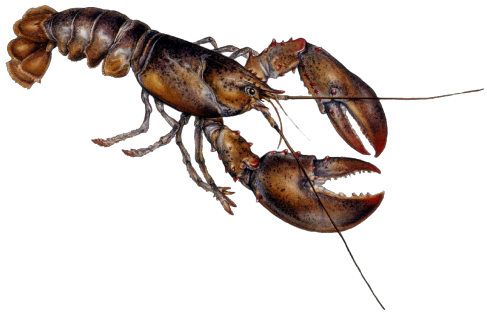
American lobster

Homarus americanus



United States: Northwest Atlantic

Pots

Report ID 524

September 6, 2022

Seafood Watch Standard used in this assessment: Fisheries Standard v3

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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the environmental sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Seafood Watch's science-based ratings are available at www.SeafoodWatch.org. Each rating is supported by a Seafood Watch assessment, in which the fishery or aquaculture operation is evaluated using the Seafood Watch standard.

Seafood Watch standards are built on our guiding principles, which outline the necessary environmental sustainability elements for fisheries and aquaculture operations. The guiding principles differ across standards, reflecting the different impacts of fisheries and aquaculture.

- Seafood rated Best Choice comes from sources that operate in a manner that's consistent with our guiding principles. The seafood is caught or farmed in ways that cause little or no harm to other wildlife or the environment.

- Seafood rated Good Alternative comes from sources that align with most of our guiding principles. However, one issue needs substantial improvement, or there's significant uncertainty about the impacts on wildlife or the environment.

- Seafood rated Avoid comes from sources that don't align with our guiding principles. The seafood is caught or farmed in ways that have a high risk of causing harm to wildlife or the environment. There's a critical conservation concern or many issues need substantial improvement.

Each assessment follows an eight-step process, which prioritizes rigor, impartiality, transparency and accessibility. They are conducted by Seafood Watch scientists, in collaboration with scientific, government, industry and conservation experts and are open for public comment prior to publication. Conditions in wild capture fisheries and aquaculture operations can change over time; as such assessments and ratings are updated regularly to reflect current practice.

More information on Seafood Watch guiding principles, standards, assessments and ratings are available at www.SeafoodWatch.org.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed, that can maintain or increase production in the long term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered, or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function, or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard.Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, Seafood Watch develops an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guides and online guide:

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught, farmed or managed.

Avoid/Red: Take a pass on these for now; they're caught or farmed in ways that harm other marine life or the environment.

[1] "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

Summary

This report provides an analysis and a recommendation for American lobster (*Homarus americanus*) in the United States Northwest Atlantic region. The American lobster is a large-bodied benthic crustacean found from Newfoundland and Labrador Province, Canada to Cape Hatteras, North Carolina in the United States. The U.S. American lobster fishery comprises two main stocks, which are identified by differences in life history parameters and biogeographic and biophysical differences, in each of these regions: the Gulf of Maine (GOM)/Georges Bank (GBK) and Southern New England (SNE). American lobster is primarily caught using fixed gear (vented traps) with vertical lines that account for 97% of all lobster landings in the New England region of the United States. Landings from trawl gear (3% of landings) are not included in this analysis.

There is an overall low concern for the impacts of the fishery on the GOM/GBK stock and high concern for the impacts of the fishery on the SNE stock. Stock assessments, which are regularly conducted by the Atlantic States Marine Fisheries Commission (ASMFC) in conjunction with the National Marine Fisheries Service (NMFS), indicate that the GOM/GBK stock is not depleted and overfishing is not occurring. The SNE stock is depleted but not undergoing overfishing. Continued low landings from the SNE stock are attributed to changes in the physical and biotic environment.

Traps used in the commercial lobster fishery are highly selective; however, data are lacking on the nature and quantity of by-catch. Overall discard and mortality rates are thought to be low relative to other fisheries. Most discards are lobster (sub-legal sized, oversized, or v-notched and ovigerous females) and some finfishes. This report also evaluates the effects of the fishery on Atlantic herring (*Clupea harengus*) because the majority of herring harvest is used by the lobster industry as bait. The American lobster fishery is considered a Category I fishery by NMFS due to interactions of endangered North Atlantic right whales (*Eubaleana glacialis*) with vertical lines associated with lobster gear. The potential for entanglement of North Atlantic right whales drives the score for Criterion 2.

The ASMFC oversees the management of the U.S. American lobster fishery. Regulations are in place to protect ovigerous females by v-notching. Gear restrictions mandate the use of traps with biodegradable ghost panels and escape vents. Trap size limits and effort control measures, such as trap limits and limited entry restrictions, have also been implemented. Management efforts have been insufficient for the SNE stock, where a proposed 5-year moratorium was not implemented. The stock continues to be depleted with no evidence of recovery. By-catch strategy is considered to be ineffective for all regions, because management measures and the Atlantic Large Whale Take Reduction Plan have not been successful at reducing serious injury and mortality to the North Atlantic right whale, which remains above the potential biological removal (PBR), and that is attributed to interactions with unknown fisheries, of which the lobster fishery may be a part.

American lobster is fished almost exclusively with trap gear and, in general, it is accepted that traps have a moderate to low impact on benthic habitats. But, because of the intense fishing effort directed at lobster, with traps deployed multiple times, the cumulative impact on benthic habitats may be underestimated. At this time, there are no extensive measures in place to manage the ecosystem and food web impacts of the fishery. Impacts to the habitat and ecosystem are rated a moderate concern.

Final Seafood Recommendations

SPECIES | FISHERY	CRITERION 1 TARGET SPECIES	CRITERION 2 OTHER SPECIES	CRITERION 3 MANAGEMENT	CRITERION 4 HABITAT	OVERALL RECOMMENDATION
American lobster | Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank	5.000	1.000	1.000	3.000	**Avoid (1.968)**
American lobster | Northwest Atlantic | Pots | United States | Southern New England	1.732	1.000	1.000	2.449	**Avoid (1.435)**

Summary

Seafood Watch recommends to **Avoid** American lobster caught by trap from the Southern New England stock due to population depletion, risks to the critically endangered North Atlantic right whale, and insufficient measures for reducing these risks.

Seafood Watch recommends to **Avoid** American lobster caught by trap from Georges Bank and the Gulf of Maine stocks due to risks to the critically endangered North Atlantic right whale and insufficient measures for reducing these risks.

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

Best Choice/Green = Final Score >3.2, and no Red Criteria, and no Critical scores

Good Alternative/Yellow = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern2, and no more than one Red Criterion, and no Critical scores

Avoid/Red = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

[2] Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

Introduction

Scope of the analysis and ensuing recommendation

This report provides recommendations for American lobster (*Homarus americanus*) caught by traps or pots using vertical lines from the United States Gulf of Maine (GOM)/Georges Bank (GBK) and Southern New England (SNE) stocks in the Northwest Atlantic. There are small volumes of lobsters landed from trawl gears and "ropeless" or "on-demand" pots and traps, which are not assessed in this report.

Species Overview

American lobster is a large-bodied territorial crustacean inhabiting the continental shelf of northeastern North America, ranging from Newfoundland and Labrador Province, Canada to Cape Hatteras, North Carolina, with abundance declining from north to south (ASMFC 2015a). This pattern is thought to be driven primarily by temperature, because the optimal temperature for lobster growth and reproduction (12–18 °C) corresponds to the more northern distribution of its range. American lobster resides in a variety of benthic habitats, especially those that provide shelter or possibilities for burrowing, and is most abundant in shallow coastal waters but ranges from the intertidal zone to ≈700 meters depth (NOAA 2020c). Two primary stocks have been identified, based on regional differences in their life history parameters as well as biophysical and biogeographical differences: Gulf of Maine (GOM)/Georges Bank (GBK) and Southern New England (SNE) (ASMFC 2015a). The lobster fisheries support both inshore (0–3 miles; state) and offshore (3–200 miles; federal) components, though the SNE fishery focuses more offshore, in deeper water banks and canyons on the edge of the continental shelf (Phillips 2013).

Since December 1997, the U.S. American lobster fishery has been under the management of the Atlantic States Marine Fisheries Commission (ASMFC) and the National Marine Fisheries Service (NMFS). The ASMFC, a regulatory body formed by 15 Atlantic coast states (Pennsylvania included), is responsible for managing the American lobster fishery in state waters up to 3 miles from shore (ASMFC 2015a). NMFS is responsible for managing the lobster fishery in federal waters, 3–200 miles from shore. Both ASMFC and NMFS are under the authority of the Atlantic Coastal Fisheries Cooperative Management Act. The U.S. American lobster fishery is managed under Amendment 3 to the Interstate Fishery Management Plan (IFMP), which delineates area management into seven Lobster Conservation Management Areas (LCMAs) (Figure 1).

Amendment 3 to the IFMP implements a management framework with the intention of minimizing population collapse due to recruitment failure (ASMFC 1997)(ASMFC 2015a). The main regulatory measures implemented in Amendment 3 and addenda involve minimum and maximum legal size limits, seasonal closures, gear restrictions, trap limits and a consolidation/transfer program, state license moratoria, and protection of ovigerous females by tail v-notching and release.

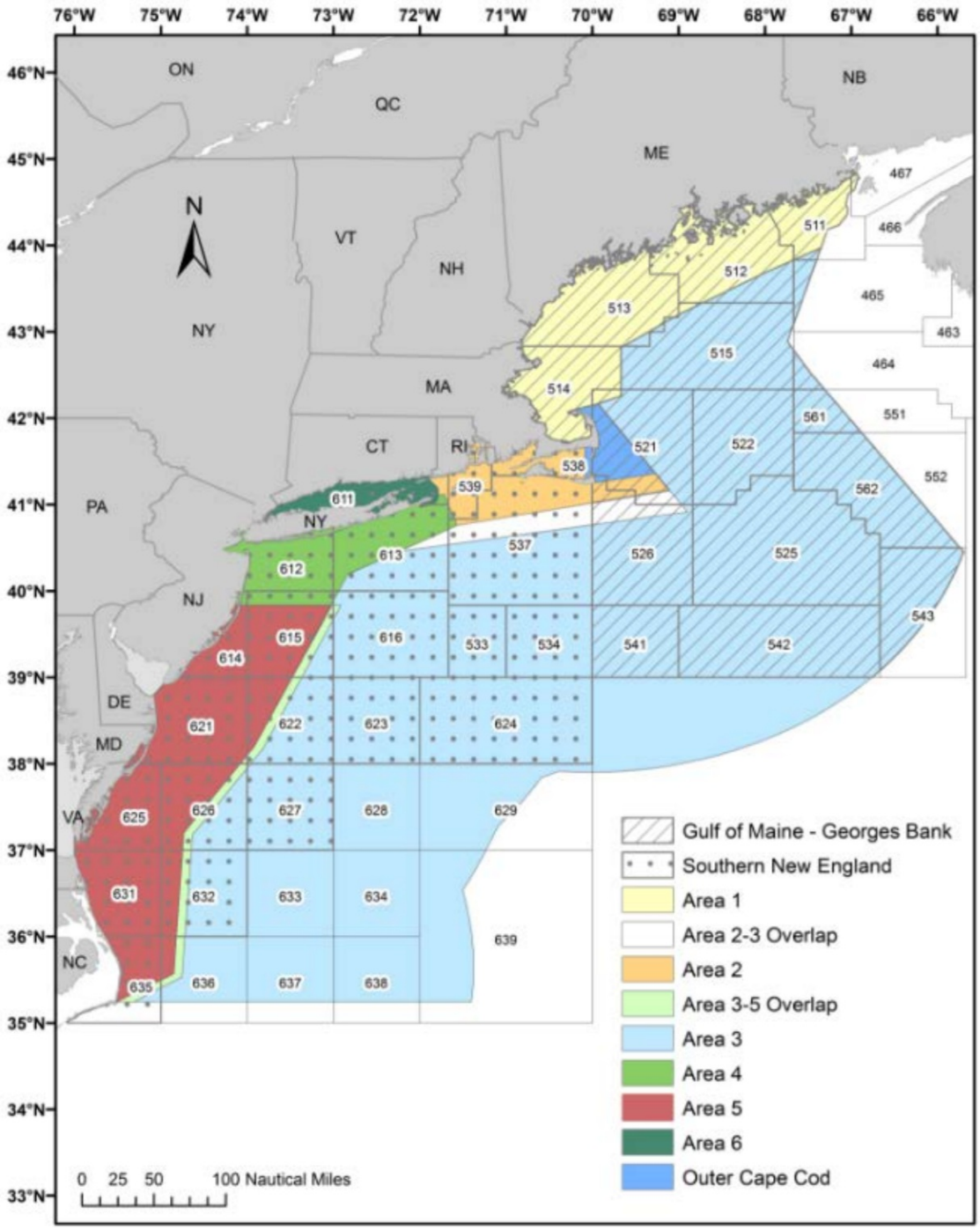

Figure 1: Lobster statistical areas by stock (GOM, GBK, and SNE) and management areas (NOAA 2018a).

Production Statistics

American lobster is found only in the waters of the Northwest Atlantic from Newfoundland and Labrador Province, Canada to Cape Hatteras, North Carolina; thus, Canada and the United States are the two

major producers. To date, despite continued research efforts, there is no large-scale commercial farmed American lobster production. American lobster was the most valuable U.S. commercial fishery in 2018, reaching annual revenue of $629 million (66,882 mt/≈147.5 million lbs. landings) {NMFS 2020}. Maine (55,181 mt) and Massachusetts (8,027 mt) led in landings, together producing 94.5% of total landings in 2018.

The GOM portion of the stock accounts for 90% of American lobster landings and is primarily an inshore fishery, while the GBK portion accounts for an average of 5% of landings (since 1981) and is primarily an offshore fishery (Figure 2) (ASMFC 2020a).

The SNE American lobster fishery lands a small proportion (3% in 2018) of lobster relative to the GOM/GBK fisheries (ASMFC 2020a)(NMFS 2020a). SNE landings peaked in the 1990s but steeply declined beginning in 1999, reaching record lows in 2018 (2,039 mt) (ASMFC 2020a).

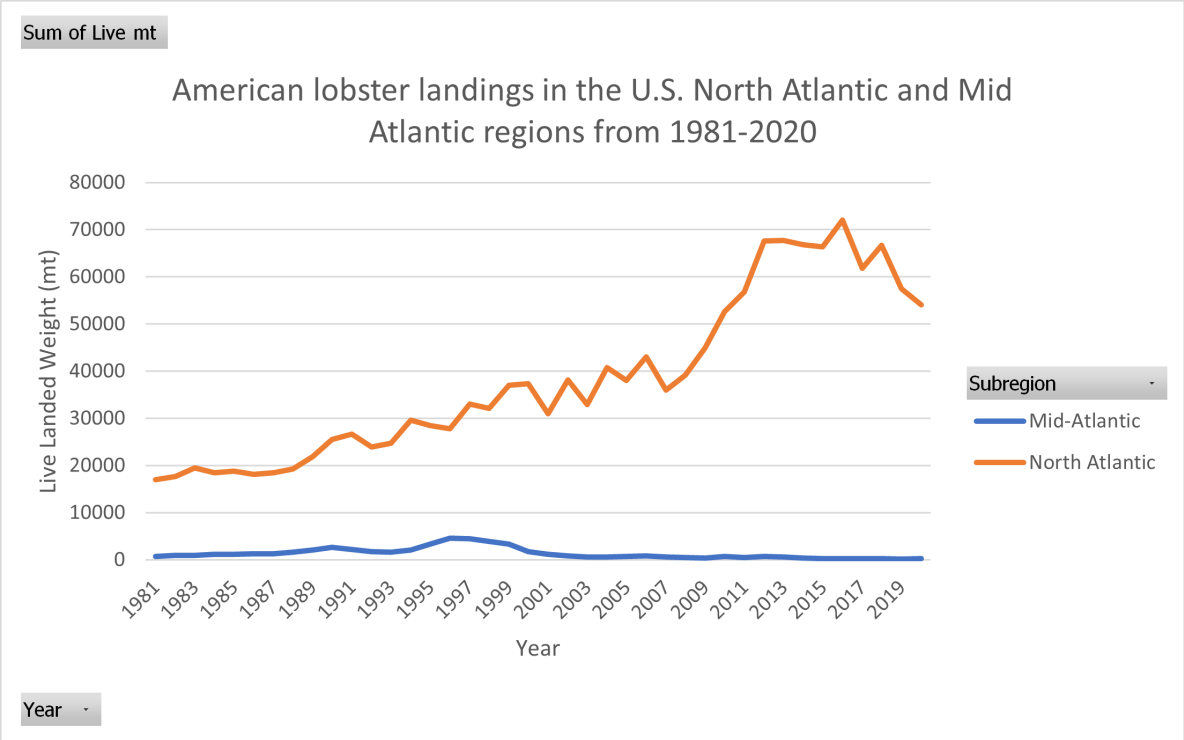

Figure 2: American lobster landings in the U.S. North Atlantic and Mid-Atlantic regions from 1981 to 2020. Source: (ACCSP 2021).

Importance to the US/North American market.

The majority of American lobster imports to the United States are from Canada, the only other major producer of American lobster (47,085 mt in 2019) (NMFS 2020b). In 2019, 38,527 mt of American lobster were exported, the majority of which went to Canada (65%), followed by China (13%) and Italy (4%) (Figure 3) (NMFS 2020b). Re-exports of American lobster (4,021 mt in 2019) were mainly from China (53%), followed by Canada (13%), Italy (10%), and Spain (4%) (Figure 4) (NMFS 2020b).

The majority of lobsters sold in the U.S. are American lobster, compared to spiny lobster. In 2018, American lobster was 95.4% (66,882 mt valued at $629 million) of total lobsters landed in the U.S., while spiny lobster (banded, Caribbean, and California spiny lobster) was 4.6% (≈3,220 mt, valued at $60.1 million) (NMFS 2020a). Imports and exports for spiny lobster were also relatively low (12.4% of total lobster imports, 6,722 mt in 2019; 1.7% of total lobster exports, 670 mt in 2019) compared to American lobster.

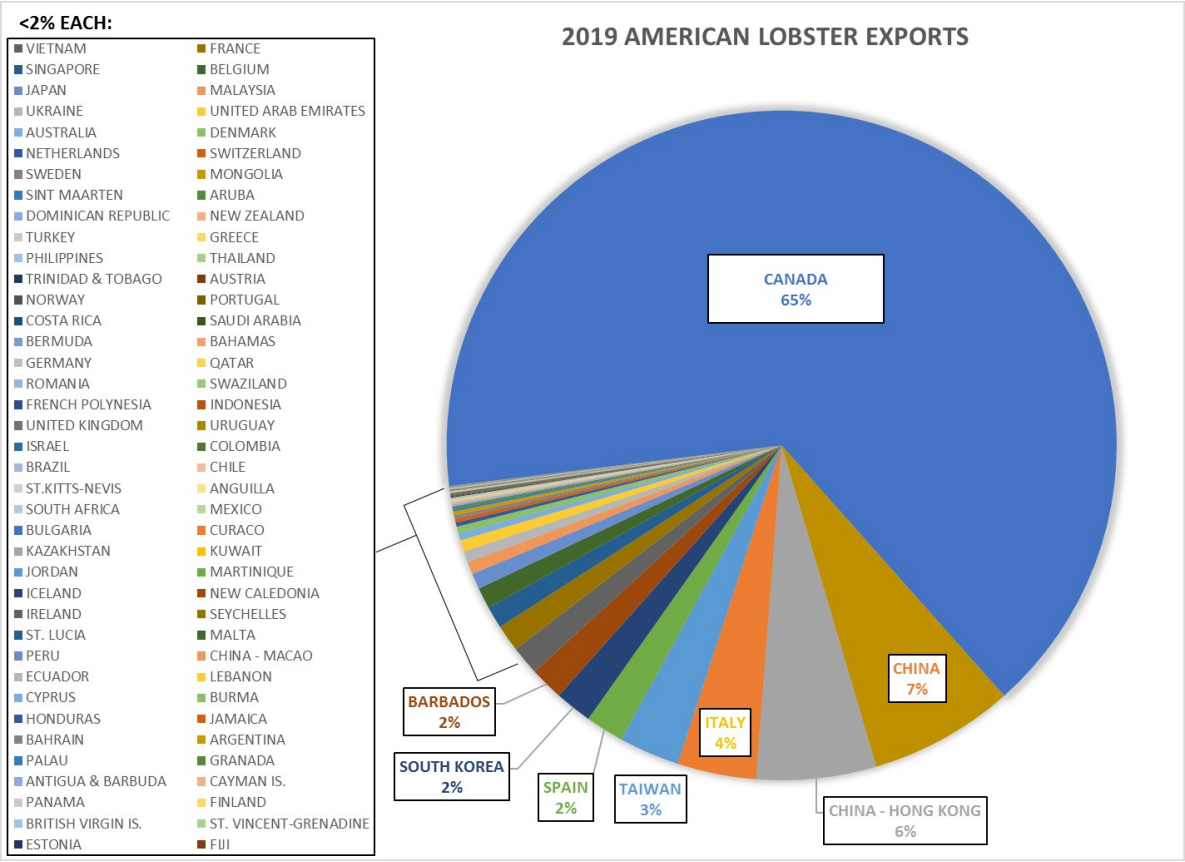

Figure 3: American lobster exports in 2019 (data from (NOAA 2020b)). Some uncertainty exists in these data because they are inclusive of products with combined lobster species.

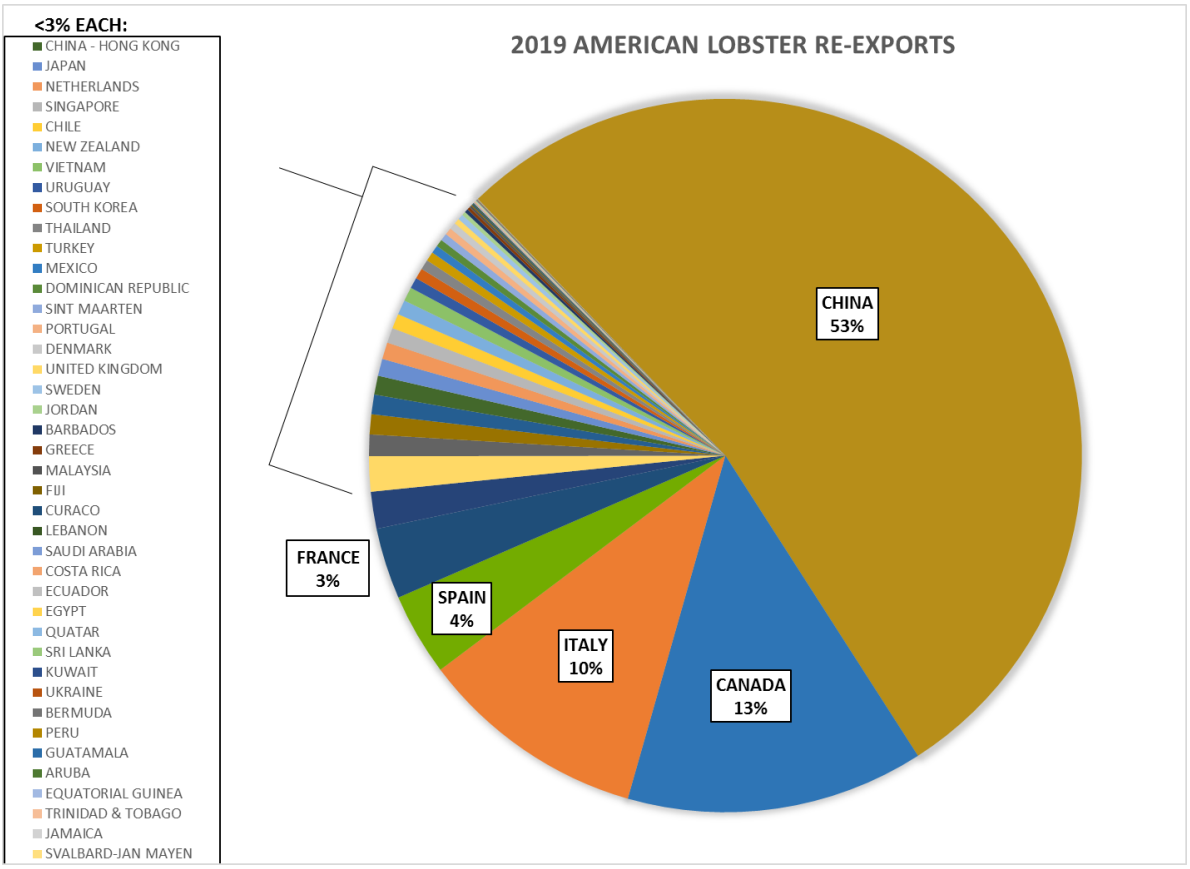

Figure 4: American lobster re-exports in 2019 (data from (NOAA 2020b)). Some uncertainty exists in these data because they are inclusive of products with combined lobster species.

Common and market names.

American lobster (common name) is also referred to simply as lobster (accepted market name). American lobster is a different species than rock or spiny lobster.

Primary product forms

American lobster is available year-round in both retail and service markets and is commonly sold whole and live. Lobster is also marketed as fresh or frozen lobster meat (cooked or raw tail and claw meat), canned (picked meat), dried/salted/brined, as lobster paste (roe and tomalley), or as value-added product (breaded and stuffed tails).

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level*

Criterion 1 Summary

AMERICAN LOBSTER			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Northwest Atlantic | Pots | United States | Southern New England	1.000: High Concern	3.000: Moderate Concern	Red (1.732)

Criterion 1 Assessments

SCORING GUIDELINES

Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

American lobster

Factor 1.1 - Abundance

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Very Low Concern

The Gulf of Maine and Georges Bank (GOM/GBK) stock is considered healthy, because the 3-year average abundance for 2016–2018 (256 million lobsters) was greater than the abundance threshold (89 million lobsters) and the abundance limit (125 million lobsters) (Figure 5) (ASMFC 2020a). The stock is currently at a historically high abundance and is scored a very low concern.

Justification:

In a 2015 stock assessment (ASMFC 2015a), it was determined that there was sufficient mixing between the GOM and GBK lobster stocks to combine them into a single stock unit (ASMFC 2015a). Analysis of the data from the NMFS Northeast Fisheries Science Center trawl survey suggested that small, immature females from the GBK stock were recruiting into the Gulf of Maine and migrating between the two areas when they reached a larger size (ASMFC 2015a).

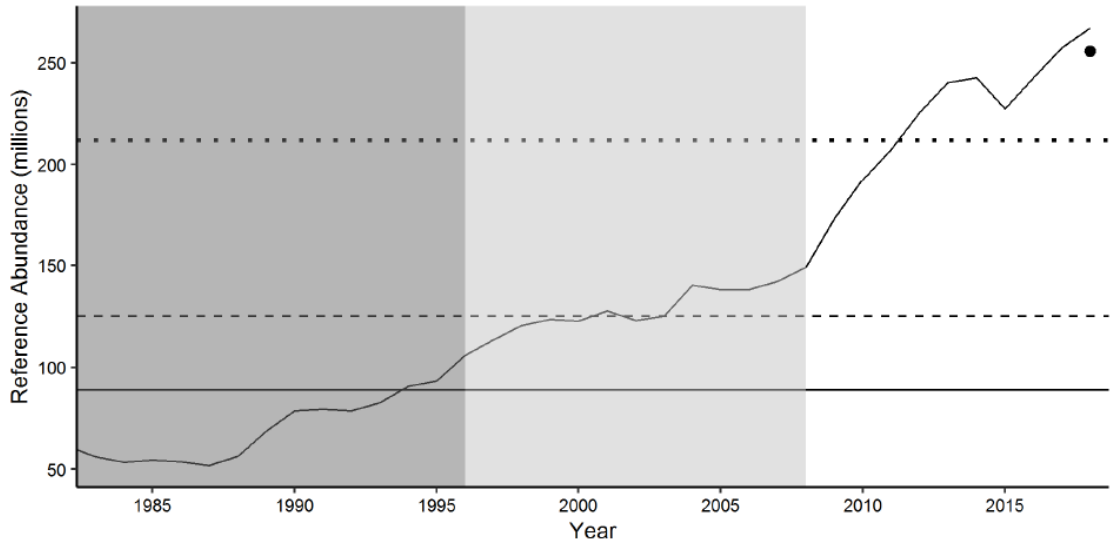

Figure 5: Gulf of Maine and Georges Bank lobster stock reference abundance compared to the fishery/industry target (dotted black line), abundance limit (dashed black line), and abundance threshold (solid black line) reference points based on detected low (dark grey period), moderate (light grey period), and high (white period) abundance regimes. The circle represents the terminal 3-year (2016–2018) average reference abundance (ASMFC 2020a).

Northwest Atlantic | Pots | United States | Southern New England

High Concern

The Southern New England (SNE) lobster stock is depleted, with the 3-year average abundance for

2016–2018 (7 million lobsters) below the abundance threshold (20 million lobsters) (Figure 6) (ASMFC 2020a). Beginning in 1997, the SNE stock suffered severe population declines, due partly to shell disease and changing environmental conditions (Phillips 2013). The stock is at an all-time low, and recruitment indices indicate that recruitment failure is preventing the stock from rebuilding (ASMFC 2020a). There is a contraction of the stock, which is now being seen in the offshore component in conjunction with the contraction of the inshore component (ASMFC 2020a). Environmental conditions remain unfavorable and disease indices are high (ASMFC 2020a). Because the SNE stock is in a depleted state, it is scored a high concern.

Justification:

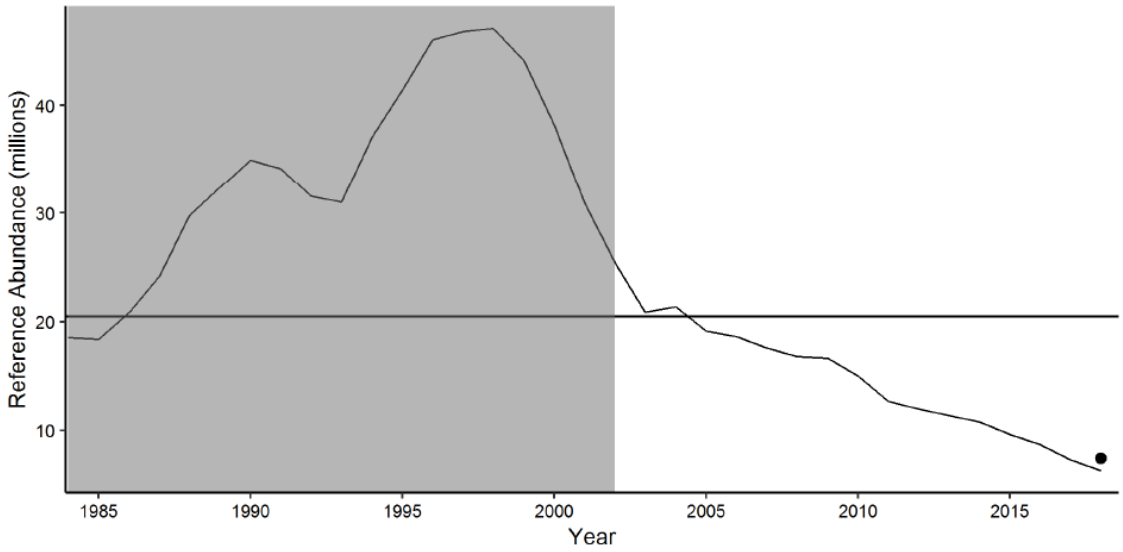

Figure 6: Southern New England lobster stock reference abundance relative to the abundance threshold (solid black line) reference point based on detected high (grey period) and low (white period) abundance regimes. The circle denotes the terminal 3-year (2016–2018) average reference abundance (ASMFC 2020a).

Factor 1.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Low Concern

Based on the average effective exploitation rate for 2016–2018, the GOM/GBK stock is not experiencing overfishing. The current rate of effective exploitation (2016–2018) of 0.459 is below both the exploitation threshold (0.475) and the exploitation target (0.461) (ASMFC 2020a). Over the last decade, the 3-year average effective exploitation has fluctuated around the exploitation threshold; however, it has been at or below the threshold since 2014 and has been below the target since 2017 (see Figure 7).

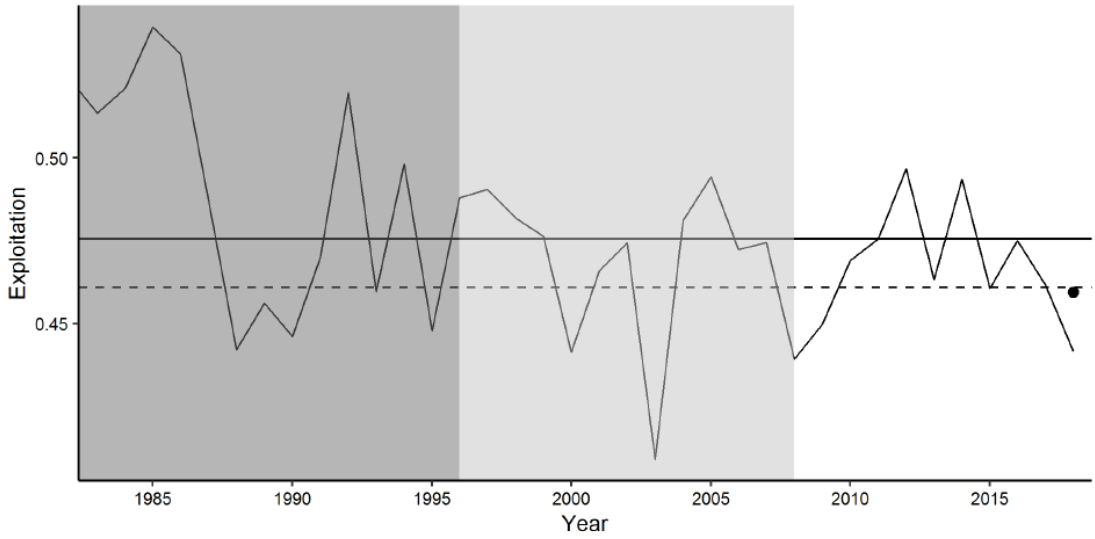

Figure 7: Gulf of Maine and Georges Bank lobster stock exploitation relative to the current target (dashed black line) and threshold (solid black line) reference points. Shaded periods are detected low (dark grey period), moderate (light grey period), and high (white period) abundance regimes. The circle represents the terminal 3-year (2016–2018) average exploitation (ASMFC 2020a).

Northwest Atlantic | Pots | United States | Southern New England

Moderate Concern

Managers do not consider the Southern New England lobster stock to be experiencing overfishing. The 3-year average exploitation for 2016–2018 (0.2742) is below the exploitation threshold (0.2895) (Figure 8). But, it exceeds the target exploitation reference point (0.2569) and is not considered favorable (ASMFC 2020a). Exploitation has fluctuated between the threshold and target reference points during the last decade (ASMFC 2020a). Because overfishing is not occurring but exceeds the target exploitation reference, a score of moderate concern is given.

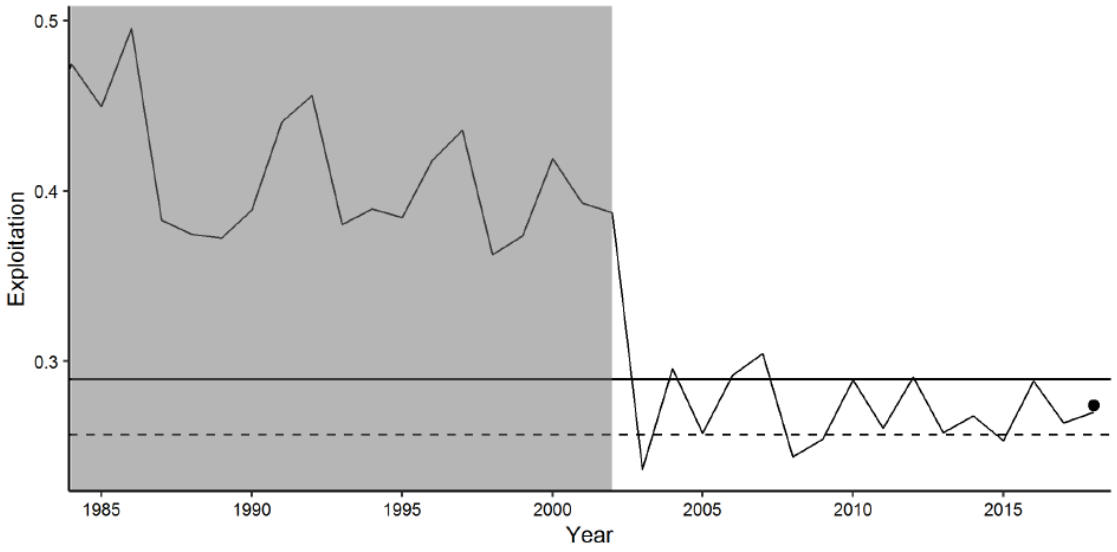

Figure 8: Southern New England lobster stock exploitation relative to the current target (dashed black line) and threshold (solid black line) reference points. Shaded periods are detected high (grey period) and low (white period) abundance regimes. The circle is the terminal 3-year (2016–2018) average exploitation (ASMFC 2020a).

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Factor 2.3 (Fishing Mortality) is Crtitical

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

AMERICAN LOBSTER			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank	1.000	1.000: < 100%	Red (1.000)
Northwest Atlantic | Pots | United States | Southern New England	1.000	1.000: < 100%	Red (1.000)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

NORTHWEST ATLANTIC | POTS | UNITED STATES | GULF OF MAINE AND GEORGES BANK			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Leatherback turtle	1.000: High Concern	1.000: High Concern	Red (1.000)
North Atlantic right whale	1.000: High Concern	1.000: High Concern	Red (1.000)
Atlantic herring	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Loggerhead turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Atlantic menhaden	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Atlantic rock crab	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Humpback whale	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Jonah crab	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Benthic inverts	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Finfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Minke whale	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
American lobster	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

NORTHWEST ATLANTIC | POTS | UNITED STATES | SOUTHERN NEW ENGLAND			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Leatherback turtle	1.000: High Concern	1.000: High Concern	Red (1.000)
North Atlantic right whale	1.000: High Concern	1.000: High Concern	Red (1.000)
American lobster	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Atlantic herring	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Loggerhead turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Atlantic menhaden	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Atlantic rock crab	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Humpback whale	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Jonah crab	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Benthic inverts	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Finfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Minke whale	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)

Traps used in the commercial American lobster fishery are considered to be highly selective, so overall by-catch levels are relatively low. Data are lacking regarding by-catch specific to the SNE fishery. But, data are available from fishery-independent studies in the neighboring GOM/GBK American lobster fishery that is prosecuted in similar habitats. Based on available data, no species represent over 5% of the catch (Zhang and Chen 2015)(Mateo et al. 2016). The most common by-catch includes juvenile lobster, ovigerous female lobster, Jonah crab (*Cancer borealis*), and Atlantic rock crab (*Cancer irroratus*). Both Jonah and Atlantic rock crabs are retained in the lobster fishery; however, these species are also subject to targeted fisheries. The most prevalent finfishes caught as by-catch include cod, cusk, flatfish, hake, spiny dogfish, cunner, sea raven, sculpins, Acadian redfish, lumpfish, mackerel, pollock, tautog, scup, black sea bass, eels, and yellowtail flounder (Mateo et al. 2016)(ASMFC 2014a).

Sea turtles are known to be entangled in American lobster pot gear, predominantly leatherback turtle (79 entanglements in 2012–2021) and occasionally loggerhead turtle (2 reported in 2012–2021 and 4 additional entanglements with unidentified gear) (NOAA 2022b).

The Northeast/Mid-Atlantic American lobster trap/pot fishery is classified as a Category I fishery under the Marine Mammal Protection Act (MMPA), driven by frequent interactions with the North Atlantic right whale (Western North Atlantic stock) (NMFS 2018c). Interactions with lobster gear have also been documented with the humpback whale (Gulf of Maine stock) and minke whale (Canadian east coast

stock); however, these two species do not drive the classification. Fin whale entanglements in lobster gear have been documented historically, but this species is not noted on the List of Fisheries (LOF) because interactions are rare enough to approach a zero serious injury and mortality rate (NMFS 2014b). Since 2017, there has been an Unusual Mortality Event, with increased minke whale strandings (from Maine through North Carolina) thought to be attributed to a combination of fisheries entanglement and infectious disease; however, the investigation is ongoing (NOAA 2018b). NMFS has recently recategorized the Massachusetts lobster and crab trap fishery as part of a "Massachusetts mixed species trap/pot" fishery that is listed as a Category II fishery. This reclassification is in recognition of the measures taken to reduce the risk to North Atlantic right whale and other species at risk. As a new fishery, there is no information available on which marine mammals are affected by the fishery (50 Federal Register 229 2022b). Because there is no fishery-specific information for the Massachusetts fishery and there is still an overlap between the fishery and the presence of North Atlantic right whale, it is included in the analysis of the Northeast/Mid-Atlantic American lobster trap/pot fishery. The North Atlantic right whale limits the score for Criterion 2 because of its endangered status and because fishing mortality exceeds the potential biological removal recommended for the species.

This report also evaluates the effects of the American lobster fishery on Atlantic herring (*Clupea harengus*) and Atlantic menhaden as bait species, because the American lobster industry is the primary source of demand for the herring fishery (Lehuta et al. 2014). Atlantic herring has historically been the main bait species used in lobster traps (90%), and approximately 70% of all Atlantic herring landings were used directly by the lobster fishery (Saila et al. 2002)(Grabowski et al. 2010). Historic lows in Atlantic herring recruitment have led to recent reductions in herring annual catch limits (ACLs) and to reduced bait availability; however, herring remains an important source of bait (MRAG Americas 2022). In Maine, landings of bait species are considered to be a reasonable proxy for the volumes used as bait; therefore, although the use of herring has decreased in recent years, the volumes landed in 2019 and 2020 were 12% of the volume of lobster landed in the state (MRAG Americas 2022). Atlantic menhaden have replaced much of the herring, with landings in Maine in 2019 and 2020 at approximately 48% of the volume of lobster landed during the same period (MRAG Americas 2022).

In SNE, skate is commonly used as bait (≈15,000 tons/year since 2001) and the skate fishery management plan acknowledges that this figure is often unreported (77 Federal Register 25117). The skate bait fishery is a directed fishery, mainly of little skate (90%), while juvenile winter skate is also utilized (NOAA 2016a)(NOAA 2016b).

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality
(same as Factor 1.2 above)

Factor 2.3 - Modifying Factor: Discards and Bait Use
Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

Ratio of bait + discards/landings	Factor 2.3 score
<100%	1
>=100	0.75

Atlantic herring

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

High Concern

Atlantic herring is considered overfished because the estimated spawning stock biomass in 2019 (77,883 mt) was below the accepted target reference point by management (SSB_{MSY} = 269,000 mt) (NEFSC 2020). Atlantic herring is considered a species of exceptional importance to ecosystems for its role as a forage fish in the transfer of energy to higher trophic levels and marine food webs (Pikitch et al. 2012)(NEFMC 2015). Available reference points are inconsistent with the Lenfest Forage Fish Taskforce Guidelines for an intermediate-information-tier forage fish fishery (as required by the Seafood Watch standards) (Pikitch et al. 2012). Unexploited biomass is estimated to be 845,176 mt (Deroba 2015), so 0.4 SSB_0 = 338,070 mt. Current biomass is below this reference point, which would be considered appropriate for forage species according to the Lenfest Forage Fish Task Force. The Herring Plan Development Team (PDT) does not believe that the Lenfest guidance is appropriate for the Atlantic herring fishery, because the Northwest Atlantic ecosystem is not upwelling-driven and many herring predators are generalists (NEFMC 2015). Because abundance is below the reference point used by management and is classified as overfished by the managing agency, abundance is considered a high concern.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

Overfishing is not occurring for Atlantic herring because $F_{7–8}$ (0.25) was estimated to be below management's accepted reference points for fishing mortality (F_{MSY} proxy = 0.543; (NEFSC 2020)). In recent years (2013–2017), recruitment for Atlantic herring has been at historic lows, leading to management implementations of reduced annual catch limits (ACLs) (ASMFC 2018b). In 2018, the ACL for herring was reduced from 110,536 mt to 49,900 mt. In November 2019, the New England Fishery Management Council approved Amendment 8 to the Atlantic Herring Fishery Management Plan, which proposes an acceptable biological catch (ABC) control rule to set ACLs that account for herring's role in the ecosystem (84 Federal Register 196). An in-season adjustment further reduced 2019 catch limits to 15,065 mt, and catch limits for 2021 were set at 23,423 mt (NOAA 2021b). Because the American lobster fishing industry is the primary user of the Atlantic herring harvest as bait for its fishery, it drives demand (Lehuta et al. 2014); however, this demand does not influence ACL limits for the herring stock.

The Seafood Watch Standard for Fisheries (Seafood Watch 2016) requires the fishery to have either reference points that are appropriate to the species' ecological role or a precautionary strategy that accounts for the needs of dependent predators. Specifically, Seafood Watch follows Lenfest-recommended fishing mortality limits for forage fisheries, which are no more than 75% of F, even in situations where the ecological role of the species is well understood {Lenfest 2012}. Amendment 8 to the herring FMP aims to address the needs of the ecosystem, but it does not appear to meet the Lenfest recommendation of fishing mortality not exceeding 50% of F_{MSY} when current biomass is lower than 1/2 B_{MSY}. But current harvest levels (11,213 mt in 2019) are below the ACL and, when compared to harvest at F_{MSY} (26,582 mt in 2019), demonstrate that current harvest is consistent with a conservative approach as outlined by the Lenfest Task Force. Because of the reduced harvest in recent years, fishing mortality is scored a moderate concern.

Atlantic menhaden

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Moderate Concern

The most recent stock assessment for Atlantic menhaden was published in February 2020. Ecological reference points (ERPs) have been developed for this stock; however, stock status is presented relative to single-species reference points in the stock assessment. Menhaden reproductive capacity is measured as population fecundity for the purposes of the single-species assessment; in 2017, fecundity was above both the single-species threshold and the single-species target (Figure 9) (ASMFC 2020c). It is unclear whether or not these single-species reference points are appropriate for the species' ecological role, so a score of moderate concern is given.

Justification:

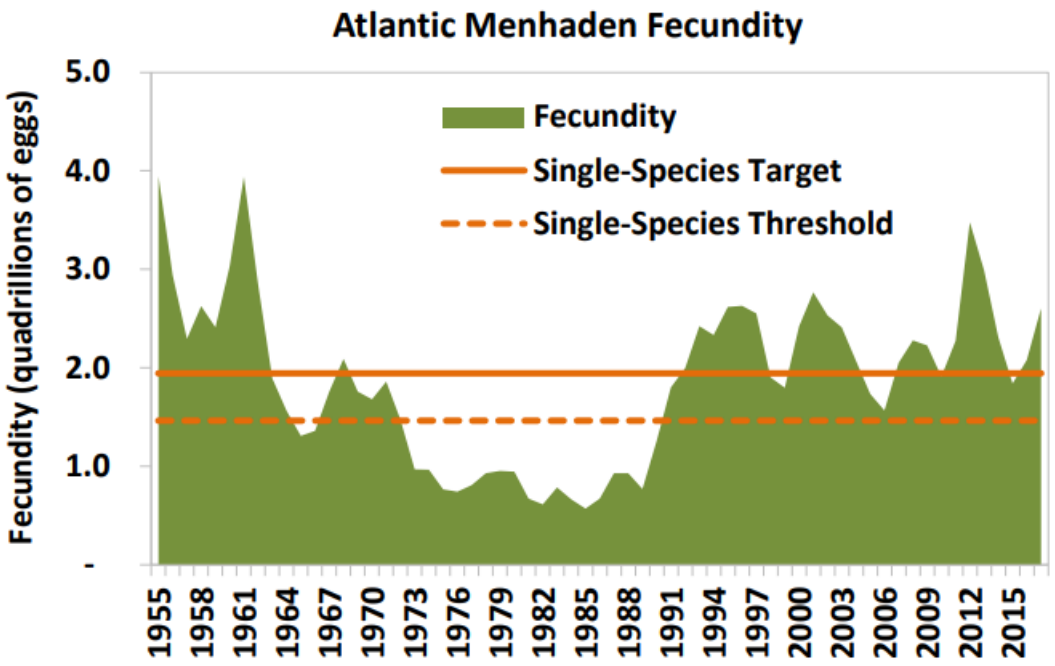

Figure 9: Atlantic menhaden fecundity from 1955 to 2017 relative to the single-species threshold and target reference points.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Moderate Concern

Fishing mortality on Atlantic menhaden in 2017 was estimated to be 0.11, which is lower than the overfishing target of 0.22 (ASMFC 2020c). Fishing mortality has been below the overfishing target since the mid-1990s; however, the ecological reference point assessment has noted that fishing mortality reference points should be lowered to account for the species' ecological role (ASMFC 2020c). Because fishing mortality is currently below the target reference point but this is likely inappropriate from an ecosystem perspective, a score of moderate concern is given.

Atlantic rock crab

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

There are no biological reference points or stock assessments for Atlantic rock crab. There is no reliable estimate for abundance and thus no evidence that the stock is either above or below a sustainable level. Because abundance in relation to reference points and conservation goals is unknown and the species has a medium vulnerability (PSA = 2.68; see table below), stock status is rated a moderate concern.

Justification:

To date, there have been no federal stock assessments conducted for Atlantic rock crab. Little is known about Atlantic rock crab populations but it has been noted that abundance varies cyclically, with periods of high abundance followed by periods of quite low abundance (Bannister et al. 2013). There is a high level of uncertainty associated with the use of landings data to estimate abundance, because they can be affected by environmental changes, market forces, and changes in fishing effort and pattern (Reardon 2006). Also, crab landings are not always publicly reported by species due to uncertainties with species identification. This will have likely improved with the recent implementation of the Jonah crab FMP, which requires more detailed reporting practices for Jonah crab (ASMFC 2015b). There are a number of fishery-independent surveys conducted by the different states that collect data on commercially important invertebrates (e.g., lobster, *Cancer* crab); however, few data are collected specifically for Atlantic rock crab (ASFMC 2018).

Atlantic rock crab has medium vulnerability (PSA score = 2.68).

Productivity Attribute	Relevant Information	Score
Average age at maturity	1–4 years	1
Average maximum age	8 years	1
Fecundity	125,000 to 500,000 eggs	1
Reproductive strategy	Egg brooder	2
Trophic level	2.5	1
Density dependence	Unknown	2

References for productivity table: (Bigford 1979)(Steneck et al. 2004)

Susceptibility	Relevant Information	Score
Areal overlap	>30% of the species concentration is fished, considering all fisheries	3
Vertical overlap	High degree of overlap between fishing depths and depth range of species	3
Selectivity of fishery	Species is targeted and/or by-catch but FMP requires escape gaps	2
Post-capture mortality	Retained species	3

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

There are no known estimates for fishing mortality for Atlantic rock crab. Rock crab is primarily caught by trap gear (ASMFC 2015d). Because fishing mortality relative to reference points is unknown, it is considered a moderate concern.

Benthic inverts

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Moderate Concern
Abundance of unidentified benthic invertebrates is scored as a moderate concern, following the scoring guidelines for pot fisheries provided by the Seafood Watch Unknown By-catch Matrix.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Low Concern
Fishing mortality of unidentified benthic invertebrates is scored as a low concern, following the scoring guidelines for pot fisheries provided by the Seafood Watch Unknown By-catch Matrix.

Finfish

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Moderate Concern
Abundance of unknown finfish is scored as a moderate concern, following the scoring guidelines for pot fisheries provided by the Seafood Watch Unknown By-catch Matrix.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Low Concern
Fishing mortality for finfish is scored as a low concern, following the scoring guidelines for pot fisheries provided by the Seafood Watch Unknown By-catch Matrix.

Humpback whale

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

The humpback whale population in the Gulf of Maine stock is estimated to be 1,396 individuals (Hayes et al. 2020). Population trends and the status of the stock relative to the optimum sustainable population (OSP) are unknown. NMFS conducted a global status review of humpback whale (Bettridge et al. 2015) and recently revised the Endangered Species Act (ESA) listing of the species (Federal Register 2016). The final rule indicated that, until the stock delineations are reviewed in light of the Distinct Population Segment (DPS) designations, NMFS would consider stocks that do not fully or partly coincide with a listed DPS as not depleted, for management purposes. Hence, the Gulf of Maine stock (part of the West Indies DPS) is considered not depleted because it does not coincide with any ESA-listed DPS (NOAA 2018b). Globally, humpback whale is considered "Least Concern" by the International Union for the Conservation of Nature (IUCN) (Cooke 2018). Because humpback whale is not considered endangered or threatened in the Gulf of Maine and is classified as "Least Concern" by the IUCN, abundance is ranked a moderate concern.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

From 2013 to 2017, the average annual rate of human-caused mortality and serious injury for the Gulf of Maine humpback whale stock was 12.15 whales (7.75 for fishery interactions), which is considered negatively biased due to detection limitations (Hayes et al. 2020). Based on the inference of undetected mortality from annual population estimates, managers determined it likely that annual average mortality and serious injury exceeds the potential biological removal (PBR) (22 whales). But, this has yet to be formally determined, and the proportion by nationality or cause is unknown. There is an Unusual Mortality Event in effect (since January 2016) for Atlantic humpback whale due to coastwide elevated mortality levels in the United States observed from strandings; however, it is likely that these are due to vessel strikes (NOAA 2021). Based on scarring, it is estimated that 48–65% of the Gulf of Maine humpback stock have experienced a previous entanglement {Robbins & Mattila 2001}.

The majority of entanglements could not be linked to a specific fishery, so the proportion of entanglement due to the American lobster pot fisheries is unclear. Annual serious injuries and mortalities (SIMs) during 2013–2017 from unidentified U.S. pot/trap interactions were 2.5 (11.4% of PBR), while those from unidentified pot and trap interactions unassigned to country but first

sighted in U.S. waters were 0.75 (3.4% of PBR). SIMs not attributable to gear type in the United States were 0.75 (3.4% of PBR), 3.2 (14.5% of PBR) for those first seen in the U.S. but unassigned to country, and 0.15 (0.7% of PBR) for those first seen in Canada but unassigned to country (Hayes et al. 2020).

Of the mortalities documented from 1970 to 2009, 24.5% were attributed to entanglement, 0.8% were attributed to a combination of ship strikes and entanglement, and 57% were due to unknown causes {van der Hoop et al. 2013}. The majority of entanglements cannot be linked to a specific fishery, so the proportion of entanglement due to lobster fisheries is unclear. Data are lacking regarding fisheries interactions with the other feeding groups in the Western Atlantic humpback whale population. Because known cumulative fisheries mortality does not exceed PBR, but with uncertainty in the proportion of contribution from the lobster fisheries, fishing mortality is considered a moderate concern.

Jonah crab

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

No range-wide stock assessments or biological reference points exist for Jonah crab, although the Atlantic States Marine Fisheries Commission considers them a priority for the future (ASMFC 2015b). Because of a lack of reference points and the stock's moderate inherent vulnerability (PSA = 2.68; see table below), abundance is rated a moderate concern.

Justification:

Jonah crab has historically been landed as a by-catch species in the lobster fishery; but in recent years, the species has become more popular in the market and is currently a targeted species, particularly in Southern New England. Landings data are available but significant uncertainty is associated with them and their suitability as a proxy for abundance, because landings have historically been underreported and can be affected by a range of factors, including environmental changes, market forces, and changes in fishing effort and pattern (ASMFC 2015b). A number of fishery-independent surveys are conducted by different states that collect data on Jonah crab. Indicators of stock health from these surveys vary: some suggest increases in abundance over the last couple of decades while others indicate declines (ASFMC 2018). There does not appear to be a comprehensive review of these surveys to provide an overall view of stock performance, further supporting the conclusion that stock health relative to a sustainable level is unknown.

This species has a moderate vulnerability (PSA = 2.68).

Productivity	Relevant Information	Score
Average age at maturity	<5 years*	1
Average maximum age	6–8 years*	2
Fecundity	1 million	1
Reproductive strategy	Egg brooder	2
Trophic level	2.5	1

* Best available estimate—based on Dungeness crab life history

References for productivity table: (Cobb et al. 1997)(CDFW 2013)(Steneck et al. 2004)(ASFMC 2015)

Susceptibility	Relevant Information	Score
Areal overlap	>30% of the species concentration is fished, considering all fisheries	3
Vertical overlap	High degree of overlap between fishing depths and depth range of species	3
Selectivity of fishery	Species is targeted and/or by-catch but FMP requires escape gaps	2
Post-capture mortality	Unknown	3

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

There are no recent fishing mortality estimates, nor is there a current definition of overfishing for Jonah crab. Landings have increased due to the increased value of Jonah crab in the marketplace (ASMFC 2015d). In the 1990s, landings in New England fluctuated between ≈900 mt and 1,360 mt; they rose to over 3,175 mt in 2005 and reached over 9,136 mt in 2018 (ASMFC 2018d)(ACCSP 2021). Because reference points are unavailable, fishing mortality is considered a moderate concern.

Justification:

Like the Atlantic rock crab, Jonah crab landings and value have dramatically increased in demand (Figure 10) with the fall of the SNE lobster fishery.

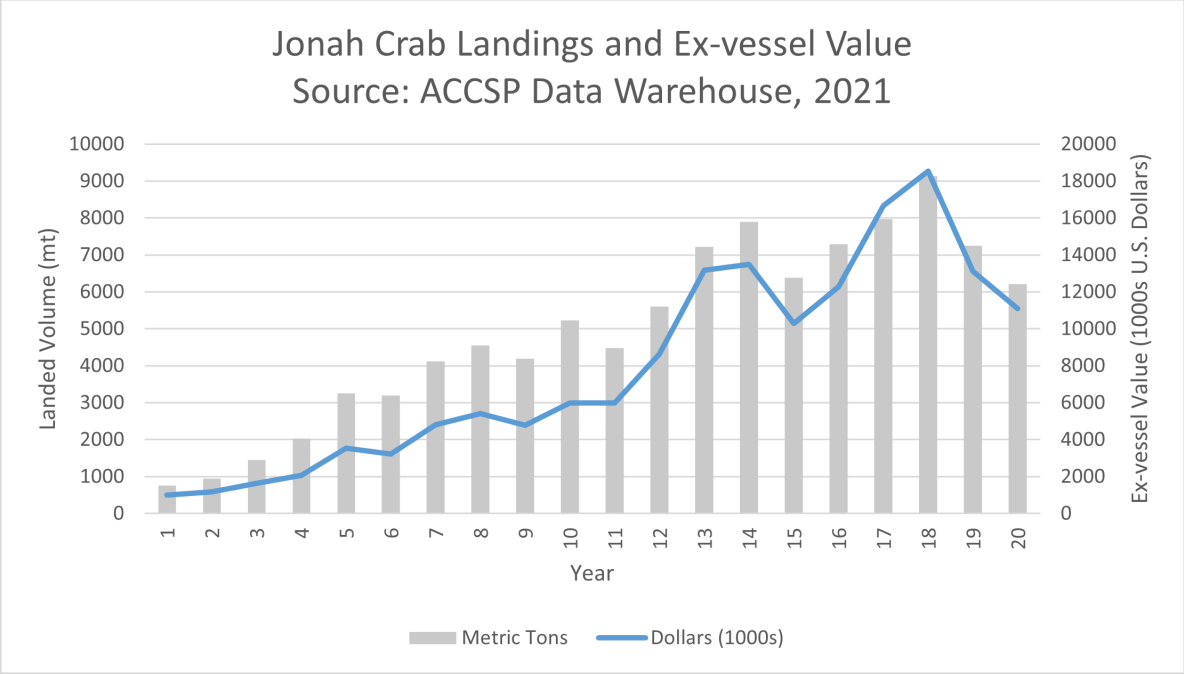

Figure 10: Jonah Crab landings and ex-vessel value from 2001 to 2020. Source: (ACCSP 2021).

Leatherback turtle

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

High Concern

Leatherback turtle is known to become entangled in the vertical lines of pot and trap gear (NMFS and USFWS 2020). The Northwest Atlantic distinct population segment (DPS) is listed as "Endangered" under the Endangered Species Act (ESA). Therefore, abundance is scored a high concern.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

High Concern

Between 2012 and 2021, 266 leatherback turtles were entangled in vertical lines associated with fishing activities. The lobster fishery was identified in 79 of these entanglements (30%), while most entanglements (163 individuals) could not be linked to a specific fishery (NOAA 2022b). Of the 79 entanglements associated with lobster fisheries, 73 were released alive while 6 were found dead (NOAA 2022b). It is unknown how many of the turtles survive the entanglement following release, but it is expected that there is some post-release mortality, based on the injuries suffered by the turtles (NMFS and USFWS 2020). There is a low level of observer coverage, so interactions are likely underestimated. Because it is probable that cumulative fishing mortality is above a sustainable level, with a high degree of uncertainty regarding mortality levels attributed to interactions with the American lobster fishery, fishing mortality is rated a high concern.

Loggerhead turtle

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

High Concern

The Northwest Atlantic Ocean Distinct Population Segment (DPS) of the loggerhead turtle is listed as "Threatened" under the Endangered Species Act (ESA) (76 Federal Register 184), so abundance is rated a high concern.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Low Concern

Loggerhead turtle is known to interact with bottom trawl, gillnet, and pot/trap fisheries. The most recent Biological Opinion for the Atlantic lobster fishery used information from Murray 2018 and data from the Sea Turtle Disentanglement Network (STDN) to estimate that five loggerhead turtles will interact with pot and trap fisheries in the U.S. Atlantic region over a 5-year period, resulting in four mortalities (NMFS 2021a). The impact of fishing activities in the region on the loggerhead turtle population is uncertain. But, it is not anticipated that lobster fisheries will appreciably affect the population, because the estimated number of fishing-related mortalities is ≈0.7% of the population, based on an estimate of the adult population (38,334 from {Richards et al. 2011}) (NMFS 2021a). Because lobster fisheries are not expected to negatively affect loggerhead turtle populations, a score of low concern is given.

Minke whale

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Moderate Concern

The Canadian East Coast minke whale stock size is estimated to be 21,968 individuals (17,022 minimum population estimate) (Hayes et al. 2021). The abundance estimate is uncertain because it utilizes an availability bias correction for which accuracy and precision are unknown. Abundance relative to reference points is uncertain. But, this species is classified by the International Union for the Conservation of Nature (IUCN) as "Least Concern" (Cooke 2018), so abundance is rated a moderate concern.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Southern New England
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Low Concern

From 2014 to 2018, an average of 1.6 annual minke whale mortalities or serious injuries were attributed to U.S. pot/trap fisheries, an average of 1.55 were not identifiable to gear in the U.S., and an average of 2.05 were unassigned to country but first sighted in the U.S. (Hayes et al. 2021). Cumulatively, these represent 3% of the potential biological removal (PBR) (PBR = 170); however, it is unclear what proportion of these involve interactions with the American lobster fishery. Minke whale entanglements were attributed to the American lobster fishery in 2017 and 2018 (five and three, respectively, based on preliminary data) (Morin et al. 2018). An Unusual Mortality Event (UME) has been ongoing for minke whale since January 2017. This is attributed to a combination of factors (preliminary data from 52 strandings: 8 mortalities due to infectious disease, 2 due to human interactions, and 9 due to fisheries interactions) (NOAA 2019c). Because cumulative annual fisheries mortality and serious injury does not exceed PBR and <50% of PBR is attributed to the American lobster fishery, fishing mortality is rated a low concern.

North Atlantic right whale

Factor 2.1 - Abundance

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

High Concern

The western Atlantic stock of North Atlantic right whale is listed as "Endangered" under the Endangered Species Act (ESA), and it is considered "Critically Endangered" by the International Union for the Conservation of Nature (IUCN) (Cooke 2020) because it is "considered to be facing an extremely high risk of extinction in the wild" (IUCN 2012). Minimum abundance from the most recent stock assessment was estimated at 364 individuals (best estimate 368) (Hayes et al. 2022), while the best estimate of the population from the North Atlantic Whale Consortium was 336 individuals at the end of 2020 (Pettis et al. 2022). There are fewer reproductive females producing fewer calves each year, with experts estimating that there are 88 or fewer reproductively active females remaining (Pettis et al. 2022)(NOAA 2022c). The population has been declining since 2011 and calving rates have been low (2017–2019 calving rates averaged four per season, which is <33% of the previous annual average). But in 2020, calving increased (10 calves sighted; 1 involved in a vessel strike) (Pace et al. 2017)(NOAA 2020b). The cause of reduced productivity is unknown but several factors are likely contributing to the declining health of North Atlantic right whale, including climate-related shifts in prey distribution, anthropogenic noise, pollution, vessel strikes, and entanglement in fishing gear (Pace et al. 2017)(NOAA 2019c). Because the North Atlantic right whale is considered "Critically Endangered" by the IUCN, abundance is rated a high concern.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

High Concern

The western Atlantic stock of the North Atlantic right whale (NARW) is considered a strategic stock because annual serious injury and mortality (SIM) (7.7 from all sources; 5.7 attributed to fisheries entanglement from 2015 to 2019) exceeds the potential biological removal (PBR) (0.7 whales) (Hayes et al. 2021). Due to a lack of information, it is often not possible to assign entanglements to a specific fishery. Documented entanglements from 2015 to 2019 involving pot/trap gear or unidentified gear are all attributed to unknown fisheries, of which the lobster fishery may be a part. Annual SIMs attributed to entanglements in pot/trap gear in Canadian fisheries were 1.95 (279% of PBR), while none were attributed to pot/trap gear in United States fisheries. Serious injuries and mortalities due to entanglement in unidentified gear from the United States were 0.20 (25% of PBR), those first seen in the United States but not attributable to country were 2.65 (379% of PBR), and those first seen in Canada but not attributable to country were 1.05 (150% of PBR) (Hayes et al. 2022). In 2014, there was one SIM (0.2 average annual serious injuries and mortality, 25% of PBR)

that was first seen in the U.S. but not attributable to country, and it was most likely caused by entanglement in netting gear from a non-lobster fishery (Sharp et al. 2019) (Sharp et al. 2019 Supplemental).

Vessel strikes and entanglement (from pot/trap and anchored gillnet fisheries) are the two leading causes of mortality and serious injury to North Atlantic right whale, with entanglements increasing over the past decade (Moore 2019). Rope strengths have increased in recent decades (based on data from 1994 to 2010), leading to reduced escape success from entangling gear (Knowlton et al. 2016). Sinking groundline (2009) and vertical line (2015) regulations have been implemented, resulting in gear configuration changes for which the effects on mitigation of whale entanglement have yet to be determined. Because of limited observation coverage, it is likely that the number of entanglements is severely underestimated (Kraus et al. 2019). Based on mark-recapture studies through photo identification, <50% of entanglement-related mortality is estimated to be detected, with these same studies demonstrating that 59% of North Atlantic right whales have been entangled more than once (83% at least once), and new scars from entanglement are observed annually for at least 26% of the observed population (Knowlton et al. 2012).

More than 90% of entanglements (based on 2010–2016 data and partial data for 2016/2017) are not linked to gear (7.8% of entangled North Atlantic right whale carry gear) and only 12% of those are linked to a location (Knowlton et al. 2012)(Knowlton et al. 2019)(Kraus et al. 2019). Fisheries interactions with North Atlantic right whale have been documented with gillnet fisheries (15% of entanglements attributed to gillnets from 1984 to 2016) (Kraus et al. 2019). An entanglement that results in gear remaining attached to the whale places an energetic strain that can compromise overall fitness and reproduction (van der Hoop et al. 2016). Also, a new paper shows that whale lengths have been decreasing due to fishing gear entanglements and vessel strikes since 1981, possibly leading to reduced reproductive success and increased probability of the lethality of entanglements (Stewart et al. 2021). Challenges in identifying the fishery involved in an entanglement occur due to ineffective gear marking (gear recovered from an entanglement does not carry a mark identifying the gear type, target species, and/or location) or the inability to recover gear from the entangled whale. Of all the vertical lines fished in the U.S. Atlantic outside the Atlantic Large Whale Take Reduction Plan (ALWTRP) exempt areas, 95% are from the lobster and crab fishery (50 Federal Register 2020). A recent study estimated that, from 2010 to 2017, the carcass detection rate (how many whale deaths were identified) was 29% (Pace et al. 2021). Pace et al. (2021) also concluded that, of the cryptic mortalities, the majority were likely caused by entanglement rather than blunt force trauma from vessel strikes. In a statement to the Atlantic Large Whale Take Reduction Team in October 2020, NOAA estimated that, since 2011, there had been 218 North Atlantic right whale deaths due to anthropogenic activities, a rate of approximately 24 whale deaths per year (NOAA 2020e).

An Unusual Mortality Event is in effect (since June 2017) for North Atlantic right whale, which includes 34 mortalities (21 in Canada and 13 in the United States, based on the location of stranding, not the location of mortality) through December 2021 (NOAA 2021). Mortalities are attributed to a combination of human interactions including vessel strikes and rope entanglement (final results are pending; however, preliminary investigations list 11 suspected as vessel strikes, 9 suspected as entanglement, 13 as pending or unknown causes, and 1 as perinatal mortality) (NOAA

2021) (see Figure 11).

The lobster fishery is classified as a Category I fishery by NOAA, and this classification is driven by its interaction with North Atlantic right whale from the western Atlantic stock (NMFS 2018c). The Massachusetts mixed species trap/pot fishery (of which the lobster fishery is a part) is classified as a Category II fishery due to its reduced risk to marine mammals; fishery-specific information is not available, so it is included in the analysis of the broader lobster fishery (with which it was previously classified) because there is continued overlap between the fishery and the presence of North Atlantic right whale and the scoring rationale is the same for both fisheries using the Seafood Watch standards. Cumulative SIMs far exceed PBR and entanglements due to unknown fisheries are considered a significant contributor. Until there is more specific information available regarding which fisheries are responsible for the unattributed entanglements, Seafood Watch considers that all relevant fisheries that may overlap with NARW pose risks. Based on the available information and the significant risks to NARW, the American lobster fishery cannot be considered sustainable, and fishing mortality is scored a high concern.

Justification:
Distributional shifts in the abundance of North Atlantic right whale (NARW) across its range may lead to shifts in regional fisheries interactions and entanglement risks. Based on data from passive acoustic monitoring (2004–2014), North Atlantic right whale is highly mobile and has a year-round presence across its geographic range (Davis et al. 2017). In recent years (2010–2014), there has been a distributional shift, with presence increased in the Southern New England and mid-Atlantic regions and decreased in the Scotian Shelf and greater Gulf of Maine. Visual surveys in Canadian waters reported increased presence farther north in the Gulf of St. Lawrence, which may be related to increased fisheries interactions with North Atlantic right whale in Canada (Meyer-Gutbrod et al. 2018). A recent study of individual whales identified in the Gulf of St. Lawrence found that there was a high return rate from year to year, indicating that this is an important feeding area for a specific group of NARW (Crowe et al. 2021). The study also found that, in 2019, a total of 137 individual NARW were estimated to have visited the Gulf of St. Lawrence (Crowe et al. 2021), which was 38% of the estimated 356 NARW alive at the end of 2019 {Pettis et al 2021}. Although this identifies the Gulf of St. Lawrence as an important foraging area for a significant proportion of the population, it does raise uncertainty regarding the location of the remaining individuals and the concern that they may be in areas that are offered less protection (Crowe et al. 2021).

In 2017, an Unusual Mortality Event for North Atlantic right whale was observed in the region (NOAA 2020). It is unclear if distributional shifts are due to environmental or anthropogenic effects; however, warming temperatures and shifting prey distributions are thought to play a part in the change (Meyer-Gutbrod et al. 2018). Although there has been a general northward shift in the distribution of the primary prey (*Calanus finmarchicus*) of the North Atlantic right whale, the western Gulf of Maine has seen record prey abundances since 2010, particularly during the spring (Record et al. 2019).

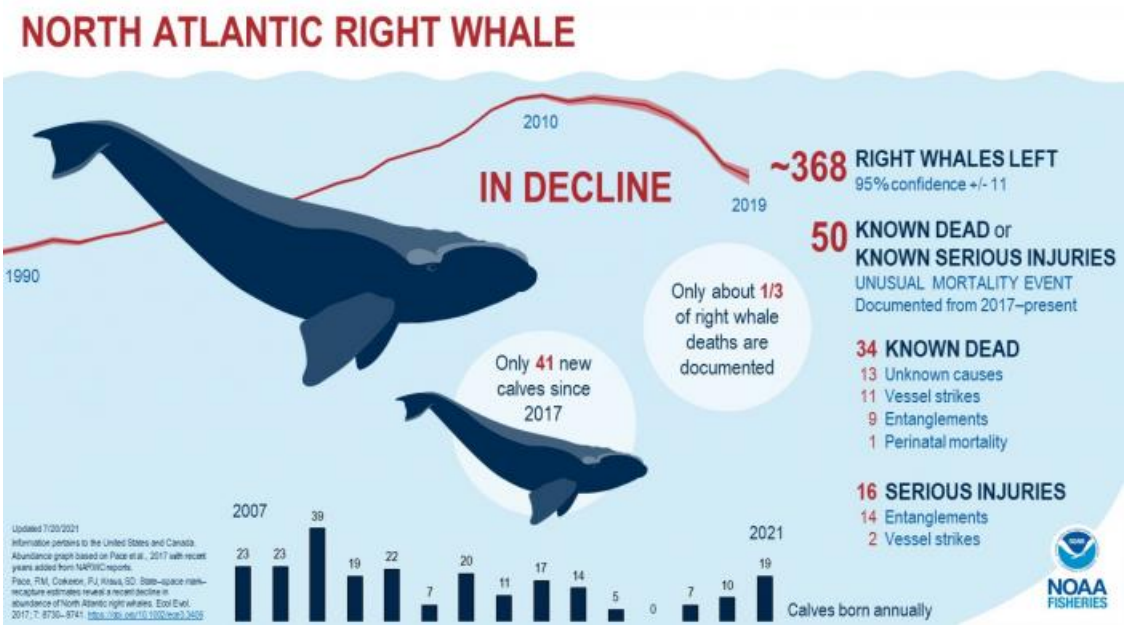

Figure 11: An infographic showing best estimates of current North Atlantic right whale population numbers and causes of death during the current Unusual Mortality Event, 2017 to present. (NOAA 2021)

Factor 2.3 - Discard Rate/Landings

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

< 100%

Traditionally, the lobster fishery has used large volumes of bait, particularly herring, so that the ratio of bait inputs to lobster landings has been greater than 100% (Grabowski et al. 2010)(ASMFC 2014a). But in recent years, herring recruitment and abundance have decreased, leading to reduced quotas and thus reduced landings. As herring became increasingly scarce, fishers turned to other species (e.g., menhaden) and reduced the amount of bait used in the fishery (SEDAR 2020). Although the volume of bait used in the fishery is uncertain, the combined quotas for herring (25 million lb) and menhaden (96 million lb) in the U.S. for use as bait are similar to the typical landings from the U.S. lobster fishery (125 million lb). Understanding that other fisheries utilize these species as bait, it is logical to determine that the volume of bait used in the lobster fishery is now less than the volume of lobster harvested, so a score of <100% is given.

Justification:

The American lobster industry and the Atlantic herring fishery have a long history of codependence, so ecological or commercial changes that affect one fishery affect the other (Ryan et al. 2010) (Grabowski et al. 2010)(Lehuta et al. 2014). The lobster fishery is the predominant market for herring and the main driver of the herring fishery {Brandt & McEvoy 2006}(Lehuta et al. 2014). Since the 19th century, Atlantic herring has been used as the primary source of bait (90%) for

lobster traps (ASMFC 2010)(Driscoll 2008). Herring bait has been subsidizing American lobster populations by increasing lobster growth rates, survivorship, and fecundity (Grabowski et al. 2010) (Saila et al. 2002). But since 2013, recruitment for Atlantic herring has been at historic lows, leading to management implementations of reduced annual catch limits (ACLs). The American lobster industry is utilizing alternative bait sources, primarily Atlantic menhaden (SEDAR 2020).

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- *5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.*
- *4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.*
- *3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.*
- *2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'*
- *1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'*
- *0 (Critical) — Management Strategy and Implementation is 'critical'.*

The Criterion 3 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Management Strategy and Implementation is Critical.

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species.

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	RESEARCH AND MONITORING	ENFORCEMENT	INCLUSION	SCORE
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank	Highly effective	Ineffective	N/A	N/A	N/A	**Red (1.000)**
Northwest Atlantic | Pots | United States | Southern New England	Ineffective	Ineffective	N/A	N/A	N/A	**Red (1.000)**

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - Management Strategy and Implementation
Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Factor 3.2 - Bycatch Strategy
Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Factor 3.3 - Scientific Research and Monitoring
Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Factor 3.4 - Enforcement of Management Regulations
Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Factor 3.5 - Stakeholder Inclusion
Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Factor 3.1 - Management Strategy And Implementation

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Highly effective
American lobster is under the management of both state (ASMFC) and federal (NMFS) authorities as mandated by the Atlantic Coastal Fisheries Cooperative Management Act (ASMFC 2015a)(ASMFC 2009). The main management unit for American lobster is the Northwest Atlantic ocean and

adjacent inshore waters from Maine to North Carolina. For management purposes, this unit has been divided into seven Lobster Conservation Management Areas (LCMAs) that cross stock boundaries, managing two discrete stocks: Gulf of Maine and Georges Bank (GOM/GBK) and Southern New England (SNE). In 1997, the American Lobster Board approved Amendment 3 to the Interstate Fisheries Management Plan (IFMP) (ASMFC 1997). The goals of Amendment 3 and addenda are to sustain a healthy American lobster resource and a management framework that provides for sustainable long-term harvest, opportunities for participation, and cooperative development of conservation measures.

The American lobster IFMP includes permit requirements, a minimum size limit to protect immature lobster, and a maximum size limit to protect older lobster. Although there are no restrictions on the total allowable catch (TAC) for American lobster, landings are limited by size limits and the protection of ovigerous females by v-notching berried females and prohibiting the possession of v-notched individuals. V-notching berried females is mandatory in LCMAs 1, 2, 4, and 5, and in parts of LCMA 3 (ASMFC 2012b). Trap size limits as well as effort control measures, such as trap limits and limited entry restrictions, have also been implemented.

Regular peer-reviewed stock assessments are conducted (every 5 years) and are informed by fishery-independent data including trawl surveys, ventless trap surveys, and annual young-of-the-year recruitment surveys (ASMFC 2018c). In the Gulf of Maine and Georges Bank, management measures have been effective at maintaining American lobster stocks at healthy abundance levels. Management also employs a precautionary approach, stating that if reference points for biomass or fishing mortality were to be exceeded, then corrective management action should be implemented (Deroba 2015). In response to recent declines in recruitment, Amendment XXVII is under development to standardize management measures across LCMAs (ASMFC 2018c). Because the stock is assessed regularly with an effort to protect spawning stock productivity, and appropriate defined reference points and precautionary policies are in place to respond to population declines, management strategy and implementation is rated highly effective.

Northwest Atlantic | Pots | United States | Southern New England

Ineffective

Management actions have not been effective in recovering the depleted Southern New England American lobster stock. Abundance has been declining since 1999 and is currently at an historic low (ASMFC 2020a). In 2009, following evidence of recruitment failure, the Technical Committee recommended a moratorium on harvest in the SNE stock area for 5 years to aid in stock recovery (NOAA 2013). In 2012, the American Lobster Board approved Addendum XVII to Amendment 3, which reduced fishing exploitation on the SNE stock by 10% beginning July 2013 (ASMFC 2012). Addendum XXII addressed scaling the capacity of the fishery in SNE to the size of the SNE lobster stock (ASMFC 2012b), and Addendum XVIII implemented trap reductions in LMAs 2 and 3 (ASMFC 2012). LMA 2 reduced traps by 25% in the first year of Addendum XVIII implementation, followed by 5% per year in the second through sixth years; while LMA 3 trap reductions were 5% per year for five consecutive years (ASMFC 2012). But, management measures were insufficient, given the initial 5-year moratorium recommendation. Although management measures are in place, they have been insufficient in promoting stock recovery and have disregarded scientific advice, so

management strategy and implementation are rated ineffective.

Justification:
American lobster is under the management of both state (ASMFC) and federal (NMFS) authorities as mandated by the Atlantic Coastal Fisheries Cooperative Management Act. The main management unit for American lobster is the Northwest Atlantic Ocean and adjacent inshore waters from Maine to North Carolina (ASMFC 2009). For management purposes, this unit has been divided into seven Lobster Conservation Management Areas (LCMAs) that cross stock boundaries. There are two discrete stocks based on regional differences in life-history parameters (ASMFC 2020a): Gulf of Maine and Georges Bank (GOM/GBK) and Southern New England (SNE). In 1997, the American Lobster Board approved Amendment 3 to the Interstate Fisheries Management Program (IFMP). The goal of Amendment 3 and addenda is to sustain a healthy American lobster resource and a management framework that provides for sustainable long-term harvest, provides opportunities for participation, and allows the cooperative development of conservation measures (ASMFC 2009).

Management of American lobster relies heavily on scientific research and monitoring. The Lobster Technical Committee (TC, comprised of scientists from member states, NFMS, USFWS, and academia), determines appropriate harvest levels, reviews the health of the fishery based on current scientific data, and provides scientific advice for state managers. In 2010, the TC recommended a 5-year moratorium on harvesting in the SNE region and acknowledged the severity of the measure as well as the catastrophic economic impacts it would have on fishery participants. The recommendation was not accepted, and in February 2012, the American Lobster Board approved area-specific measures to reduce fishing exploitation in SNE by 10% (ASMFC 2012).

Additional regulations include a minimum size limit to protect immature lobster and a maximum size limit to protect older lobster. There are different minimum and maximum sizes and fishing pressures between inshore and offshore SNE (ASMFC 2016c); however, these are potentially insufficient. Though the minimum size is set at size-at-maturity, precautionary management would set larger limits to allow for increased egg production. Protection of egg-bearing females is achieved through v-notching and prohibiting the possession of v-notched individuals. Trap size limits as well as effort control measures, such as trap limits and limited entry restrictions, have also been implemented.

The trap transferability program was designed to provide flexibility to lobster permit holders in the wake of severely reduced fishing effort by enabling fishers to buy and sell traps in certain lobster management areas if traps do not exceed an area's trap limit. Each transfer transaction requires a 10% conservation tax trap (where 10% of traps are retired when a license is being sold by one fisher to another) to further reduce fishing effort by reducing the number of traps being fished. NMFS works with state agencies annually to approve valid trap transfers. Although the trap transfer program began in 2015, traps may be transferred in the 2017/18 season (in LCMAs 2 and 3) (NOAA 2017c).

The TC has advised that a reduction in exploitation of ≈85% would be required to stabilize the stock and reach management goals (20–60% increased egg production). Precautionary management is critical in light of the recent reduced recruitment (declining by ≈15% annually) and settlement (which is at record lows). Reducing fishing mortality substantially would enable the fishery to

maximize egg production, if favorable environmental conditions occur (ASMFC 2016g)(ASMFC 2016a)(ASMFC 2016c). But environmental changes, such as forecasted increases in seawater temperature, are expected to further affect lobster health (e.g., shell diseases) and growth (McKibben et al. 2017).

Table 1. Management in SNE lobster fishery. Sources are shown in table and supplemented with information from Table 4 in ASMFC 2016e.

	Yes/No	Comments	Source
Trap limits	Yes	Yes, though these vary between LMAs; e.g., LMA 6 only has state requirements.	Table 1 (NOAA 2016d)
Maximum trap size	Yes	Yes, though these vary between LMAs.	Table 1 (NOAA 2016d)
Escape vents	Yes	Yes, though these vary between LMAs.	Table 1 (NOAA 2016d)
Soak times	Yes	Traps must be hauled at least once every 30 days. Wet storage of traps is not permitted.	(Mateo et al. 2016)
Other trap requirements	Yes	Traps must be tagged to be identified, and must have biodegradable escape panels.	(Mateo et al. 2016)
Minimum carapace length	Yes	Usually around 3–3/8"	Table 2 (NOAA 2016d)
Minimum carapace size	Yes	Between 5–1/4" and 6–3/4"	Table 2 (NOAA 2016d)
Inshore fishery sizes	Yes	86 mm min., 133 mm max.	(ASMFC 2016h)
Offshore fishery sizes	Yes	89 mm min., 171 mm max.	(ASMFC 2016h)
V-notch marking requirement	Yes	Mandatory for all egg-bearing females	Table 2 (NOAA 2016d)
V-notch possession	Yes	Only for individuals <1/8	Table 2 (NOAA 2016d)
Closed seasons	Yes	Dependent on area—LMA 4: April 30–May 31; LMA 5: February 1–March 31. Closed areas have been implemented to prevent gear conflicts—LMA 6: September 8 to November 28.	Table 2 (NOAA 2016d) (ASMFC 2013b) (ASMFC 2012b)
TACs	No		

Factor 3.2 - Bycatch Strategy

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Ineffective

The main by-catch concern in the U.S. lobster and Jonah crab fisheries relates to the risk of entanglement of North Atlantic right whale (*Eubalaena glacialis*), a species that is considered "Endangered" under the Endangered Species Act (ESA) (Hayes et al. 2021) and "Critically Endangered" under the International Union for the Conservation of Nature (IUCN) Red List (see

Criterion 2) (Cooke 2020). The species is one of the rarest of all large cetaceans and among the most endangered species in the world (NMFS 2021b). It is "considered to be facing an extremely high risk of extinction in the wild" (IUCN 2012).

Human sources are the leading cause of mortality of North Atlantic right whale; analysis of non-calf carcasses from 2003 to 2018 determined that all mortalities were the result of human activity (Sharp et al. 2019). Of mortalities and serious injuries (SIM) detected between 2010 and 2019, 57% occurred as a result of entanglement in fishing gear, 15% were caused by vessel strikes, and 3% were entrapments. The remaining 25% could not be attributed to a source (NMFS 2021b).

In recognition of the current high rate of human-caused mortality on North Atlantic right whale, the National Oceanic and Atmospheric Administration (NOAA) has declared an "Unusual Mortality Event" (UME) from 2017 to the present (2021). During the UME, to date, 34 dead whales have been found stranded (21 in Canada, 13 in the United States), with an additional 16 whales determined to be free-swimming but seriously injured (NOAA 2021).

When considering only entanglements in U.S. gear or entanglements first seen in U.S. waters, the potential biological removal (PBR) level [1] has been exceeded every year since 2010, except 2013 (NMFS 2021b). Actual mortalities and serious injuries of North Atlantic right whale in U.S. fisheries are likely higher than the number observed in the Stock Assessment Reports, with an estimated 64% of all mortalities going undetected between 1990 and 2017 (Pace et al. 2021). Despite the implementation of additional management measures to reduce the impacts on North Atlantic right whale (including the use of sinking groundlines) (2009), efforts to reduce the number of vertical buoy lines (2014), and an expansion of the Massachusetts Restricted Area (MRA) (2015), mortalities and serious injuries of North Atlantic right whale in U.S. gear and first seen in the U.S. persist at levels above the potential biological removal (PBR) (NMFS 2021b).

On September 17, 2021, NOAA published a final rule to amend the Atlantic Large Whale Take Reduction Plan (ALWTRP): the Risk Reduction Rule, including new measures to reduce risk to North Atlantic right whale entanglement mortality from the lobster and Jonah crab pot fisheries. NOAA initiated the rulemaking for U.S. lobster and Jonah crab fisheries first because they represent 93% of the vertical (buoy) lines in U.S. waters (NMFS 2021b). NOAA's intention is to also consider other fixed-gear fisheries in subsequent years (NMFS 2021b).

The Risk Reduction Rule is part of a new North Atlantic right whale Conservation Framework established in the May 27, 2021 biological opinion by NOAA that is estimated to reduce impacts from U.S. fisheries to low levels by 2030. Seafood Watch analyzed these measures through the Standard for Fisheries and determined a score of ineffective for Criteria 3.2. NOAA's measures do not meet the criteria for a moderately effective rating due to high uncertainty regarding their effectiveness and continued cumulative impacts to the North Atlantic right whale. Seafood Watch notes the following specific concerns:

- The risk reduction rule and Conservation Framework do not sufficiently reduce cumulative impacts of U.S. fisheries, because NOAA estimates it will take 9 years before mortality is projected to be below the current PBR (NMFS 2021a). The risk reduction rule is the first in a

series of regulatory actions to reduce average mortality from all U.S. fisheries over the next decade as part of the Conservation Framework. The risk reduction rule specifies new regulations for the U.S. lobster and Jonah crab fisheries to protect North Atlantic right whale, and NOAA predicts that the risk reduction rule will reduce the risks from these fisheries by 69% {50 Federal Register 229 & 697 2021}. NOAA has long recognized that the mortality of even one North Atlantic right whale will likely impede the survival and recovery of the species (50 Federal Register 229 2001). Under the Conservation Framework, NOAA predicts continued serious injury and mortalities of North Atlantic right whale above PBR for 9 years, which Seafood Watch believes will exacerbate the situation.

- The risk reduction rule does not account for all of the unknown fishing mortalities or other sources of mortality that have been observed and are predicted to continue to occur in the near future (NMFS 2021a)(Hayes et al. 2022). In developing the risk reduction rule, NOAA assigned 50% of the unknown entanglement incidents to U.S. fisheries, but then chose a risk reduction target (60%) that did not consider unobserved mortalities and serious injuries {50 Federal Register 229 & 697 2021}. The 2021 Biological Opinion predicts that additional sources of mortality (i.e., Canadian fisheries mortality, unknown mortality, and vessel strikes) are expected, and this contributes to a high risk that PBR will be exceeded (NMFS 2021a).
- NOAA has acknowledged that there is a risk from pot, trap, and gillnet fisheries within the range of the North Atlantic right whale, including lobster and Jonah crab fisheries {50 Federal Register 229 & 697 2021}(NMFS 2021a)(NMFS 2021b)(NOAA 2021). Until there is more specific information available regarding which fisheries are responsible for unattributed entanglements, Seafood Watch considers that all relevant fisheries that may overlap with NARW pose risks.

In July 2022, a District Court ruled that the 2021 Risk Reduction Rule and 2021 Biological Opinion were invalid, partly due to the concerns noted above. Specifically, the court ruled that the Risk Reduction Rule and 2021 Biological Opinion violated requirements of the Endangered Species Act and Marine Mammal Protection Act on two accounts: 1) "through its failure to satisfy the required antecedent in section 101 (a)(5)(E) of the MMPA before issuing an ITS"; and 2) "the Final Rule did not attempt to meet the take-reduction measures that it was obligated to under the MMPA within the required timeline" {US District Court 2022}.

Considering NOAA's analysis and the potential impacts of the lobster and Jonah crab fisheries, the failure of the management system to reach compliance with the ESA and MMPA, and the District Court ruling to find the Risk Reduction Rule and 2021 BiOp invalid, Seafood Watch finds that the Risk Reduction Rule and the broader Conservation Framework will be insufficient to reduce the risk to the endangered North Atlantic right whale population in a reasonable timeframe. These significant concerns result in a Seafood Watch assessment of ineffective for Criteria 3.2.

[1] The potential biological removal (PBR) level is defined by the Marine Mammal Protection Act (MMPA) 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.

Justification:
Fish and invertebrates:

Management measures are in place to reduce the impacts of the American lobster fishery on fish and other invertebrate species caught as by-catch. Based on limited data, lobster trap gear is highly selective, so overall by-catch is low (<5% per species) (ASMFC 2014a). Regulations prohibit the landing of juvenile lobster, ovigerous females, and lobster above maximum size limits. A biodegradable panel is mandatory to minimize ghost fishing in the event of trap loss.

Turtles:

In 2002, the Northeast Region Sea Turtle Disentanglement Network (STDN) was developed by NMFS to act as an event response network to disentangle sea turtles (NMFS 2014b). Currently, no mitigation measures have been implemented to reduce the impact of vertical line fisheries on sea turtles in U.S. waters. But, measures that are being implemented to reduce the risk to marine mammals by reducing the amount of gear in the water are likely to offer some benefit to sea turtles (NMFS and USFWS 2020).

Mammals:

In 1997, the Atlantic Large Whale Take Reduction Plan (ALWTRP) was developed under the Marine Mammal Protection Act (MMPA) to reduce serious injury and mortality (SIM) to whales due to incidental take in U.S. commercial fisheries that interact with strategic stocks, including the American lobster and Jonah crab fishery (NOAA 2012)(NOAA 2018c). To achieve this goal, several measures have been implemented, including requirements of sinking groundline, weak links, a vertical line rule, gear marking requirements, and area closures {Gouveia & Swails 2017}(NOAA 2018c). But, the Take Reduction Plans (TRPs) in the northeastern U.S. are regarded as the least successful of the U.S. TRPs at reducing marine mammal by-catch (McDonald et al. 2016). To date, the ALWTRP has failed to meet its statutory goal of reducing SIM to a level below PBR, and to a level approaching zero (the Zero Mortality Rate Goal). Historically, management measures have been ineffective in reducing entanglement rates (based on data from 1999 to 2009, inclusive of entanglements attributed to unidentified fisheries) (Pace et al. 2014). Annual SIMs due to entanglement continue to exceed PBR (NOAA 2019c). The impacts of introducing regulations such as the "sinking groundline rule" in 2009 and the "vertical line rule" in 2015 (50 Federal Register 2014) are not fully understood due to limited data and analyses (the latest marine mammal stock assessments consider data from 2014 to 2018). There have also been challenges in confidently attributing entanglements to specific fisheries. In a study of rope diameters from entangled whales, 79% of rope used in the Maine lobster fishery was found to be less than 1/2 in. diameter while 81% of rope recovered from right whales was greater than 1/2 in. diameter (ME DMR 2019). But, for most entanglement interactions, gear is not recovered or is unidentifiable (77% of entanglements between 2000 and 2018) (NOAA 2019a).

In a lawsuit filed against the National Marine Fisheries Service regarding lobster and Jonah crab fisheries management, The Center for Biological Diversity, Defenders of Wildlife, The Humane Society of the United States, and the Conservation Law Foundation asserted that the take of North

Atlantic right whale is in violation of the Endangered Species Act (ESA) and Marine Mammal Protection Act {Center for Biological Diversity et al. vs. Ross et al. 2018}. Plaintiffs stated that the 2014 Biological Opinion was outdated and lacked critical information regarding recent North Atlantic right whale population declines and reduced calving rates. Thus, plaintiffs determined that managers were failing to base the jeopardy determination on the best data available. In April 2020, the court ruled that NOAA's management of the American lobster fishery was in violation of the Endangered Species Act (ESA). The 2014 Biological Opinion was declared invalid under the ESA due to a failure to include an incidental take statement for North Atlantic right whale, and the court ordered a briefing from both parties on a remedy. In May 2021, a new biological opinion was published that included an incidental take statement.

In September 2021, NOAA published the Risk Reduction Rule {50 Federal Register 229 & 697 2021} to reduce the risk posed by the U.S. lobster and Jonah crab trap fisheries to North Atlantic right whale and other large whales in the region (e.g., humpback whale, fin whale). The new rule requires fishers to increase the number of traps between buoys, known as "trawling up." This allows the same number of traps to be fished while reducing the threat of entanglement in vertical buoy lines. The minimum number of traps that must be fished per trawl varies by region and distance from shore (Table 2). In some management zones, fishers may opt to fish a lower number of traps per trawl and use only one vertical line (thus ensuring equivalency with the rule).

Table 2: Trap per trawl limits by management area for U.S. lobster and Jonah crab fisheries (adapted from {50 Federal Register 229 & 697 2021}).

Area	Traps per trawl
Maine 3–6 nm*, Zone A West	8 traps/trawl per two buoy lines; 4 traps/trawl per one buoy line.
Maine 3–6 nm*, Zone B	5 traps/trawl per one buoy line.
Maine 3–6 nm*, Zones C, D, E, F, G	10 traps/trawl per two buoy lines; 5 traps/trawl per one buoy line.
Maine 3–12 nm, Zone A East	20 traps/trawl per two buoy lines; 10 traps/trawl per one buoy line.
Maine 6*–12 nm, Zone A West	15 traps/trawl per two buoy lines; 8 traps/trawl per one buoy line.
Maine 6*–12 nm, Zones B, D, E, F	10 traps/trawl per two buoy lines; 5 traps/trawl per one buoy line (status quo in D, E, F).
Maine 6*–12 nm, Zones C, G	20 traps/trawl per two buoy lines; 10 traps/trawl per one buoy line.
Maine Lobster Management Area (LMA) 1, 6*–12 nm	15 traps/trawl
LMA1 and Outer Cape Cod (OCC) 3–12 nm	15 traps/trawl
LMA1 over 12 nm	25 traps/trawl
LMA3, north of 50 fathom line on south end of Georges Bank	45 traps/trawl, increase maximum trawl length from 1.5 nm to 1.75 nm.
LMA3, south of 50 fathom line on south end of Georges Bank	35 traps/trawl, increase maximum trawl length from 1.5 nm to 1.75 nm.
LMA3, Georges Basin Restricted Area	50 traps/trawl, increase maximum trawl length from 1.5 nm to 1.75 nm.

The Risk Reduction Rule also introduces two new closed areas, increases the coverage of an existing area, and adjusts the fishing activities permitted in existing area closures. The LMA 1 Restricted Area and the South Island Restricted Area (see Figure 12) will be closed seasonally to lobster and crab

fishing using persistent buoy lines. Also, the rule modified existing closures, the Massachusetts Restricted Area (MRA), and the Great South Channel Restricted Area, resulting in seasonal closure to lobster and crab fishing using persistent buoy lines (previously, harvest of any lobster and crab using traps was prohibited). This modification has been made to allow fishers to harvest lobster and crab when trialing "ropeless" technologies that may further reduce the risk to North Atlantic right whale. The MRA is also extended northward to the New Hampshire border. In addition to these mandated closures, in 2022 NMFS announced a temporary emergency closure between the Massachusetts Restricted Area North and the Massachusetts Restricted Area from April 1 to April 30, 2022 to protect whales that were expected to be leaving the Cape Cod Bay area through an area that saw high densities of gear in 2022 {50 Federal Register 229 2022}.

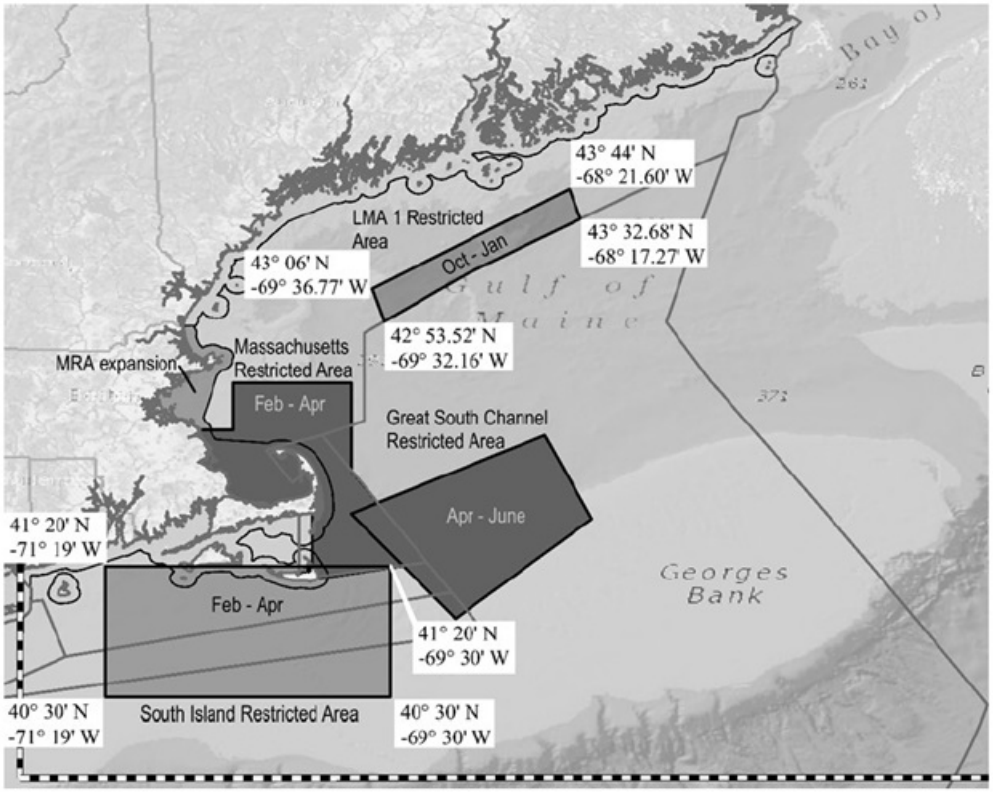

Figure 12: Restricted fishing areas implemented under the Risk Reduction Rule {50 Federal Register 229 & 697 2021}.

In addition to the trawling up requirements and the restricted fishing areas, the Risk Reduction Rule also requires all vertical lines to include a weak rope or weak insert, reducing the breaking strength of the vertical line to 1,700 lb. The specific requirements vary, depending on the area fished and the distance from shore (Table 3).

Table 3: Weakened rope requirements by management area as required by the Risk Reduction Rule (adapted from {50 Federal Register 229 & 697 2021}).

Area	Weak Rope or Weak Insert

Northeast Region	For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at the surface system.
Maine state waters outside of exemption line	One weak insertion 50% down the line.
Maine state waters	Fully weak line or weak inserts every 60 ft in top 75% of line.
New Hampshire state waters	One weak insertion 50% down the line.
Rhode Island state waters	Fully weak line or weak inserts every 60 ft in top 75% of line.
Maine Zone A West, B, C, D, E; federal waters 3–12 nm	Two weak insertions, at 25% and 50% down the line.
Maine Zone A East, F, and G; federal waters 3–12 nm	One weak insertion 33% down the line.
Maine and New Hampshire LMA 1, OCC; federal waters 3–12 nm	Two weak insertions, at 25% and 50% down the line.
LMA 1 & OCC over 12 nm	One weak insertion 33% down the line.
LMA 2	Fully weak line or weak inserts every 60 ft in top 75% of line.
LMA 3	One buoy line weak to 75%.

The Risk Reduction Rule introduces new requirements for the marking of gear in the lobster and crab fisheries, establishing state-specific colors for Maine (purple), New Hampshire (yellow), Massachusetts (red), and Rhode Island (silver/gray), except for vessels fishing in LMA 3, which retain the black mark. A large, 3-ft. mark is required within the surface system, and an additional 1-ft. green mark is required within 6 in. of the area mark to distinguish gear fished in state versus federal waters. In LMA 3, the green mark will distinguish vessels fishing the Northeast region from those fishing the southern and western regions of the area. Further detail on the gear marking requirements can be found in Table 4. The new gear marking regulations are not anticipated to directly reduce the risk or severity of entanglement. Rather, they aim to provide greater clarity on the source of an individual entanglement, which will enable managers to better resolve the issue of whale entanglement by more accurately attributing the fisheries responsible for whale entanglements (NMFS 2021b).

Table 4: Gear marking requirements implemented through the Risk Reduction Rule (adapted from {50 Federal Register 229 & 697 2021}).

Area	**Northeast Region Lobster and Jonah Crab Trap/Pot Gear Marking Requirement**
State waters	One 3-ft. state-specific colored mark (based on principal port state) in surface system within 2 fathoms of the buoy. At least two 1-ft. marks in the state (principal port) color in the primary buoy line: one in the top half and one in the bottom half. Maine exempt waters will be regulated by Maine and not included in federal regulations.
All Northeast Region federal waters, except LMA 3	A 3-ft. state-specific colored mark within 2 fathoms of the buoy. At least three 1-ft. marks in the state (principal port) color on the top, middle, and bottom of the primary buoy line. Additional Northeast Region federal mark within 6 in. of each state-specific color: 1-ft. long green marks. For dual-permitted vessels, state regulations will determine whether green federal markings can remain on gear being fished in state waters.
LMA 3	A 3-ft. black mark within 2 fathoms of the buoy. At least three 1-ft. black marks on the top, middle, and bottom of the primary buoy line. Additional Northeast Region federal water mark within 6 in. of each black mark: 1-ft. green marks within 6 in.

The Risk Reduction Rule developed by NOAA was devised to reduce the impact of the U.S. lobster and Jonah crab fisheries by 69%. In developing the rule, a 60% reduction target was developed by adding the known impact of U.S. lobster and Jonah crab fisheries (0.2 North Atlantic right whale SIMs per year, averaged from 2009 to 2018) and then attributing 50% of the unknown impact (2.0 North Atlantic right whale SIMs per year, averaged from 2009 to 2018), resulting in an estimated impact of 2.2 North Atlantic right whale SIMs per year. A 69% reduction in the risk of U.S. lobster and Jonah crab fisheries results in 0.68 North Atlantic right whale SIMs per year, below the PBR of 0.8. But the impact of the lobster and Jonah crab fisheries cannot be considered independent of other factors—including the remaining 50% of unattributed entanglements, vessel strikes, and entrapment—because, cumulatively, these impacts exceed PBR.

The Risk Reduction Rule and its associated Conservation Framework will initiate additional regulatory actions between 2021 and 2030. Although the biological opinion reached a determination that fisheries in U.S. federal waters will not jeopardize the continued existence of North Atlantic right whale, NOAA predicts that the Conservation Framework will take 9 years to reduce the impact of U.S. fisheries to below PBR (currently 0.7) (Table 5). NOAA's analysis indicates that the proposed management measures will fail to limit the impact of U.S. fisheries to below PBR within a reasonable timeframe as required by the Marine Mammal Protection Act, thus failing to meet the requirements of moderately effective in the Seafood Watch Standards. The impact of the Risk Reduction Rule is expected to reduce the impact of U.S. pot and trap fisheries from 4.57 SIMs per year to 2.56 SIMs, and 2.69 SIMs per year in federal waters inclusive of gillnet interactions.

Table 5: Actions to be taken under the ALWTRP Conservation Framework (adapted from (NMFS 2021a)).

Phase	Year	Framework Action Description
	Annually	Provide updates, as appropriate, on the implementation of the Framework to the New England and Mid-Atlantic Fishery Management Councils, Atlantic States Marine Fisheries Commission, and ALWTRT.
1	2021	NMFS implements the MMPA ALWTRP rulemaking, focused on 60% reduction in right whale M/SI incidental to American lobster and Jonah crab trap/pot fisheries. In federal waters, this action reduces M/SI on average annually to 2.69. Implementation for certain measures will begin in 2021; others will be phased over time.
2	2023	NMFS implements rulemaking to reduce M/SI in federal gillnet and other pot/trap fisheries (i.e., other than lobster and Jonah crab fisheries included in Phase 1) by 60%, reducing M/SI on average annually to 2.61. The ALWTRT will convene in 2021 to recommend modifications to the ALWTRP to address risk in the remaining fixed-gear fisheries. This phase will consider how any changes to the ALWTRP contribute to achieving the target reduction under this Framework.
Evaluation	2023–2024	NMFS evaluates any updated or new data on right whale population and threats, to assess progress toward achieving the conservation goals of this Framework. At this time, we will also assess measures taken by Canada to address M/SI in Canadian waters.
3	2025	NMFS implements rulemaking to further reduce M/SI by 60% in all federal fixed-gear fisheries, reducing M/SI on average annually to 1.04.
Evaluation	2025–2026	NMFS evaluates measures implemented in 2025 action as well as new data on right whale population and threats, to assess progress toward achieving the conservation goals of this Framework. Based on the results of this evaluation, NMFS will determine the degree to which additional measures are needed to ensure that the fisheries are not appreciably reducing the likelihood of survival and recovery. As described above, if actions outside the federal fisheries reduce risk to right whales by 0.5 M/SI on average annually (one whale every 2 years), the M/SI reduction requirement in Phase 4 will be reduced from 87% to 39%. If M/SI from other sources is reduced by greater than 1.0 M/SI on average annually, we will evaluate whether further action in the federal fisheries is needed.

4	2030	In accordance with the goals identified in the 2025–2026 evaluation, NMFS implements regulations to further reduce M/SI (up to 87%) in fixed gear fisheries.

In addition to the federal management measures described above, the Massachusetts Division of Marine Fisheries has implemented a suite of measures to reduce the risk to NARW in Massachusetts state waters effective from May 1, 2021 (Massachusetts Register 2022). A seasonal closure has been implemented that prohibits the use of traps and gillnets within 53% of state waters from February 1 to May 15 (with the possibility of opening after April 30, or extending beyond May 15, dependent on the presence of NARW in the area). All buoy lines in the trap fisheries are required to have a 1,700-lb. breaking strength contrivance, and buoy lines shall be no thicker than 3/8" in diameter. Further to the federally required gear marking (Table 4), MDMF requires all trap fisheries in state waters to include a 3-ft. red mark within the surface system, and four 2-ft. red marks along the buoy line (two within the top 50%, and two within the bottom 50% of the line) (MDMF 2022).

In Maine, additional gear marking requirements were introduced in 2020. Gear within the exemption line (waters within one mile of the coast have previously been exempted from the requirements of the ALWTRP) are required to show a 3-ft. purple mark in the top two fathoms of the buoy line, a 1-ft. purple mark at the midway point, and a 1-ft. purple mark at the bottom of the buoy line (lines shorter than 100 ft. do not need to show the mark at the midpoint) (MDMR 2020). Gear fished between the exemption line and 3 nm (referred to as "the sliver"), and in federal waters outside of 3 nm must be marked with four purple marks and one green mark (a 3-ft. purple mark and a 6-in. green mark in the top two fathoms, and 1-ft. purple marks at the top, midpoint, and bottom of the buoy line) (MDMR 2020).

There is a need for improved cooperation between United States and Canadian agencies in addressing the impact of fisheries on North Atlantic right whale. Since 2010, there has been a shift in North Atlantic right whale distribution, with whales migrating to the Gulf of St. Lawrence during the summer months (Davis et al. 2017). The number of entanglements involving Canadian fisheries, including snow crab fisheries, increased starting in 2016 (NOAA 2021); during the ongoing Unusual Mortality Event, 21 of the 34 known mortalities have been attributed to Canadian waters (NOAA 2021). Although United States and Canadian agencies have introduced measures aimed at reducing the impact of and the risk posed by commercial fisheries (and other human activities) on North Atlantic right whale, the effectiveness of these measures remains unproved, and the impact of these activities continues to exceed a sustainable level (Hayes et al. 2021). Cumulative impacts (average of 7.7 SIMs per year from 2015 to 2019), particularly on SIMs from unknown sources (3.7 SIMs), remain far above the levels required to recover the population (PBR = 0.7) (Hayes et al. 2021), and the Conservation Framework will allow continued impacts above PBR for the next 9 years. Cumulative impacts must be addressed through a comprehensive and coordinated management strategy to account for the transboundary nature of North Atlantic right whales that migrate between United States and Canadian waters.

New scientific data indicate additional risks that have not been addressed in the risk reduction rule or the Conservation Framework: specifically, risks related to entanglements that do not result in SIMs (Stewart et al. 2021) and range shifts due to climate change and the impact this has on food availability (Meyer-Gutbrod et al. 2021). There is a growing body of evidence indicating that entanglements that do not result in SIMs can still have a negative impact on North Atlantic right

whale populations as a result of decreased growth (Stewart et al. 2021), increased energy consumption {van der Hoop et al. 2017}, declining body condition (Pettis et al. 2017), and reduced reproductive output (Fauquier et al. 2020). As scientific understanding of these issues improves, there will likely be a need for improved management to ensure that negative impacts of entanglements are avoided.

Factor 3.3 - Scientific Research And Monitoring

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

N/A
In cases where either Factor 3.1 or 3.2 scores ineffective, Factor 3.3 is not scored because the overall score for Criterion 3 is a very high concern (1), regardless of how a fishery performs against Factor 3.3.

Factor 3.4 - Enforcement Of Management Regulations

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

N/A
In cases where either Factor 3.1 or 3.2 scores ineffective, Factor 3.4 is not scored because the overall score for Criterion 3 is a very high concern (1), regardless of how a fishery performs against Factor 3.4.

Factor 3.5 - Stakeholder Inclusion

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

N/A
In cases where either Factor 3.1 or 3.2 scores ineffective, Factor 3.5 is not scored because the overall score for Criterion 3 is a very high concern (1), regardless of how a fishery performs against Factor 3.5.

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Guiding principles

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	SCORE
Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank	Score: 3	Score: 0	Moderate Concern	**Yellow (3.000)**
Northwest Atlantic | Pots | United States | Southern New England	Score: 2	Score: 0	Moderate Concern	**Yellow (2.449)**

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate
Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom*

longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.

- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl) Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts
Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management
Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect*

species' ecological roles and ecosystem functioning.

- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

Factor 4.1 - Impact of Fishing Gear on the Habitat/Substrate

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Score: 3

The American lobster trap/pot fishery is carried out on a variety of benthic habitats, including complex rocky habitat (typically offshore) and mud, sand, and gravel (typically inshore). Although individual traps are generally accepted as low-impact gear, the sheer volume of lobster traps being fished can have cumulative effects on bottom habitats (Smolowitz 1998). Lobster traps are ranked a score of 3.

Justification:

It is generally accepted that lobster traps have relatively little impact on benthic habitats and communities (NMFS 2011). The biological and physical impact in mud, sand, and gravel habitats is low; the impact in rocky habitats, where emergent epifauna or biogenic structures exist, is higher (NEFMC 2002). The cumulative effects of dragging traps and their movements when harvested, with the tides, and with weather can be significant in scouring benthic habitat, and have adverse effects on essential fish habitat (Smolowitz 1998)(NEFMC 2011). Studies in American lobster fisheries in Canada have found that, in general, traps used in inshore areas are smaller and lighter, thus causing less damage (Mateo et al. 2016).

Northwest Atlantic | Pots | United States | Southern New England

Score: 2

The American lobster trap/pot fishery is carried out on a variety of benthic habitats including complex rocky habitat (typically offshore) and mud, sand, and gravel (typically inshore). Although individual traps are generally accepted as low-impact gear, the sheer volume of lobster traps being fished can have cumulative effects on bottom habitats (Smolowitz 1998)(NEFMC 2011). In some regions, the lobster fishery overlaps with vulnerable coral and biogenic habitats (MAFMC 2016). Because the effects of the lobster fishery on the sustainability of biogenic habitat are unknown, lobster traps are ranked as a score of 2.

Justification:

It is generally accepted that lobster traps have relatively little impact on benthic habitats and communities (NMFS 2011). The biological and physical impact in mud, sand, and gravel habitats is low; the impact in rocky habitats, where emergent epifauna or biogenic structures exist, is higher (NEFMC 2002). The cumulative effects of dragging traps and their movement when harvested, with

the tides, and with weather can be significant in scouring benthic habitat, and have adverse effects on essential fish habitat (Smolowitz 1998)(NEFMC 2011).

Studies in American lobster fisheries in Canada have found that, in general, traps used in inshore areas are smaller and lighter, thus causing less damage (Mateo et al. 2016). However, the SNE lobster fishery often occurs offshore in deep water, at banks, in canyons, and along the edge of the continental shelf (Phillips 2013).

Because the Northeast Canyons and Seamounts National Marine Monument area falls within the Southern New England fishery, there is potential for interaction with deepwater corals.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank

Score: 0

Trap gear is generally considered to have a low impact on benthic habitats compared to mobile gear (such as trawl gear) and is deployed in less vulnerable habitats. Measures to mitigate gear impacts include escape vents, a ghost panel, trap material requirements, and trap trawl length limits (ASMFC 2018c). In the Gulf of Maine (GOM), vessel entry to Lobster Conservation Management Area 1 was limited under Amendment XV to the IFMP (ASMFC 2018c). In the GOM, trap fishing effort is in high density in state waters, and traps are hauled frequently (Mateo et al. 2016). Because management measures do not protect >20% of habitat from trap fishing and gear modifications do not reduce the direct impact to habitat, mitigation of gear impacts is rated a 0.

Justification:

As part of the NEFMC Coral Amendment, lobster traps are prohibited from the Georges Bank Deep Sea Coral Protection Area, which represents over 60,000 km^2. This is a significant area of protection; however, the lobster fishery is unlikely to interact with vulnerable corals (partly due to this closure), so the score for Factor 4.1 already reflects this reduced risk (scoring 3 rather than 2 out of 5).

Northwest Atlantic | Pots | United States | Southern New England

Score: 0

Trap gear is generally considered to have a low impact on benthic habitats compared to mobile gear (such as trawl gear) and is deployed in less vulnerable habitats. Measures to mitigate gear impacts include escape vents, a ghost panel, trap material requirements, and trap trawl length limits (ASMFC 2018c). Partly because of reduced stock size, the number of traps fished in Southern New England has declined since the late 1990s, with a growing proportion of unfished trap allocation (ASMFC 2012)(ASMFC 2015a). For lobster conservation, management has further reduced fishing capacity in Southern New England through trap reductions (50% and 25% in LMAs 2 and 3, respectively). Reduced fishing effort through trap reductions and seasonal closures may yield a positive impact on habitat (NMFS 2014b). The scale of fishing in the SNE fishery is small; however, there is not enough

evidence to determine if it is sufficiently reduced to minimize the impact on marine habitats. Because management measures do not protect >20% of habitat from trap fishing and gear modifications do not reduce the direct impact to habitat, mitigation of gear impacts is rated a 0.

Factor 4.3 - Ecosystem-based Fisheries Management

Northwest Atlantic | Pots | United States | Gulf of Maine and Georges Bank
Northwest Atlantic | Pots | United States | Southern New England

Moderate Concern

In terms of fully assessing the ecological impacts of the fishery, there are no extensive measures in place other than fishing effort reduction via trap limits and limited access programs for a number of the LCMAs. Lobsters are mid-trophic-level consumers (Phillips 2013), so their abundance affects ecosystem food-web dynamics. Knowledge of the ecological interactions of American lobster (as predator and prey) is lacking for developing robust, ecological-based fisheries management (Phillips 2013). The impact of the lobster fishery on populations of Jonah crab and Atlantic rock crab is not well documented or understood, although there is some information on catch levels. This may be one of the key uncertainties of the ecosystem impacts of the fishery. These *Cancer* species are common to coastal communities and may have a role in structuring ecosystems as predators and as prey (Bannister et al. 2013). Their relative importance in coastal ecosystems has increased in the past decade with the decline in green sea urchin (Leland 2002)(Steneck et al. 2004)(Bannister et al. 2013). The design of traps and escape vents ensures that all females of these species, most male rock crab, and a proportion of male Jonah crab are not taken in the lobster fishery.

Ghost fishing can have a significant effect on the ecosystem; however, the extent of ghost fishing for the SNE American lobster fishery is unknown. The Gulf of Maine Lobster Foundation has collected over 1,000 traps from 3 lobster conservation management zones. The Cornell Cooperative Extension (CCE) retrieved 2,298 derelict lobster traps in 2010. Traps found in deep waters or near sheltered environments can continue to fish for years, due to the lack of oxidation of metal at that depth (NFWF 2012). In addition, bio-fouling can occur over the escape panels, thus reducing the sizes of animals that can escape or trapping them for longer periods (NFWF 2012)(ASMFC 2014a).

Removal of herring from the marine ecosystem may have significant impacts. Atlantic herring is a vital forage species for other fishes, marine mammals, and seabirds; if the stocks crash, there could be severe ecosystem-wide consequences (Pikitch et al. 2012). Herring bait input to the ecosystem is also altering ecosystem energy flow, possibly leading to significant ecological impacts and shifts in population dynamics compared to areas that have not been artificially enriched (Grabowski et al. 2010)(Phillips 2013). Amendment 8 to the herring fishery management plan established a harvest strategy that considers the needs of the ecosystem with respect to herring (NEFMC 2018).

Because some ecosystem-based management is in place but with the possibility of detrimental food web effects requiring stronger policies to fully protect the ecological role of harvested species, ecosystem-based management is rated a moderate concern.

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Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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