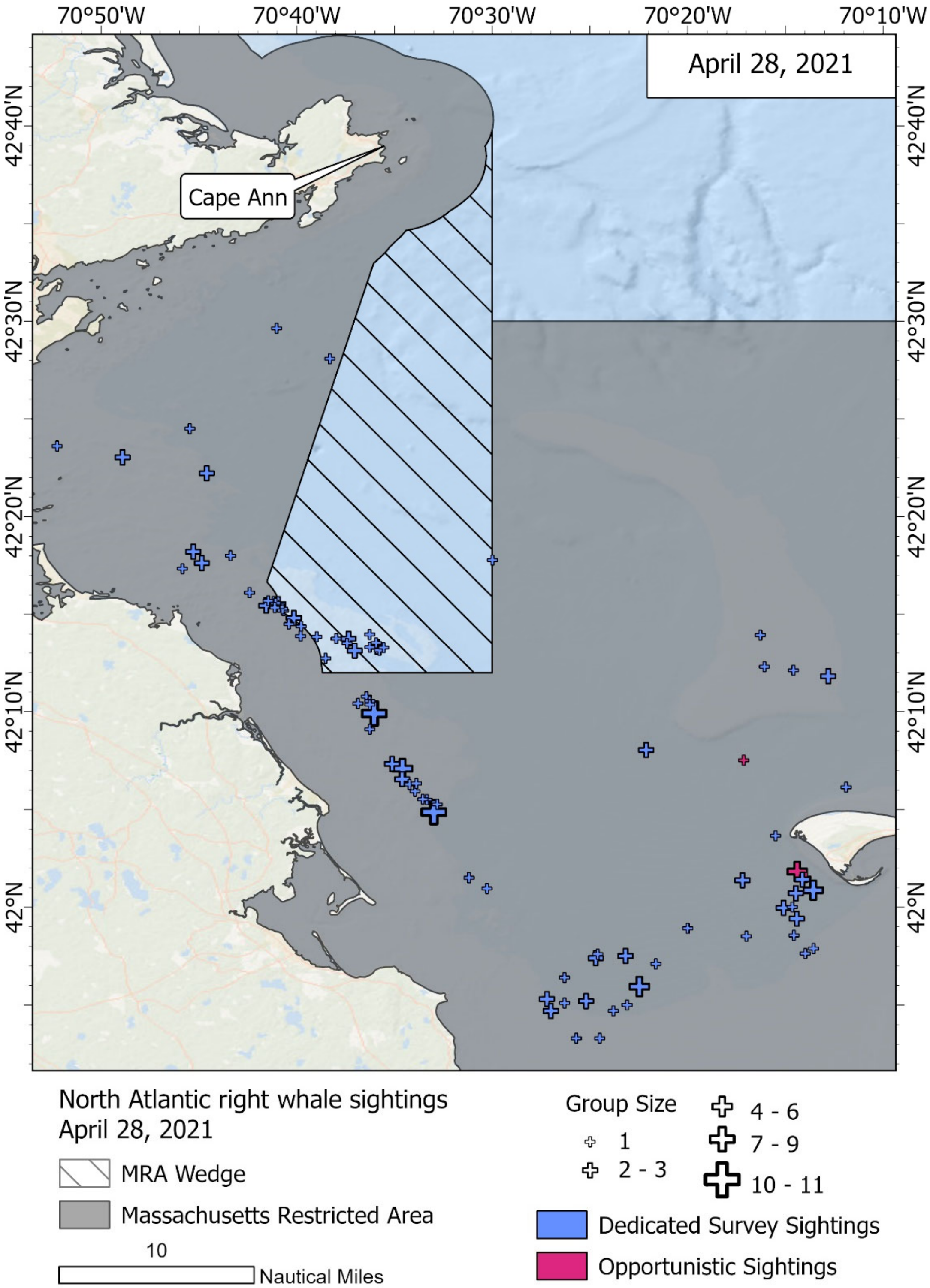
A-3: North Atlantic right whale sightings collected on April 8, 2021 in the Massachusetts Restricted Area (MRA), MRA Wedge, and adjacent waters. The Northeast Fisheries Science Center aerial survey team observed 40 right whales within the MRA Wedge. The observed right whales were in multiple groups of 2 and 3, one group of 11, and 7 individuals. Right whale sightings in the surrounding waters of the MRA were collected through dedicated aerial surveys conducted by Center for Coastal Studies (CCS) and NEFSC and dedicated shipboard surveys conducted by CCS and Stellwagen Bank National Marine Sanctuary. Among the right whales sighted in the MRA were four mom calf pairs among the whales sighted south of the MRA Wedge. One right whale was also reported opportunistically from shore near Race Point Beach in Provincetown. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



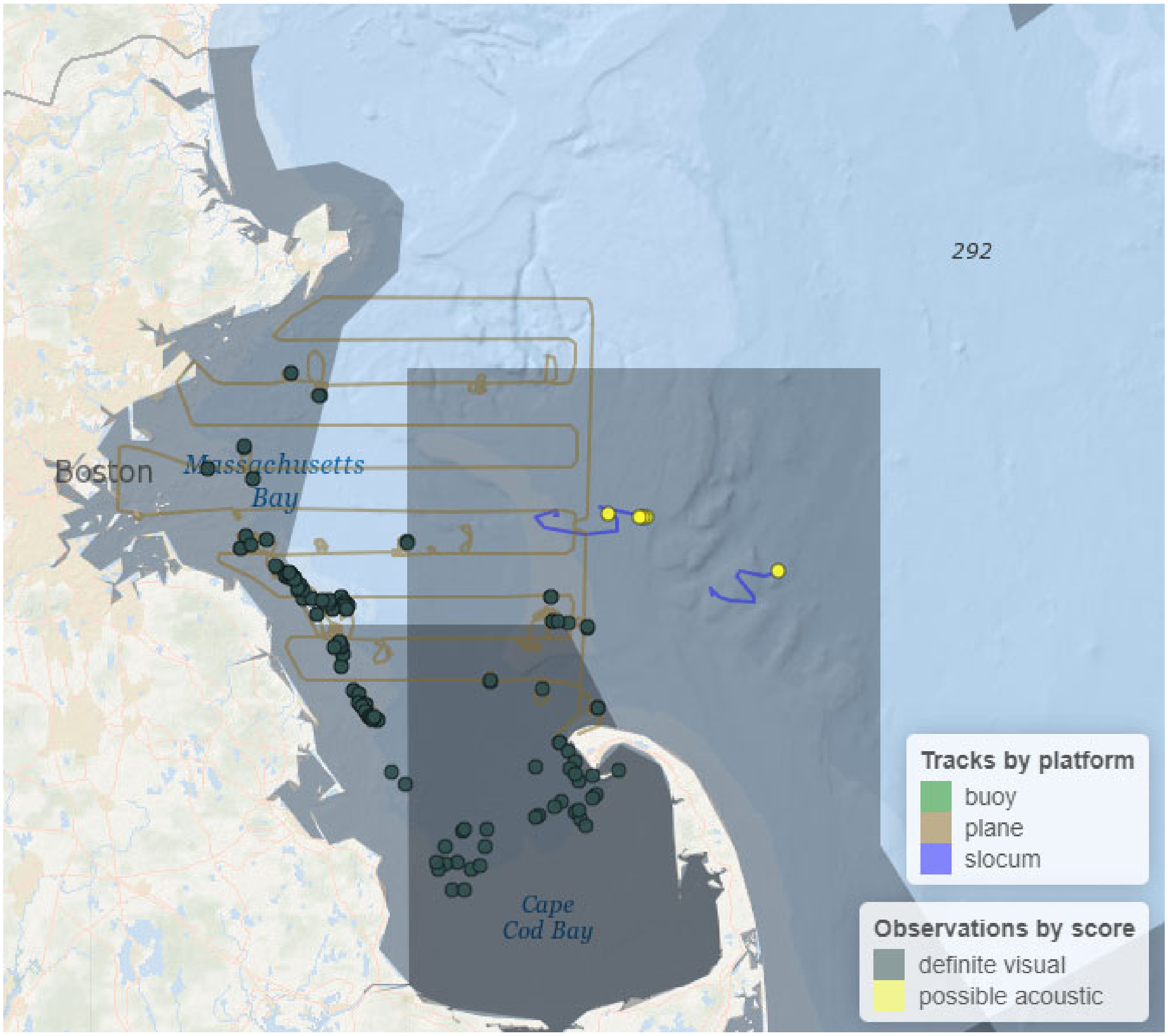
A-4: Definite visual (dark gray) detections of North Atlantic right whales on April 8, 2021. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed January 26, 2024; https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



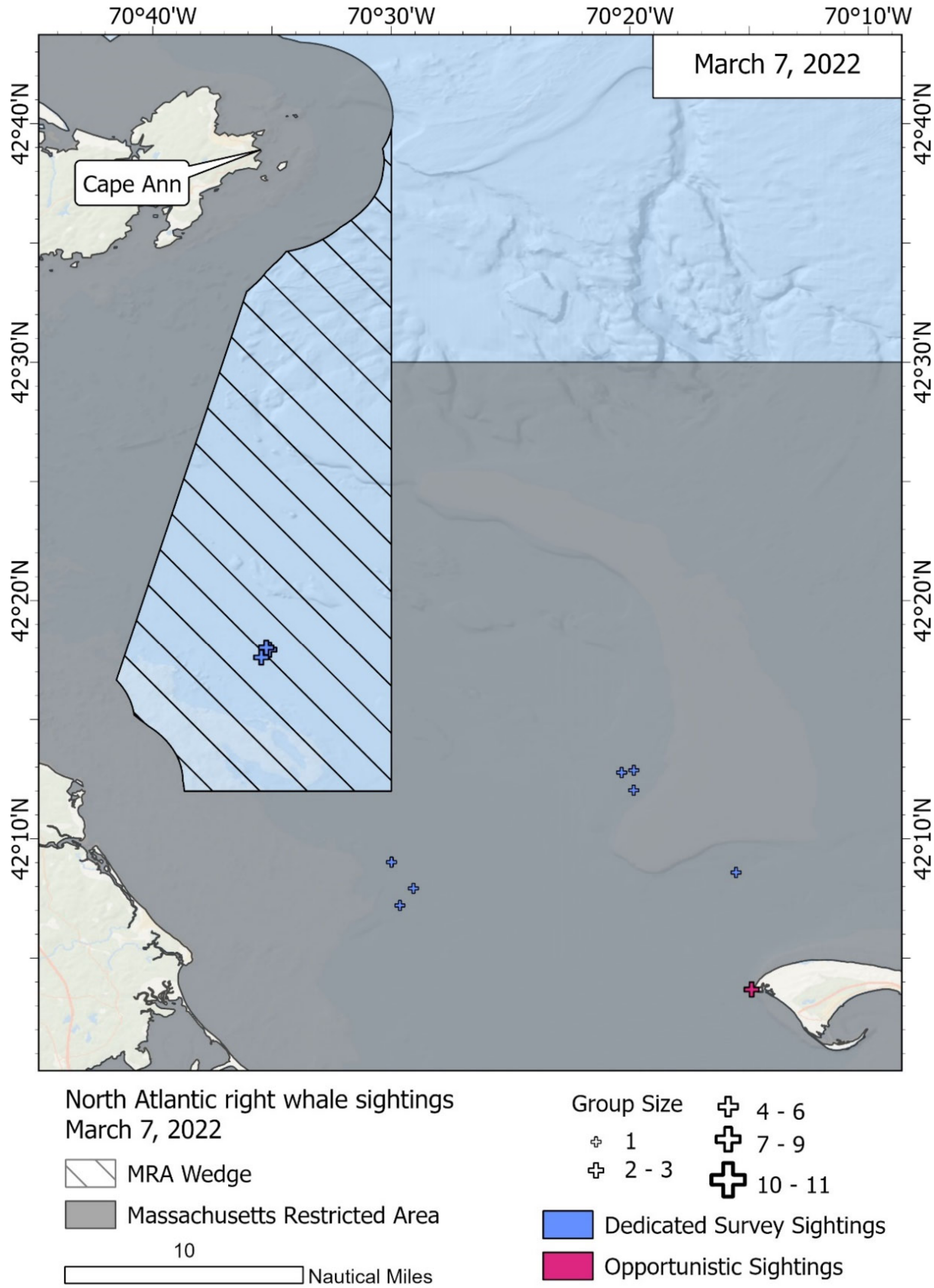
A-5: North Atlantic right whale sightings collected on April 28, 2021 in the Massachusetts Restricted Area (MRA), MRA Wedge, and adjacent waters. On April 28, 2021, the Center for Coastal Studies (CCS) aerial survey team observed 19 right whales in groups of up to 2 in the MRA Wedge. CCS and the Northeast Fisheries Science Center aerial survey teams also observed right whales in the MRA in groups of up to 9 and six mom-calf pairs. Seven right whales (2 individuals and one group of 5) were reported as opportunistic sightings by Dolphin Fleet Whale Watch. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



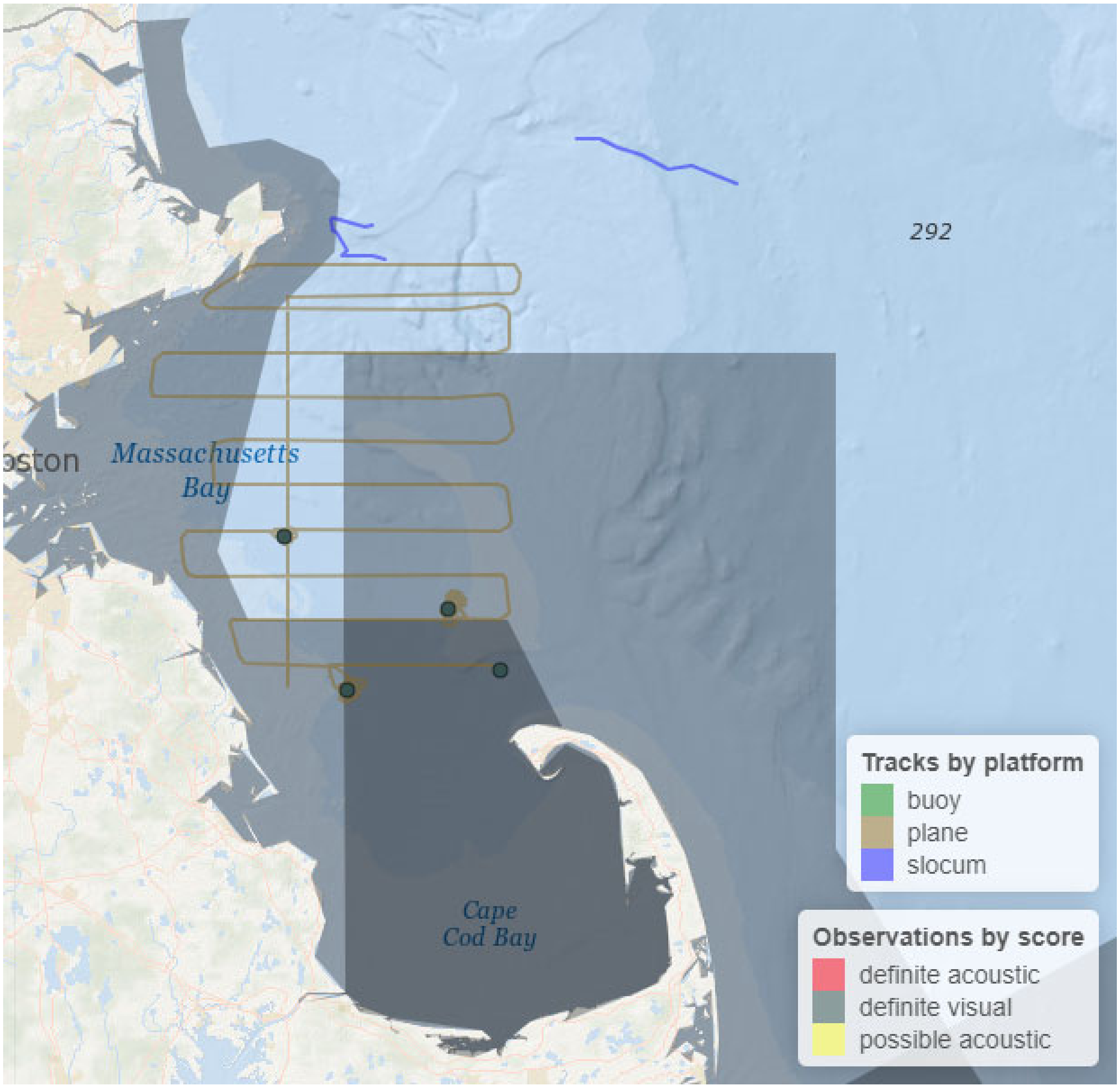
A-6: Possible acoustic (yellow circles) and definite visual (dark gray) detections of North Atlantic right whales on April 28, 2021. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed January 26, 2024; https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



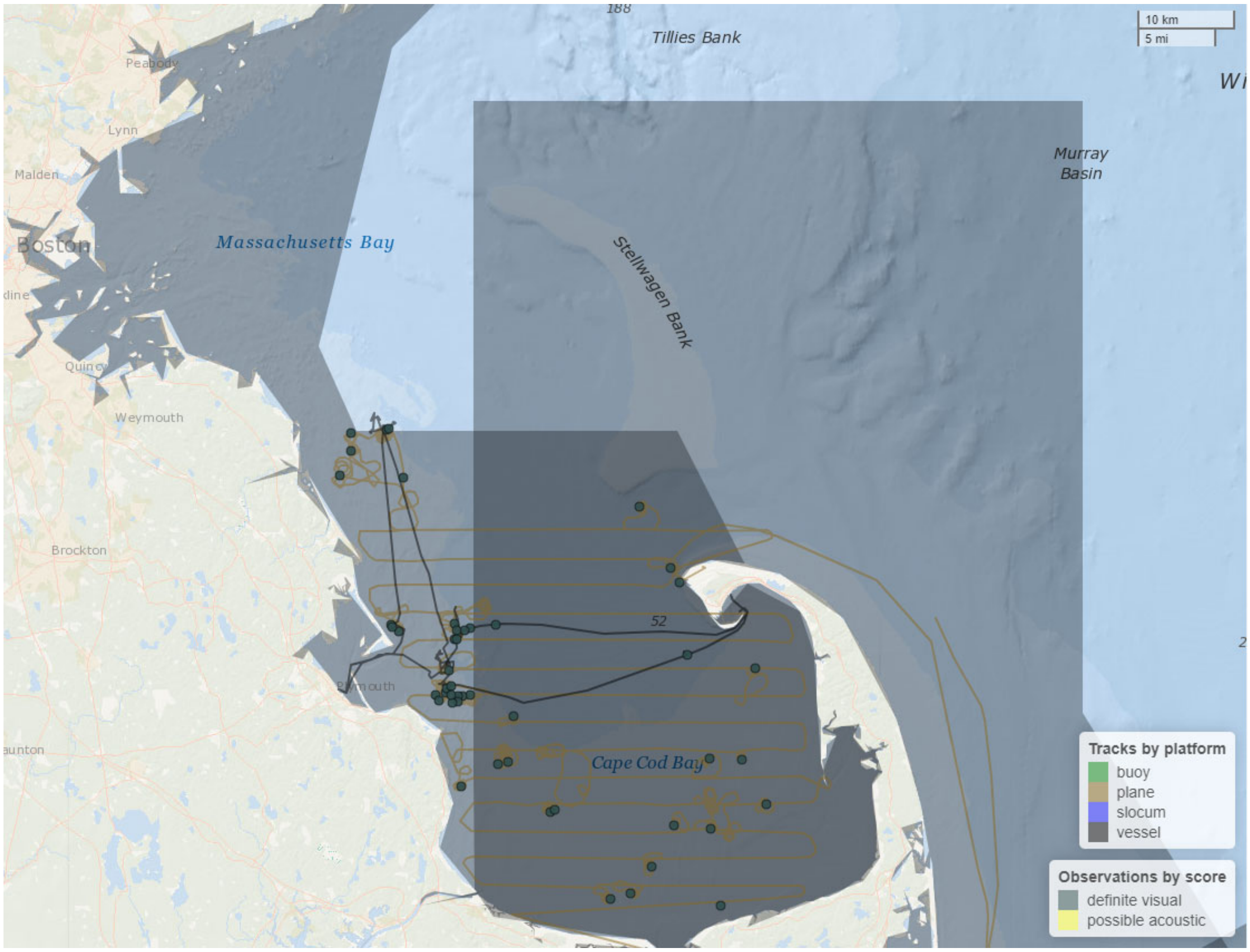
A-7: North Atlantic right whale sightings collected on March 7, 2022 in the Massachusetts Restricted Area (MRA), MRA Wedge, and adjacent waters. On March 7, 2022, NEFSC reported sighting three groups of 3 right whales (9 whales total) in the middle portion of the MRA Wedge around 42°20′ North latitude. Seven other individual right whales were sighted by NEFSC within the MRA. A pair of right whales were also reported opportunistically from shore near Race Point Beach in Provincetown. Aerial surveys concentrate on Cape Cod Bay; surveyors rarely fly north of mid Cape Ann, off Rockport, MA.



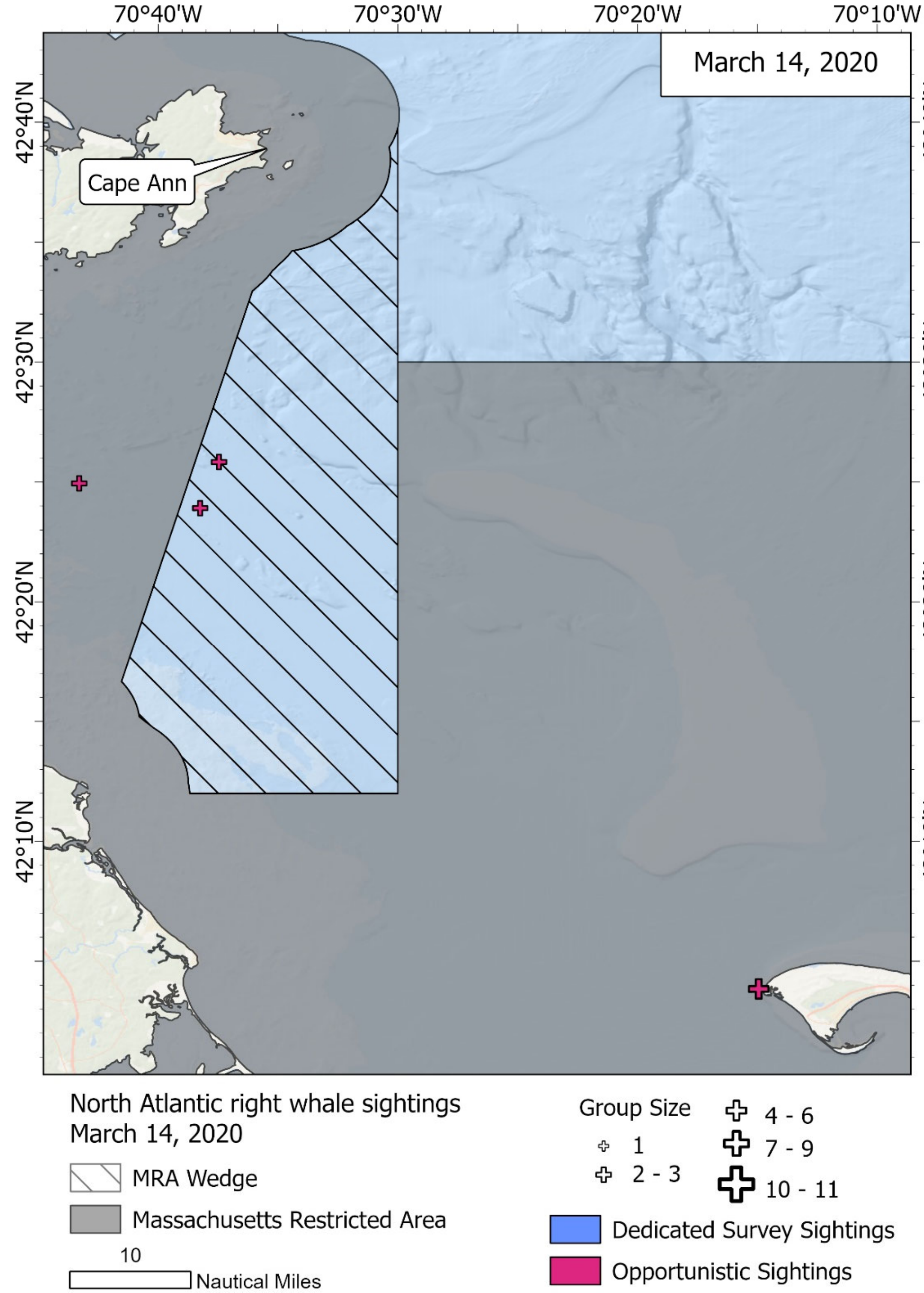
A-8: Definite visual (dark gray) detections of three North Atlantic right whales on March 7, 2022. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed January 26, 2024; https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



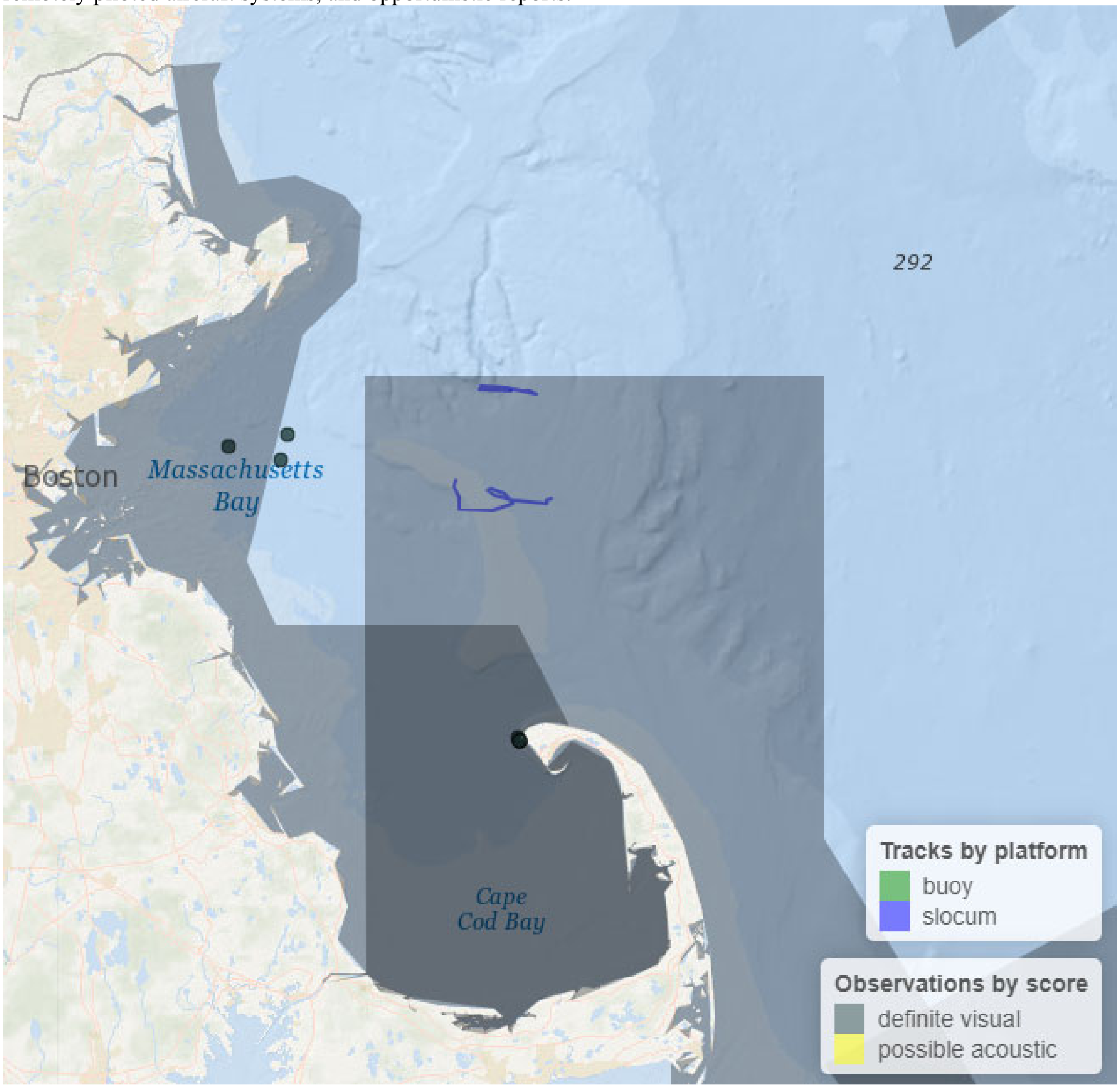
A-9: Definite visual (dark gray) detections of North Atlantic right whales on April 14, 2023. Five right whales (a group of 4 and one individual) were sighted in the southernmost portion of the MRA Wedge by the Center for Coastal Studies aerial survey team. CCS also observed 4 individual whales near the southern border of the MRA Wedge. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed January 26, 2024; https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



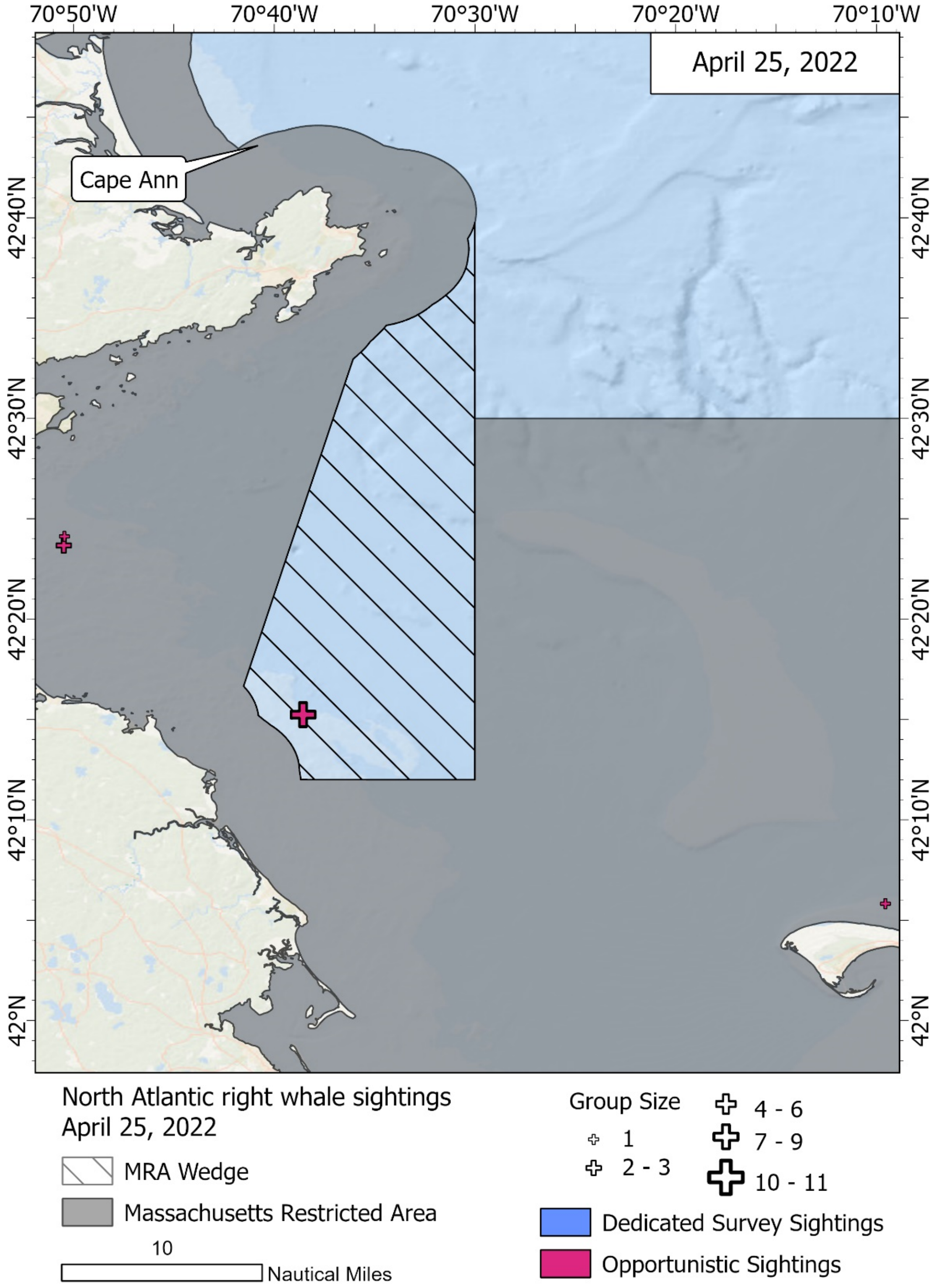
A-10: North Atlantic right whale sightings collected on March 14, 2020 in the Massachusetts Restricted Area (MRA), MRA Wedge, and adjacent waters. Five right whales (one group of 2 and one group of 3) were reported by commercial vessels in the middle portion of the MRA Wedge around 42°20′ North latitude. Boston Harbor Dredge also reported a group of 3 whales in Massachusetts Bay just west of the MRA Wedge. Another group of 5 whales were reported opportunistically from shore near Race Point Beach in Provincetown.



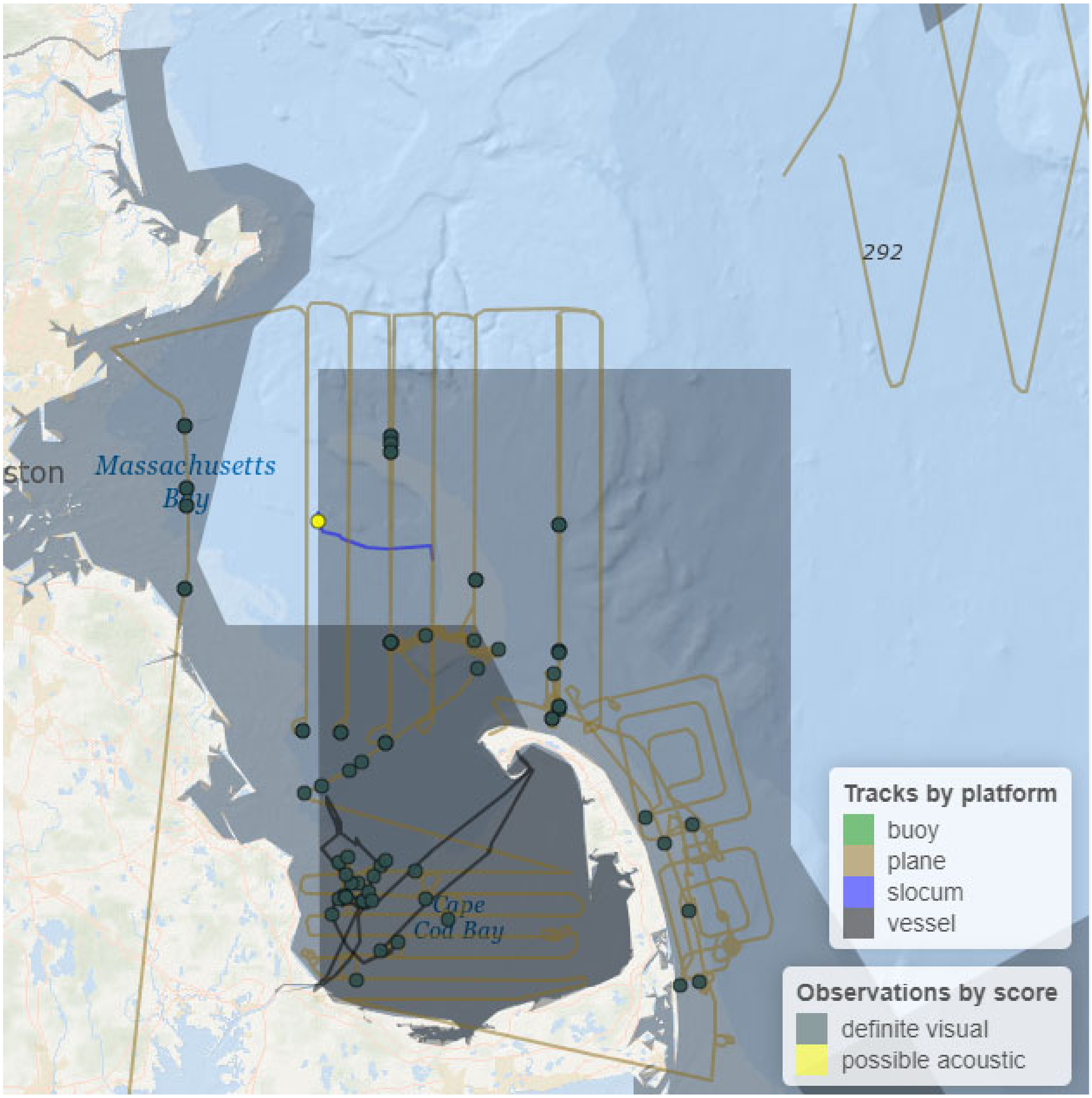
A-11: Definite visual (dark gray) detections of North Atlantic right whales on March 14, 2020. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed February 4, 2024; https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



A-12: North Atlantic right whale sightings collected on April 25, 2022 in the Massachusetts Restricted Area, MRA Wedge, and adjacent waters. On April 25, 2022, an opportunistic sighting of a group of 7 right whales was reported in the southern portion of the MRA Wedge, off of North Scituate by Stellwagen Bank National Marine Sanctuary. Three whales (one individual and one group of 2 right whales) were also reported as opportunistic sightings in Massachusetts Bay.



A-13: Possible acoustic (yellow circles) and definite visual (dark gray) detections of North Atlantic right whales on April 25, 2022. The map was created by the WhaleMap Website (Johnson et al. 2021; Accessed February 4, 2024; https://whalemap.org/WhaleMap/) and includes detection data from a variety of platforms including Slocum gliders, aerial and shipboard surveys, buoys, remotely piloted aircraft systems, and opportunistic reports.



FINAL REGULATORY IMPACT REVIEW &
FINAL REGULATORY FLEXIBILITY ANALYSIS OF MODIFICATIONS TO THE ATLANTIC LARGE WHALE TAKE REDUCTION PLAN BY MAKING PERMANENT THE MASSACHUSETTS BAY RESTRICTED AREA WEDGE

Table of Contents

1. Introduction

Actions taken to amend fisheries management plans or implement other regulations governing U.S. fisheries are subject to the requirements of a number of Federal laws and executive orders, including conducting a Regulatory Impact Review and a Regulatory Flexibility Analysis. The Regulatory Impact Review evaluates the costs and benefits of modifications to the rules that the National Marine Fisheries Service is considering. This includes the justifications for modifications, a cost benefit analysis of the alternatives, and the potential social impacts of the action. The Regulatory Flexibility Act requires Federal regulatory agencies to develop an Initial Regulatory Flexibility Analysis and a Final Regulatory Flexibility Analysis to evaluate the impact that the regulatory alternatives would have on small entities and examine ways to minimize these impacts. Although the Regulatory Flexibility Act does not require that the alternative with the least impact on small entities be selected, it does require that the expected impacts be adequately characterized. This document includes both the Final Regulatory Impact Review and Final Regulatory Flexibility Analysis of the considered modifications to the Atlantic Large Whale Take Reduction Plan.

2. Objectives and Legal Basis for 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, NMFS created the Atlantic Large Whale Take Reduction Team (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, NMFS 2021) accompanying the 2021 amendment (86 FR 51970, September 17, 2021) to the Plan and Subsection 3.1 in the associated Environmental Assessment.

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 whales) 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 months of February, March, and 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, an area of approximately 200 square miles (518 square kilometers) of Federal waters remain open to trap/pot fishing between state and Federal waters of the closure, creating the Massachusetts Restricted Area Wedge (MRA Wedge; Figure 1) where 2021 and 2022 data indicate that buoy lines from fixed-fishing gear (*i.e.*, gillnet and trap/pot gear) overlap with annual presence of right whales during the months of February, March, and

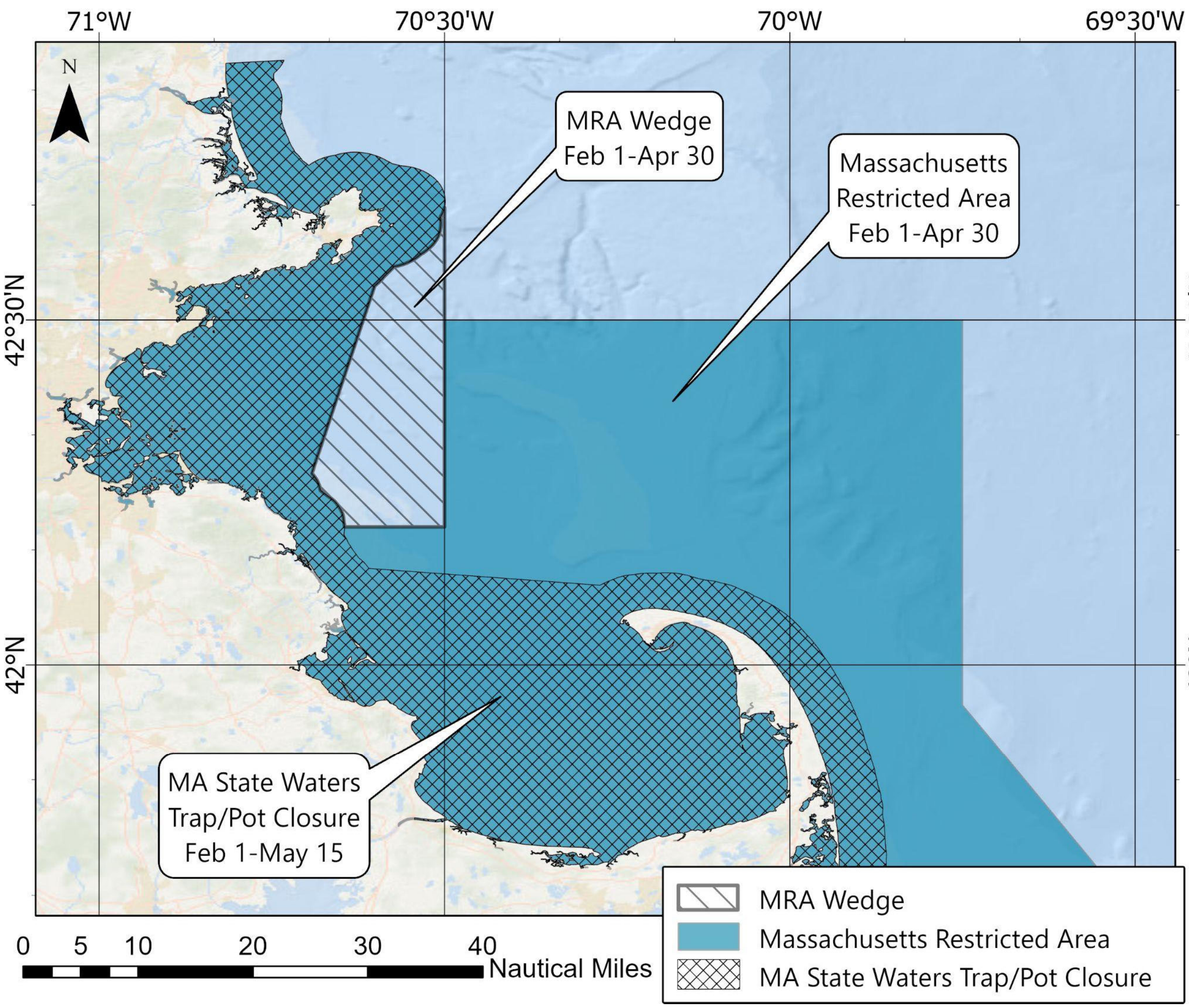
April (for more details on the co-occurrence of fixed fishing gear and right whales, see Subsection 6.2 and Figures 2, 3, and 4 in the associated EA). Aerial surveys conducted by Center for Coastal Studies (CCS) in April 2021 and February and March of 2022 documented the presence of lobster and Jonah crab trap/pot fishing gear aggregated in the MRA Wedge and waters north of the MRA (see Figures 2, and 11-13 in the associated EA). Additionally, CCS and the Northeast Fisheries Science Center (NEFSC) observed right whales within the MRA Wedge February through March 2018-2023 (see Figure 3 in the accompanying EA). Fishermen participating in the lobster and Jonah crab fishery are likely using the adjacent 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 just outside of the MRA has created an area of high risk of right whale entanglement. In early 2022, NMFS received letters and emails from Massachusetts Division of Marine Fisheries (MA DMF), Stellwagen Bank National Marine Sanctuary, and non-governmental organizations expressing concerns about this gap in restricted waters and the heightened risk of entanglement for right whales (see Appendix 3.1 of the associated EA for Letters of Concern). After reviewing available information and due to the high risk of entanglement in this relatively small area, NMFS issued an emergency rule prohibiting trap/pot fishery buoy lines between Federal and state waters of the MRA Wedge for the month of April in 2022 (87 FR 11590; March 2, 2022).

In December 2022 and January 2023, NFMS again received letters and emails from MA DMF expressing concerns about this gap in restricted waters and the heightened risk of entanglement for right whales. NMFS discussed this area with the Team in January 2022, and in December of 2023 the Team included a closure of this area within a suite of recommendations that achieved a majority but non-consensus support. Further, NMFS received public comments expressing concern about entanglement risk and associated recommendations for large seasonal restricted areas in the Federal waters surrounding MRA. These comments were submitted by non-governmental organizations during the scoping period (September 9, 2022 through October 11, 2022) for additional modifications to the Plan (87 FR 55405, September 9, 2022). In 2023 the emergency rule was extended, closing the MRA Wedge from February 1, 2023 through April 30, 2023 (88 FR 7362; February 3, 2023).

On December 29, 2022, President Biden signed H.R. 2617, the Consolidated Appropriations Act (CAA), into law. The CAA establishes that from December 29, 2022, through December 31, 2028, NMFS' September 17, 2021, rule amending the Plan, Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations, published at 86 FR 51970 (September 17, 2021), "shall be deemed sufficient to ensure that the continued Federal and State authorizations of the American lobster and Jonah crab fisheries are in full compliance" with the MMPA and the ESA. H.R. 2617-1631–H.R. 2617-1632 (Division JJ–North Atlantic Right Whales, Title I–North Atlantic Right Whales and Regulations, § 101(a)). The CAA requires NMFS to promulgate new lobster and Jonah crab regulations, consistent with the MMPA and ESA, that take effect by December 31, 2028. Id at § 101(a)(2). Notwithstanding these directions, § 101(b) of the CAA provides that § 101(a) shall not apply to "any action taken to extend or make final an emergency rule that is in place on the date of enactment of this Act, affecting lobster and Jonah crab."

The objective of the evaluated actions is to reduce the acute risk of right whales to entanglement with trap/pot fisheries in waters adjacent to the existing MRA where there is high overlap between right whales and 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) of 0.7 serious injuries or mortalities a year for this population (Hayes et al. 2023). Modifying the boundaries of the MRA to include the MRA Wedge will address a critical gap where there is a particularly high chance of entanglement that was not addressed in recent modifications to the Plan.

Figure 1: Massachusetts Restricted Area, MRA Wedge, and MA State Waters Trap/Pot Closure Areas under consideration. Massachusetts Restricted Area waters are closed to commercial trap/pot buoy lines from February 1 through April 30. Massachusetts State regulations prohibit trap/pot fishing from February 1 through May 15, but can be extended past May 15 in the continued presence of North Atlantic right whales or rescinded after April 30 in their absence (322 CMR 12.04(2)).



3. Affected Fisheries

As required by the Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (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 (PBR) 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 Atlantic Large Whale Take Reduction 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. The evaluated alternatives focus on trap/pot fisheries within the vicinity of the Massachusetts Restricted Area Wedge in Lobster Management Area 1, particularly Massachusetts permitted lobster and Jonah crab vessels that are most likely to be impacted by this measure during the months of February, March, and April.

4. Regulatory Alternatives

The alternatives were selected based on the results of surveys conducted by Center for Coastal Studies and the Northeast Fisheries Science Center that observed North Atlantic right whales from February through April of 2018-2023 and/or fixed fishing gear adjacent to the Massachusetts Restricted Area (MRA) throughout February, March, and April in 2021 and 2022; acoustic and visual detections of North Atlantic right whales from various platforms collected February through April of 2020-2023; and quantitative modeling using the Large Whale Decision Support Tool. The data and analyses are further described in Subsection 6.2 of the associated Environmental Assessment.

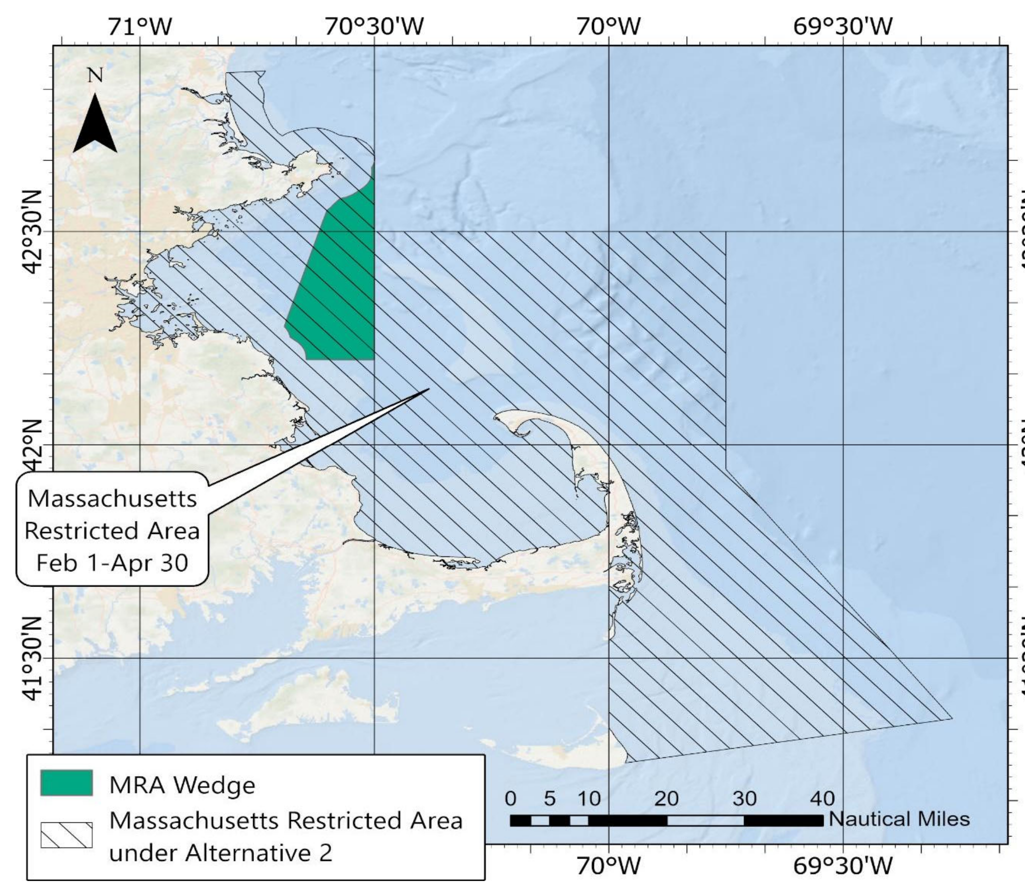
Alternative 1: No Action (Status Quo)

Alternative 1, No Action, leaves the current Atlantic Large Whale Take Reduction Plan (Plan) intact with no regulatory changes. This includes the restricted areas implemented by the 2021 Final Rule on September 17, 2021 (86 FR 51970) that went into effect October 18, 2021 and requirements for minimum traps per trawl and weak inserts throughout the buoy line that went into effect May 1, 2022.

Alternative 2: Preferred

Alternative 2, the Preferred Alternative, would add approximately 200 square miles (518 square kilometers) of Federal waters to the existing Massachusetts Restricted Area (MRA) that prohibits the use of persistent trap/pot buoy lines from February 1 through April 30. The additional Federal waters, referred to as the Massachusetts Restricted Area Wedge (MRA Wedge), begin in Federal waters east of Cape Ann, are bounded landward by the Massachusetts State waters within the MRA and south along the 70°30′ W longitude line until they intersect with the MRA at the 42°12′N latitude line, and run west along that line until it intersects the State water boundary of the MRA in the southwest corner of the MRA Wedge (Figure 2). Authorizations for fishing without buoy lines using on-demand gear (sometimes referred to as ropeless gear) in the MRA during this time must be obtained through an Exempted Fishing Permit until modifications to regulations are implemented that allow alternative gear marking schemes.

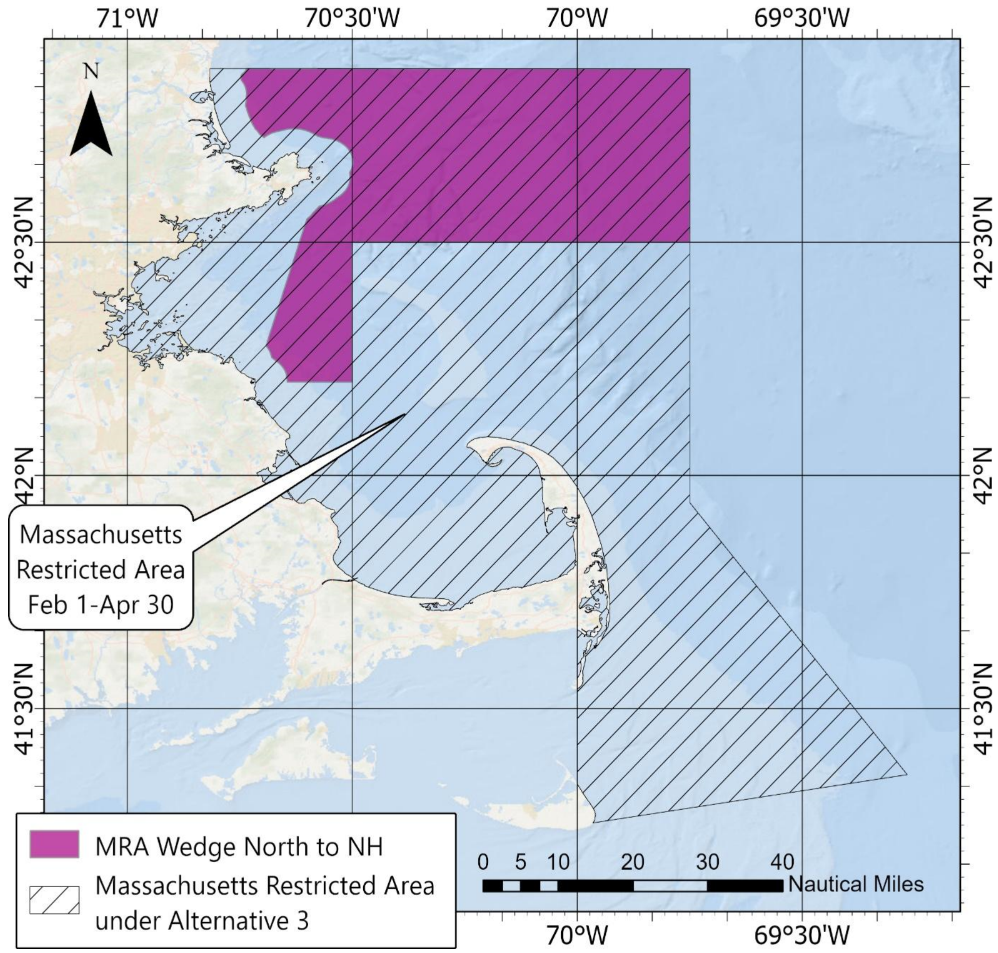
Figure 2: Alternative 2 (Preferred Alternative) would add approximately 200 square miles (518 square kilometers) of Federal waters, referred to as the MRA Wedge, to the Massachusetts Restricted Area during the existing closure period of February 1 through April 30. The Massachusetts Restricted Area would remain closed to trap/pot fishing with buoy lines from February 1 through April 30.



Alternative 3: Non-Preferred Alternative

Alternative 3 would add approximately 1,297 square miles (3,359 square kilometers) of Federal waters to the existing MRA that restricts the use of persistent trap/pot gear buoy lines from February 1 through April 30. Alternative 3 would extend the northern MRA boundaries up to the New Hampshire border at 42°52.58′ N (MRA Wedge North to NH; Figure 3). Authorizations for fishing without buoy lines using on-demand gear (sometimes referred to as ropeless gear) in the MRA during this time must be obtained through an Exempted Fishing Permit until modifications to regulations are implemented that allow alternative gear marking schemes.

Figure 3: Alternative 3 would add approximately 1,297 square miles (3,359 square kilometers) of Federal waters, referred to as the MRA Wedge North to New Hampshire to the Massachusetts Restricted Area during the existing closure period of February 1 through April 30. The Massachusetts Restricted Area would remain closed to trap/pot fishing with buoy lines from February 1 through April 30.



5. Final Regulatory Impact Review

5.1. Economic Baseline for Comparison

The baseline for the economic analysis is Alternative 1, which requires no action. The number of fishing vessels and fisheries landings data used for this economic analysis are the averages from 2017 to 2021. For Alternative 2, the Preferred Alternative, it is estimated that 26 to 31 trap/pot vessels would be affected by the modification of the Atlantic Large Whale Take Reduction Plan (Plan). Alternative 3 would affect 53 to 66 vessels.

5.2. Time Horizon

The final rule would become effective on February 1, 2024 or thirty days after publication if later than January 1, and will be in effect for the months of February, March, and April every year for at least the next five years as broad amendments to the Plan are anticipated to take effect by December 31, 2028, pursuant to the Consolidated Appropriations Act. For the economic impact analysis, we provide the estimated compliance costs for the first year after implementation, as well as the annualized cost for five years with discount rates of 3 percent as well as 5 percent.

5.3. 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 changes to the Plan, which would impose additional restrictions on commercial fishing operations.

Assessing the benefits of a 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 action 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. However, the dollar values for protecting whales are difficult to calculate. The value of protecting right whales might not be adequately or fully captured by people’s willingness to pay for ecosystem services. The loss or injury to whales as individuals might be deemed relevant, regardless of people’s willingness to pay. Chami et al. (2020) estimated that large whales along the coast of Brazil and Chile could provide various ecosystem services including carbon capture in whale bodies, carbon capture through phytoplankton enhancement, fisheries enhancement, and ecotourism. For the southern right whales, the average annual services value of each large whale could be $2.2 million. 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.

5.4. Economic Analysis of Alternatives

5.4.1. Benefits of the Alternatives

Although it is difficult to calculate the monetary benefits of whale protection from this action, we could estimate the effects on risk reduction 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 restricted areas included in the 2021 final rule (86 FR 51970, September 17, 2021) are considered part of the status quo for this 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.

Importantly, the presence of buoy lines used by the trap/pot fishery during these months creates an acute entanglement risk in an area where right whales are known to aggregate and feed (for more information on fishing effort and large whale sightings and habitat use in the action area, see Subsection 6.2 in the associated Environmental Assessment (EA)). Trap/pot gear was observed in the Lobster Management Area 1 (LMA 1) waters adjacent to the Massachusetts Restricted Area (MRA) on April 19 and 28, 2021 and February 6 and March 11, 2022 by Center for Costal Studies and Northeast Fisheries Science Center aerial surveys (see Figure 2 in the associated EA). Aggregations of right whales in Cape Cod Bay are particularly dense beginning in February and extending through April, indicating that they use the Massachusetts Restricted Area Wedge (MRA Wedge) seasonally and as they transit in and out of the Cape Cod Bay and the surrounding waters (see Figure 3 in the associated EA). Dedicated right whale survey efforts are centralized in Cape Cod Bay, and surveys northward in Massachusetts Bay are not conducted with the same frequency. Right whale presence often goes undetected, and detectability can be dependent on behavioral states (transiting, feeding, socializing; Hain et al. 1999, Pendleton et al. 2009, Clark et al. 2010, Ganley et al. 2019, Ceballos et al. 2022). Removing and/or relocating lines away from areas of high whale use provides benefits to right whales present during the months of February, March, and April.

As discussed in detail in Subsection 6.2.2 of the accompanying EA, the Large Whale Decision Support Tool (DST) employs a right whale habitat-based density model built by researchers at Duke University's Marine Geospatial Ecology Laboratory in the Nicholas School of the Environment (hereafter referred to as the Duke University whale density model or right whale habitat density layer) that estimates the spatiotemporal distribution and density of right whales throughout the action area based on observations of right whales from standardized surveys from January 2010 through September 2020 and co-located oceanographic and habitat variables to create a map of likely whale presence.

For the purposes of comparing the relative risk reduction of Alternatives 2 and 3, the DST considered two likely fishing behaviors in response to the MRA Wedge seasonal closure to estimate a range of maximum and minimum relative risk reduction, as discussed in Subsection 6.2.2 of the associated EA. The maximum relative risk reduction considers the effects of vessels removing all buoy lines from the water (gear reduction scenario), whereas the minimum risk reduction considers the effects of vessels relocating all of their gear to areas outside of the restricted area (closure scenario). Actual risk reduction will likely fall between the two analyzed extremes. Within the Massachusetts' portion of LMA 1, the modification of the MRA seasonal closure to include the MRA Wedge closure, the DST estimates a reduction in the annual risk by 13 to 16.5 percent, and to include the MRA Wedge North to New Hampshire, the DST estimates a reduction in risk by 22.6 to 38.3 percent, depending on whether gear is relocated outside of the seasonal closure or removed respectively. Relative to the risk in the Northeast Region Trap/Pot Management Area (Northeast Region), the addition of the MRA Wedge to the MRA seasonal closure is an estimated 1.8 to 2.3 percent reduction of trap/pot entanglement risk. In the Northeast Region, estimated mean risk reduction under Alternative 3 ranges from 3.1 to 5.3 percent depending on whether gear is relocated or removed from this area. Reducing the risk that a right whale encounters buoy rope reduces the potential for an entanglement incident that could lead to mortality or serious injury.

Table 1: Comparison of Large Whale Decision Support Tool relative reduction in estimates of North Atlantic right whale entanglement risk within the seasonal restricted areas described in Alternative 2 (Preferred) and Alternative 3 from February 1 through April 30. Under Alternative 2, the Massachusetts Restricted Area is modified to include the MRA Wedge, and under Alternative 3, the Massachusetts Restricted Area boundaries are expanded northward to New Hampshire to include MRA Wedge North to New Hampshire. Under Closure scenarios, gear is relocated outside of the seasonal restricted area, leaving the number of buoy lines within the water the same before and after a management intervention. Under Gear Removed scenarios, fishing gear is removed from the waters. The MA portion of LMA 1 refers to the Massachusetts portion of Lobster Management Area 1. The Northeast Region refers to the lobster and Jonah crab trap/pot fishery in the Northeast Region Trap/Pot Management Area. See Subsection 6.2.2 of the associated Environmental Assessment for an overview of the Large Whale Decision Support Tool and analysis included in this Environmental Assessment.

Estimated Relative Risk Reduction under Alternative Action Areas	Feb 1-Apr 30 Closure	Feb 1-Apr 30 Gear Removed
Relative to MA portion of LMA 1		
with MRA Wedge (Alternative 2: Preferred)	13%	16.5%
with MRA Wedge North to NH (Alternative 3)	22.6%	38.3%
Relative to All Northeast Trap/Pot		
with MRA Wedge (Alternative 2: Preferred)	1.8%	2.3%
with MRA Wedge North to NH (Alternative 3)	3.1%	5.3%

5.4.2. Costs of the Alternatives

As mentioned earlier, the action will generate economic impacts on the trap/pot fisheries for at least five years after implementation. To estimate the short-term and long-term economic impacts, we will provide the compliance cost for the first year, and then we will estimate the annualized cost based on a period of five years and the discount rates of three and seven percent.[1] We analyzed three alternatives for this action. Alternative 1 leaves the provisions of the Plan unchanged, and thus would have no economic impacts relative to current regulatory requirements. Alternative 2, the Preferred Alternative, expands the spatial boundaries of the MRA to include the MRA Wedge from February 1 through April 30. It would add approximately 200 square miles (518 square kilometers) to the 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 would add approximately 1,297 square miles (3,359 square kilometers) of Federal waters (referred to as the MRA Wedge North to NH) to the existing MRA that restricts the use of persistent trap/pot gear buoy lines from February 1 through April 30. Alternative 3 would extend the northern MRA boundaries up to the New

[1] We assume that the compliance cost remains the same each year for five years.

Hampshire border at 42°52.58′ N. Alternative 3 would impact additional vessels in Northern Essex County compared to Alternative 2.

The following section gives an overview of the analytic approach and results of economic impacts.

Research Method

Vessels that fished within the restricted area have two options to comply with this rule: relocate their traps to waters north or east of the MRA Wedge and keep fishing, or bring their traps back to dock and suspend fishing activity. Vessel Trip Report (VTR) gear distribution data from the past few seasons show that at least half of the traps were placed at the southern portion of the restricted areas under Alternative 2 (Preferred) and Alternative 3. Because these traps are about 20 to 30 miles from the northern or eastern boundary of the restricted area, they would be difficult to relocate, as the distance is beyond the normal range of fishing vessels.

Vessels that fished within the restricted area have two options to comply with this action: relocate their traps outside of the restricted area boundaries and continue fishing, or remove their traps from the restricted area to suspend fishing activity. This analysis considers the impacts if half of the vessels relocate their traps and the other half removes their gear and stops fishing. For relocated vessels, the cost differences come from reduced revenue on the new fishing ground, and extra operating costs to move gear. For vessels that stop fishing, the cost differences include lost revenue, gear moving costs, and saved operating costs from not fishing. The lower and higher end of cost estimates come from a combination range of the lost revenue of the relocated vessels, and the gear moving costs for all vessels (see details in the following section).

To estimate catch impacts of the action, we first used the VTR data for 2017-2021 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 landings weight for both lobster and Jonah crab. And finally, we calculated the landings value by multiplying the weight and price. The monthly average prices were calculated from NMFS dealer data for 2017-2021. All final values are adjusted to 2021 U.S. dollars by using gross domestic product (GDP) deflator from U.S. Bureau of Economic Analysis (BEA 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 landings value by the percent of VTR vessel coverage. NMFS Federal permit data show that from 2017 to 2021, about 41 percent of Massachusetts federal lobster vessels in LMA 1 did not have VTR requirement, which means the landings value from VTR data need to be divided by 59 percent.

Another factor that needs to be considered is the operating cost savings from vessels that stop fishing. 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 only occur when the vessel goes on a fishing trip. If a vessel does not fish, then these costs should be considered as savings. We use VTR data to determine the total number of fishing days, and then we apply an average daily operating cost to estimate the total savings.

For the operating costs of transporting gear back to the dock, or to resume fishing outside the restricted area, we assume that fishermen need three to six days to move all their traps around, and multiply that by 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.

Predicted Impacts

Vessel Lost Revenue

The modified restricted area would be in place from February to April. During these months, few vessels were actively fishing and the landings were relatively low compared to summer/fall season. In Table 2 and 3, we list all lobster and Jonah crab vessels and landings value during February, March, and April from 2017 to 2021 for Alternative 2 and Alternative 3. We also provide the adjusted value by dividing the average value by 59 percent, as not all vessels were reporting their trips. We estimated that 26 to 31 vessels would be affected by Alternative 2, with a total estimated lobster and Jonah crab landings value of $318,770 (Table 2). Alternative 3 would impact 53 to 66 vessels with a total estimated landings value of $1,052,569 (Table 3).

Table 2: The number of affected vessels and landings values in the Alternative 2 from 2017-2021 (in 2021 $).

	February		March		April	
	Number of vessels	Landings Value	Number of vessels	Landings Value	Number of vessels	Landings Value
2017	18	$44,672	18	$37,343	24	$99,552
2018	25	$130,445	18	$64,155	19	$144,306
2019	16	$46,591	14	$35,915	20	$80,831
2020	19	$47,206	12	$22,222	14	$33,499
2021	13	$61,224	15	$43,883	12	$47,748
Average	18	$66,028	15	$40,704	18	$81,187
Adjusted Average	31	$112,004	26	$69,046	30	$137,719

Notes:
1. Landings values include both lobster and Jonah crab.
2. Both vessel number and landings are from Federal VTR data. Based on Federal vessel permit data, only 59 percent of Massachusetts federal lobster vessels are required to submit VTR, so the final numbers are adjusted proportionally to reflect the whole lobster fleet.

Table 3: The number of affected vessels and landings values in the Alternative 3 from 2017-2021 (in 2021 $).

	February		March		April	
	Number of vessels	Landings Value	Number of vessels	Landings Value	Number of vessels	Landings Value
2017	32	$144,973	31	$83,673	39	$163,309
2018	48	$488,671	35	$264,741	39	$391,033
2019	37	$194,738	31	$155,475	35	$179,161
2020	42	$250,343	32	$99,482	31	$102,029
2021	35	$266,417	26	$175,252	26	$143,211
Average	39	$269,028	31	$155,725	34	$195,749
Adjusted Average	66	$456,358	53	$264,159	58	$332,052

Notes:
1. Landings values include both lobster and Jonah crab.
2. Both vessel number and landings are from federal VTR data. Based on federal vessel permit data, only 59 percent of Massachusetts federal lobster vessels are required to submit VTR, so the final number is adjusted proportionally to reflect the whole lobster fleet.

Vessel Operating Cost Savings

Vessels that decide to stop fishing during closure months could save some operating costs. We estimated the vessel operating costs based on the cost surveys conducted by the NEFSC for fishing years 2011, 2012, and 2015. Survey data show that the average annual operating costs for lobster vessels in the Northeast Region is about $50,365 (in 2021 dollars). Table 4 displays the potential cost savings. We calculate the percentage of trips in each month, and then assign the operating cost to each month based on the trip percentage. At the end, we multiply the cost per vessel and the affected vessel number to get the total cost saving for each month.

Table 4: Cost savings for vessels that stop fishing during closure months (in 2021 $)

		Affected vessel number	Annual cost per vessel	Closure month trip %	Monthly cost per vessel	Total cost
Alt. 2	Feb	15	$50,365	4.77%	$2,403	$37,092
	Mar	13	$50,365	3.31%	$1,669	$21,806
	Apr	15	$50,365	4.10%	$2,067	$31,210
Alt. 3	Feb	33	$50,365	4.77%	$2,403	$79,075
	Mar	26	$50,365	3.31%	$1,669	$43,894
	Apr	29	$50,365	4.10%	$2,067	$59,614

Notes:
1. We assume that half of the vessels would stop fishing.
2. Annual cost per vessel is based on NEFSC survey results.
3. Closure month trip percentage is from VTR data.

Final Results

We estimated that 26 to 31 vessels would be affected by Alternative 2, and 53 to 66 vessels affected by Alternative 3. For Alternative 2, the first year compliance costs including gear transportation cost and lost revenue range from $339,000 to $608,000 for February to April. For vessels moving their gear to new fishing grounds, the costs are around $139,000 to $278,000, about $9,500 to $19,100 per vessel; for vessels that stop fishing, the costs are around $200,000 to $331,000, about $11,000 to $18,000 per vessel (Table 5). For Alternative 3, the compliance costs range from $898,000 to $1,453,000. Total costs for vessels moving their gear to new fishing grounds range from $290,000 to $581,000, about $9,900 to $20,000 per vessel. Total costs for vessels that stop fishing are from $608,000 to $872,000, about $11,400 to $20,500 per vessel (Table 6).

Table 5: Economic impacts of Alternative 2 by month (in 2021$)

	Feb		March		April		Total	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Relocating costs (half vessels)								
Lost revenue	$2,800	$5,600	$1,726	$3,452	$3,443	$6,886	$7,969	$15,938
Gear moving	$46,310	$92,619	$39,185	$78,370	$45,292	$90,583	$130,786	$261,572
Sum	$49,110	$98,219	$40,911	$81,822	$48,735	$97,469	$138,755	$277,511
Stop fishing costs (half vessels)								
Lost revenue	$56,002	$56,002	$34,523	$34,523	$68,860	$68,860	$159,385	$159,385
Gear moving	$46,310	$92,619	$39,185	$78,370	$45,292	$90,583	$130,786	$261,572
(Cost savings)	$37,092	$37,092	$21,806	$21,806	$31,210	$31,210	$90,107	$90,107
Sum	$65,219	$111,529	$51,903	$91,088	$82,942	$128,233	$200,064	$330,850
Total cost	$114,329	$209,748	$92,814	$172,910	$131,676	$225,703	**$338,819**	**$608,361**

Notes:
1 We estimate lost revenue of the relocating vessels to be between 5 and 10 percent of the total landings value.
2. We estimate gear moving costs to take between 3 and 6 days at $1,000/day.

Table 6: Economic impacts of Alternative 3 by month (in 2021 $)

	Feb		March		April		Total	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Relocating costs (half vessels)								
Lost revenue	$11,409	$22,818	$6,604	$13,208	$8,301	$16,603	$26,314	$52,628
Gear moving	$98,726	$197,452	$78,879	$157,758	$86,512	$173,025	$264,117	$528,234
Sum	$110,135	$220,270	$85,483	$170,966	$94,814	$189,627	$290,431	$580,862
Stop fishing costs (half vessels)								
Lost revenue	$228,179	$228,179	$132,079	$132,079	$166,026	$166,026	$526,285	$526,285
Gear moving	$98,726	$197,452	$78,879	$157,758	$86,512	$173,025	$264,117	$528,234
(Cost savings)	$79,075	$79,075	$43,894	$43,894	$59,614	$59,614	$182,584	$182,584
Sum	$247,829	$346,555	$167,064	$245,943	$192,924	$279,437	$607,818	$871,935
Total cost	$357,964	$566,825	$252,547	$416,908	$287,738	$469,064	**$898,249**	**$1,452,797**

Notes:
1 We estimate lost revenue of the relocating vessels to be between 5 and 10 percent of the total landings value.
2. We estimate gear moving costs to take between 3 and 6 days at $1,000/day.

Based on the annual compliance costs, we provide the total costs and annualized costs for five years assuming that the costs remain the same every year. The total costs for Alternative 2 are around $1.7 million to $3 million. With a three percent discount rate, the annualized costs would be around $370,000 to $664,000; with a seven percent discount rate, the annualized costs would be around $413,000 to $742,000. For Alternative 3, the total compliance costs for five years are around $4.5 million to $7.3 million. With a three percent discount rate, the annualized costs would be around $981,000 to $1.6 million; with a seven percent discount rate, the annualized costs would be around $1.1 million to $1.8 million.

5.4.3. 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 trap/pot buoy lines.

The biological impacts analysis is presented in the associated EA and based primarily on empirical evidence demonstrating co-occurrence of aggregated gear and right whales within areas analyzed. In addition to the empirical evidence, the analysis compares the relative risk reduction of the alternative using the DST to examine how the regulatory alternatives might relatively reduce the risk of mortality and serious injury of right whales in trap/pot gear. The DST integrates information on buoy line density, line strength, and whale sightings as indicators of the potential for mortality and serious injury to occur as a result of entanglement. Risk includes the chance of encounter estimated using co-occurrence as well as the relative severity of an encounter through the use of line strength. Biological impacts are characterized by estimating risk outcomes of each alternative relative to the baseline risk (no action). See Subsection 6.2 in the associated EA and Volume II Appendices 3.1 and 5.1 of the 2021 FEIS (NMFS 2021) accompanying the 2021 final rule (86 FR 51970, September 17, 2021) for more details on the DST and how empirical evidence of risk and relative risk reduction is evaluated for this action.

Table 7 summarizes the annual compliance costs related to the relative estimated change in risk under each Alternative relative to the No Action Alternative (Alternative 1). The DST estimates the relative risk of right whale mortality or serious injury in the Massachusetts' portion of LMA 1 would be reduced by approximately 13 to 16.5 percent under Alternative 2, which has an estimated total compliance costs of $339,819 to $608,361 for 26 to 31 vessels. For every unit of gear threat reduction estimated, the cost of Alternative 2 is estimated at $22,740 to $40,830.

Alternative 3 achieved relatively better risk reduction than Alternative 2, with an estimated 22.6 to 38.3 percent decrease in right whale entanglement mortality or serious injury relative to the MA portion of LMA 1. This alternative would increase the likelihood of reducing right whale entanglement risk. However, the total compliance costs associated with the estimated risk reduction in Alternatives 3 are substantially higher, ranging from $898,249 to $1,452,797; or $30,092 to $48,670 for each unit of risk reduction. That is, each risk reduction unit of Alternative 3 would cost about 19 to 32 percent more than Alternative 2.

Table 7: A summary of annual compliance costs (in 2021 dollars) related to estimated right whale gear risk reduction relative to existing risk in the LMA 1 portion of Massachusetts.

	Alternative 2	Alternative 3
Affected vessels	26-31	53-66
Risk reduction	13.2 -16.6 %	22.3 -37.4 %
Total compliance costs	$338,819 - $608,361	$898,249 - $1,452,797
Costs for each unit of risk threat reduction	$22,740 - $40,830	$30,092 - $48,670

Notes:
1. Risk reduction ranges are based on fully relocated gear and fully removed gear.
2. To calculate the cost per unit of risk reduction, we used the middle point of the risk reduction ranges, as the compliance costs assumed that half of the vessels would relocate and half would stop fishing.

5.4.4. Uncertainties

There are a few uncertainties in our analysis.

When considering whether fishermen would relocate or remove their gear, we expected that half of the vessels that had previously fished in the MRA Wedge would suspend their fishing activities, and the other half would relocate their traps to northern waters. The restricted area expansion is located in Federal waters and surrounded by the existing MRA. VTR data from the 2020 and 2021 show that at least half of the vessels fished at the southern portion of the restricted areas in Alternative 2 and Alternative 3. For Alternative 2, we used the 42°30' N line to decide whether vessels relocate or stop-fishing based on locations in VTR data because this line is the northern boundary of the current MRA east to the MRA Wedge. The analysis considers that fishermen fishing south of this line would choose to not relocate as it would not be economically efficient. Similarly we used 42°40' line for Alternative 3 because vessels south of this line are likely too far to move outside of the restricted area (Massachusetts Division of Marine Fisheries pers. comm. January 12, 2023). During the April 2022 emergency closure, MA DMF communicated it was likely 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, we split the anticipated reaction of vessels between relocating and suspending fishing in our analysis.

We also used VTR data in the calculation of the number of vessels and landings value, which may have limitations. We are aware that VTR are self-reported data and the catch and location data are limited in accuracy for some vessels. However, the geographic information and gear configuration data could not be found in any other data sources for lobster and Jonah crab trap/pot fisheries. Therefore, we decided to use the data from recent years (2017-2021) after careful review and the removal of outliers.

Furthermore, because not all vessels are required to provide federal lobster VTRs, we divided the VTR landings value by the percent of VTR vessels that report to estimate the total number of vessels fishing in this area. NMFS federal permit data show that from 2017 to 2021, about 41 percent of Massachusetts Federal lobster vessels in LMA 1 did not have a VTR requirement, which means the landings value from VTR data needed to be divided by 59 percent.

For the total compliance costs, we estimated that trap/pot fisheries in the MRA Wedge would be impacted for at least five years, and the annual compliance costs would remain constant each year.

As previously noted, the inability to quantify and value the benefits of potential changes to the Plan prohibits the use of BCA to identify the regulatory alternative that would provide the greatest net benefit. Instead, Table 7 summarizes the estimated cost of complying with each regulatory alternative combined with the risk reduction estimated for each alternative.

5.5. Results of Final Regulatory Impact Analysis

The purpose of Executive Order (E.O.) 12866 is to enhance planning and coordination with respect to new and existing regulations. This E.O. requires the Office of Management and Budget to review regulatory programs that are considered to be “significant.” E.O. 12866 requires a review of 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 $200 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.

The action does not constitute a significant regulatory action under E.O. 12866 for the following reasons: The action will not have an annual effect on the economy of more than $200 million and is not predicted to have an adverse impact on fisherman and fishing businesses, ports, recreational anglers, and operators of party/charter businesses. In addition, there should be no interactions with activities of other agencies and no impacts on entitlements, grants, user fees, or loan programs. The action does not raise novel legal or policy issues as the action has already been implemented twice by emergency rulemaking, once for one month and once for the full extent of the closure period. As such, the action is not considered significant as defined by E.O. 12866.

All beneficial and adverse impacts of the action have been analyzed to reach the conclusion of no significant impacts. NMFS has considered the cost information presented above and believes that Alternative 2 (Preferred) achieves the goal of reducing acute entanglement risk within the MRA Wedge in 2024 and beyond. Alternative 1 remains status quo and though it does not incur a cost, it leaves right whales at risk. Compared to Alternative 2, Alternative 3 provides more protection, but the cost per unit of risk reduction is 19 to 32 percent higher. Based on these considerations, NMFS has identified Alternative 2 (Preferred) as its approach to addressing the considerable risk to right whales that occurs in the MRA Wedge in a manner that is consistent with the goals of the Plan.

6. Final Regulatory Flexibility Analysis

The purpose of the Regulatory Flexibility Analysis is to reduce the impacts of burdensome regulations and record-keeping requirements on small businesses. To achieve this goal, the Regulatory Flexibility Act (RFA) requires government agencies to describe and analyze the effects of regulations and possible alternatives on small business entities. Based on this information, the Final Regulatory Flexibility Analysis (FRFA) determines whether the preferred alternative would have a significant economic impact on a substantial number of small entities. This Chapter contains a FRFA prepared under §604 of the RFA, which includes an assessment of the effects that the proposed action and other alternatives are expected to have on small entities.

6.1. Description and Estimate of the Number of Small Entities

This section provides an assessment and discussion of the potential economic impacts of the action, as required of the RFA.

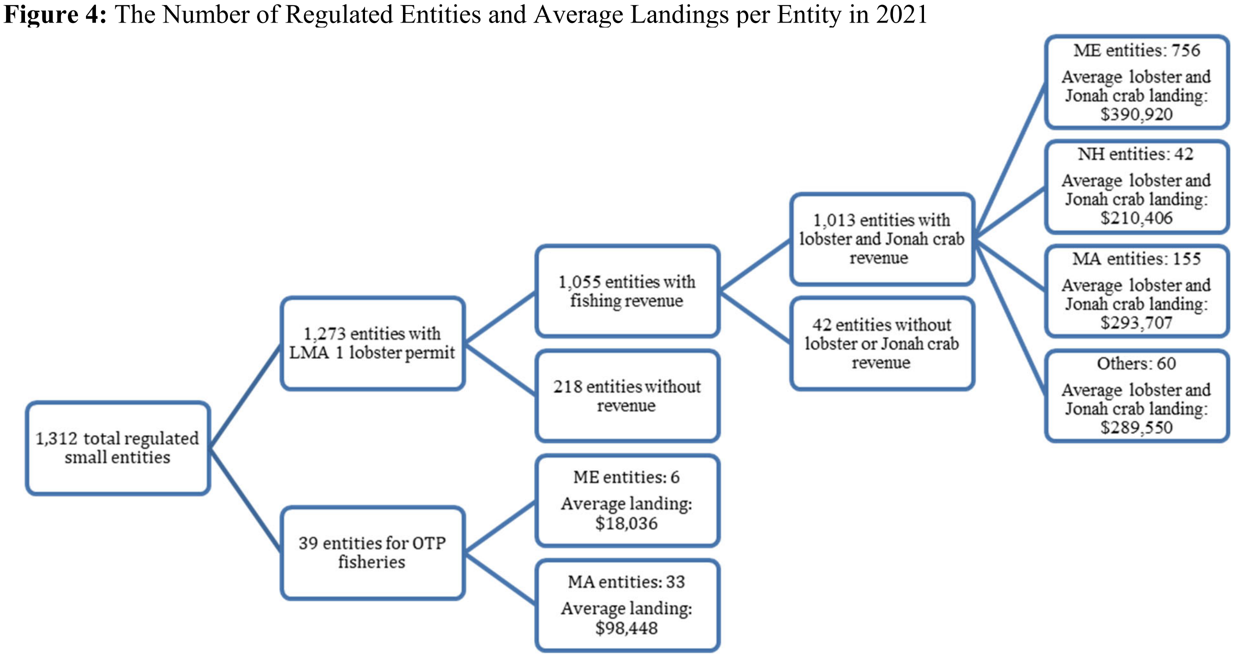
Section 3 of the Small Business Act defines affiliation as an entity or a concern that may arise among two or more persons with an identity of interest. Individuals or firms that have identical or substantially identical business or economic interests (such as family members, individuals or firms with common investments, or firms that are economically dependent through contractual or other relationships) may be treated as one party with such interests aggregated (13 CFR 121.103(f)). These principles of affiliation allow for consideration of shared interest that does not necessarily require common ownership. However, data are not available to ascertain non-ownership interest so we use an affiliated vessel database created by the Northeast Fisheries Science Center (NEFSC). There are three major components of this dataset: vessel affiliation information, landings values by species, and vessel permits. All federal permitted vessels in the Northeast Region from 2019 to 2021 are included in this dataset. Vessels are affiliated into entities according to common owners. The entity definition uses only unique combinations of owners.

The total number of regulated entities is based on permits held. Since this action applies to the trap/pot fishery in the Massachusetts Restricted Area Wedge (MRA Wedge), only entities that possess one or more of these permits are evaluated. Then for each affiliation, the revenues from all member vessels of the entity are summed into affiliation revenue in each year. On December 29, 2015, the NMFS issued a final rule establishing a small business size standard of $11 million in annual gross receipts for all businesses primarily engaged in the commercial fishing industry

(NAICS 11411) for RFA compliance purposes only. The $11 million standard became effective on July 1, 2016. Thus, the RFA defines a small business in the lobster fishery as a firm that is independently owned and operated with receipts of less than $11 million annually. Based on this size standard, the three-year average (2019-2021) affiliation revenue is greater than $11 million, the fishing business is considered a large entity, otherwise it is a small entity. Then we determine the number of directly impacted entities by examining their actual fishing location in 2021 and the landings values of lobster and Jonah crab.

Because the MRA Wedge is located entirely in Lobster Management Area 1 (LMA 1) Federal waters, the regulated entities in this rulemaking include all federal LMA 1 lobster and Jonah crab trap/pot vessels authorized to fish in LMA 1, as well as mixed species trap/pot (MSTP) vessels that are not regulated by federal regulations. Some common MSTP fisheries include black sea bass, conch/whelk and hagfish. We used the 2021 NMFS dealer report and identified 39 small MSTP entities inside the LMA 1. For the lobster and Jonah crab fishery, we used the fishery ownership data from the NEFSC, and estimated that 1,273 distinct entities had at least one LMA 1 federal lobster permit in 2021, and all of them are small entities with annual landings value smaller than $11 million. Out of these 1,273 entities, 218 did not have any revenue. Within the remaining 1,055 entities, 42 entities did not have any lobster or Jonah crab landings. As a result, 1,013 entities with LMA 1 permit landed lobster in 2021. Figure 4 displays the number of regulated entities and average landings by state. However, not all these entities are considered directly impacted as, while they are capable of fishing in the restricted area, most of them are located far away from the MRA Wedge and unlikely to fish there. Based on the RIR analysis, we only identified 26 to 31 impacted entities under Alternative 2, and 53 to 66 impacted entities under Alternative 3. The next section will examine the economic impact of the action on impacted small entities.

Figure 4: The Number of Regulated Entities and Average Landings per Entity in 2021



Note: Others include entities from all the other states and entities without state information.
Data sources: NEFSC vessel affiliation data, NMFS 2021 dealer report data

6.2. Estimated Economic Impacts of the Actions on Small Entities

In this section we examine the two economic impacts of the actions on small entities. The first one is the disproportionality and profitability, and the second one is the average compliance cost per entity.

6.2.1. Disproportionality and Profitability of Regulated Small Entities

No absolute dollar or quantity threshold exists to establish criteria for significance of economic impacts. However, NMFS and Small Business Administration guidelines suggest disproportionality and profitability as the primary drivers of significance. Disproportionality is calculated as the distribution of impacts over large and small entities. This is important to determine whether the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities. Although there are no large entities under this rule, we could still divide the small entities into a few categories based on the average vessel size of each entity, and then examine their profitability and reliance on lobster fishery. Profitability is the magnitude of these impacts. Entities with lower profitability are likely to be more impacted by the action.

Although available data are limited to make a definitive determination, a comparison of lobster and Jonah crab revenue dependence by size class can be used to highlight the potential for disproportionate impacts.[2] The average annual percent of total ex-vessel revenue earned from lobsters and Jonah crab compared to their total ex-vessel revenue is specified by entity vessel size in Table 8. Larger sized entities tend to rely less on lobster and Jonah crab landings. Most entities with vessels below 55 feet (16.8 meters) highly relied on lobster and Jonah crab revenue, especially entities with average vessel sizes below 35 feet (10.7 meters), 96 percent of their revenue in 2021 came from lobster and Jonah crab fishery. According to this analysis, smaller entities are more sensitive to this rule but they have a higher profitability compared to larger entities.

Table 8: The Economic Performance of Regulated Entities by Size Class in 2021

Average vessel size	Average profit per entity	Lobster and Jonah crab landings value	Average total landings value per entity	Lobster and Jonah crab percentage	Profitability
35 ft and below	$54,045	$235,123	$244,124	96.3%	22.1%
36 to 45 ft	$56,160	$350,268	$371,384	94.3%	15.1%
46 to 55 ft	$87,397	$516,087	$563,523	91.6%	15.5%
Above 55	$53,365	$248,360	$388,906	63.9%	13.7%

Data sources: NEFSC Social Science Branch vessel affiliation data
NMFS 2021 dealer report data

To calculate the average profitability of small and large entities, we need to deduct the operation costs and fixed costs from the annual gross revenue for each vessel, and then sum the profits of all vessels in each entity class. A vessel by vessel evaluation is not feasible for this analysis,

[2] Because MSTP vessels are usually not under federal management plans, we do not have enough cost and profit information collected through surveys. Here we will only focus on lobster and Jonah crab vessels.

therefore we adopt the results from a lobster fleet profitability study based on cost survey data (Zou et al. 2021). The profit was calculated based on the average vessel size class of entities, so we assigned the profits to the affiliated vessel class by matching vessel length. Table 8 displays the average profit for entities by their size, compared to their total revenue. Results indicate the profitability for entities with average vessel size of 35 feet (10.7 meters) and below have a profitability of 22.1 percent, while entities with medium sized vessels profit around 15 percent. Entities with average vessel size over 55 feet (16.8 meters) make a profit of 13.7 percent. In conclusion, the action would not be likely to create a significant economic impact on smaller entities.

6.2.2. Estimated Compliance Costs for Directly Impacted Entities from Each Alternative

While considering the compliance costs for the small entities, it is worth re-stating that the vast majority of the regulated entities are located far away from the MRA Wedge and unlikely to be affected by an expansion of the MRA. Therefore, this rule will only directly affect a very limited number of entities, those that actually fished in the MRA Wedge within the past few seasons. Based on our analysis in Chapter 5, Alternative 2 would affect 26 to 31 entities, with the total annual compliance costs range from $339,000 to $608,000. The cost for each entity ranges from $9,500 to $19,100. Alternative 3 would affect 53 to 66 entities, and the annual compliance costs range from $898,000 to $1,453,000. The cost for each entity ranges from $9,900 to $20,500.

Based on the annual compliance costs, we provide the total costs and annualized costs for five years in Table 9. The total costs for Alternative 2 across five years are around $1.7 million to $3 million. With a three percent discount rate, the annualized costs would be around $370,000 to $664,000; with a seven percent discount rate, the annualized costs would be around $413,000 to $742,000. For Alternative 3, the total compliance costs across five years are around $4.5 million to $7.3 million. With a three percent discount rate, the annualized costs would be around $981,000 to $1.6 million; with a seven percent discount rate, the annualized costs would be around $1.1 million to $1.8 million.

In conclusion, the action would not create a significant economic impact on a substantial number of small entities. By comparing the compliance costs and potential benefits of the two action alternatives, the action adopts a smaller closure to minimize the potential economic impact on small entities while achieving the goal of reducing acute entanglement risk adjacent to the MRA in 2024 and beyond.

Table 9: Total Compliance costs for Alternative 2 and Alternative 3 (in 2021$)

	Alternative 2		Alternative 3	
Number of directly impacted entities	26-31		53-66	
Year 1 cost	$338,819	$608,361	$898,249	$1,452,797
Year 2 cost	$338,819	$608,361	$898,249	$1,452,797
Year 3 cost	$338,819	$608,361	$898,249	$1,452,797
Year 4 cost	$338,819	$608,361	$898,249	$1,452,797
Year 5 cost	$338,819	$608,361	$898,249	$1,452,797
Total costs (NPV)	$1,694,096	$3,041,805	$4,491,244	$7,263,985
Annualized costs (3%)	$369,914	$664,192	$980,684	$1,586,124
Annualized costs (7%)	$413,174	$741,868	$1,095,373	$1,771,618

Notes:
1. The compliance costs for Year 1 to Year 5 are present values based on the year of 2021. We assume the compliance costs remain constant for five years as the data we used for estimation were based on average value from past few seasons
2. NPV stands for net present value
3. The annualized cost estimation is based on the total cost for five years and discount rates of 3 percent and 7 percent.

6.2.3. Rules That May Duplicate, Overlap, or Conflict with Final Rule

No duplicative, overlapping, or conflicting Federal rules have been identified.

7. References

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