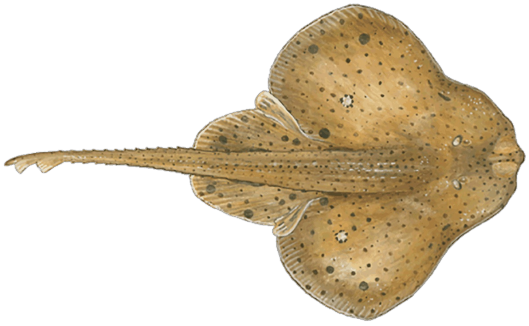
Winter Skate

Leucoraja ocellata



United States: Northwest Atlantic

Bottom trawls, Set gillnets

Report ID 1002

September 6, 2022

Seafood Watch Standard used in this assessment: Fisheries Standard v2

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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

Seven skate species make up the Northeast skate complex. Only winter and thorny skates are consumed by humans, and it is currently illegal to land thorny skate. As a result, this report focuses on the winter skate (*Leucoraja ocellata*) bottom trawl and sink gillnet fisheries in U.S. Atlantic waters.

Winter skate is not overfished, but harvest is limited by quotas for other benthic species, especially Atlantic cod, because winter skate wings are mostly landed as one of many species in the groundfish or Northeast multispecies fishery, and less so in the goosefish fishery. According to how overfishing is defined for skate, it was not occurring on winter skate in FY 2019. But, stock assessments and fishing mortality rates contain a moderate level of uncertainty because species are not reliably identified or reported.

Bottom trawl and sink gillnet fisheries for skate in the Northeast and Mid-Atlantic regions result in some by-catch. By-catch species are ranked on a number of factors, including inherent vulnerability and listing as endangered or threatened species. The lowest scoring by-catch species drive the rankings for Criterion 2. The lowest scoring species in the sink gillnet fishery for skate are North Atlantic right whale and Atlantic sturgeon. In the bottom trawl skate fishery, several groundfish species, including Atlantic cod, have low scores because their stocks have a high species inherent vulnerability and depleted status, and are being overfished.

Managers are following scientific advice, and work is ongoing to minimize by-catch, particularly of species of special concern such as marine mammals and sea turtles. But, entanglement in fishing gear is the leading cause of mortality for North Atlantic right whale, and the Atlantic Large Whale Take Reduction Plan has failed to curtail mortality to a sustainable level.

Sink gillnets contact the bottom, but they have less impact than bottom trawls on the seafloor. In northern areas, there is some mitigation of trawl gear impacts, primarily through closed areas and spatial management.

Final Seafood Recommendations

SPECIES | FISHERY	CRITERION 1 TARGET SPECIES	CRITERION 2 OTHER SPECIES	CRITERION 3 MANAGEMENT	CRITERION 4 HABITAT	OVERALL RECOMMENDATION
Winter skate | Northwest Atlantic | Bottom trawls | United States	3.831	1.343	3.000	2.598	**Good Alternative (2.516)**
Winter skate | Northwest Atlantic | Set gillnets | United States	3.831	0.950	1.732	3.122	**Avoid (2.106)**

Summary

Winter skate (*Leucoraja ocellata*) wings landed with sink gillnets are rated Avoid, because of the high risk of interactions with critically endangered North Atlantic right whale. Skates landed by bottom trawls have a slightly higher score than those landed by sink gillnets, due to different by-catch species, and are therefore considered a Good Alternative.

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

The Northeast skate complex includes seven species of skate: winter (*Leucoraja ocellata*), little (*Leucoraja erinacea*), barndoor (*Dipturus laevis*), clearnose (*Raja eglanteria*), rosette (*Leucoraja garmani*), smooth (*Malacoraja senta*), and thorny (*Amblyraja radiata*). Of these seven species, only winter and thorny skates (wings) are consumed by humans.

Little skate is primarily used as bait. Clearnose and rosette skates may also be used for bait. It is illegal to keep barndoor, smooth, and thorny skates.

This report provides information and a recommendation for U.S. winter skate (*Leucoraja ocellata*). Most skate landings are from bottom trawls (82%) and sink gillnets (18%) in the Northeast and Mid-Atlantic regions (pers. comm., T. Curtis 2013) as part of the Northeast multispecies groundfish fishery, and less so in the goosefish and sea scallop fisheries.

Species Overview

Winter skate can live for up to 20 years and becomes mature at approximately age 12. It can grow up to 5 feet long. It is likely that female skates lay egg cases year-round. These egg cases are hard and leathery, and hatch after 6–12 months.

Winter skate is distributed mainly around Georges Bank and southern New England in the Northeast region. The New England Fishery Management Council developed a fishery management plan for skates after the first stock assessment was performed in 1999, and the plan was implemented in 2003. The last stock assessment was conducted in 2012, and annual updates are based on information collected in trawl surveys. Skate is mainly caught with bottom trawls and sink gillnets, but can also be caught by scallop dredges, longlines, and trap gear.

Skates are often misidentified by species, so they are only reported as the skate complex. Winter skate wings are the only wings on the market, because it is currently illegal to land thorny skate (the other species known to be consumed by humans). There has been mistaken reporting of wings from rosette, little, and smooth skates, which are too small to be winged. There are also catches of skate species that are mistakenly reported from areas where they do not occur.

Production Statistics

Skate landings declined in the 1970s, and only 800 metric tons (mt) were landed in 1981. Landings then increased, mostly in response to the increased demand for skate wing exports. In 2007, landings reached a high of 19,000 mt. Skates are landed in the U.S. relatively evenly in all months, with a slight increase in the summer due to increased demand for lobster bait. Most landings (85–95%) are from Massachusetts (New Bedford) and Rhode Island (Point Judith).

Importance to the US/North American market.

Most winter skate wings are exported, mainly to France, Korea, and Greece. There is a small fine-dining U.S. market. Globally, winter skate wings originate only from the northeastern United States or

Canada, but there are wings available from different species on the U.S. West Coast and in Europe.

Common and market names.

The market name is winter skate wings. There are no other common or market names.

Primary product forms

Wings (skin on), fillets (skin off).

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. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown.

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.

Criterion 1 Summary

WINTER SKATE				
REGION / METHOD	**INHERENT VULNERABILITY**	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Northwest Atlantic | Bottom trawls | United States	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Northwest Atlantic | Set gillnets | United States	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)

Criterion 1 Assessments

SCORING GUIDELINES

Factor 1.1 - - Inherent Vulnerability

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing).*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator). Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing*

based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Factor 1.2 - Abundance

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Factor 1.3 - Fishing Mortality

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

Winter skate

Factor 1.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High

Winter skate has high vulnerability (FishBase score of 62) (FishBase 2013). Winter skate is a moderately long-lived species, reaching a maximum age of 21 years (FishBase 2013), and has a low fecundity, laying a small number of egg cases on the seabed each year.

Factor 1.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For winter skate, the 2017 to 2019 NEFSC autumn average biomass index of 8.61 kg/tow is above the biomass threshold reference point (2.83 kg/tow) and above the B_{MSY} proxy (5.66 kg/tow; see Figure 1) (Sosebee 2020). Because the stock is not overfished, but there is uncertainty associated with using the survey index as a proxy for abundance, a score of low concern is given (rather than very low concern).

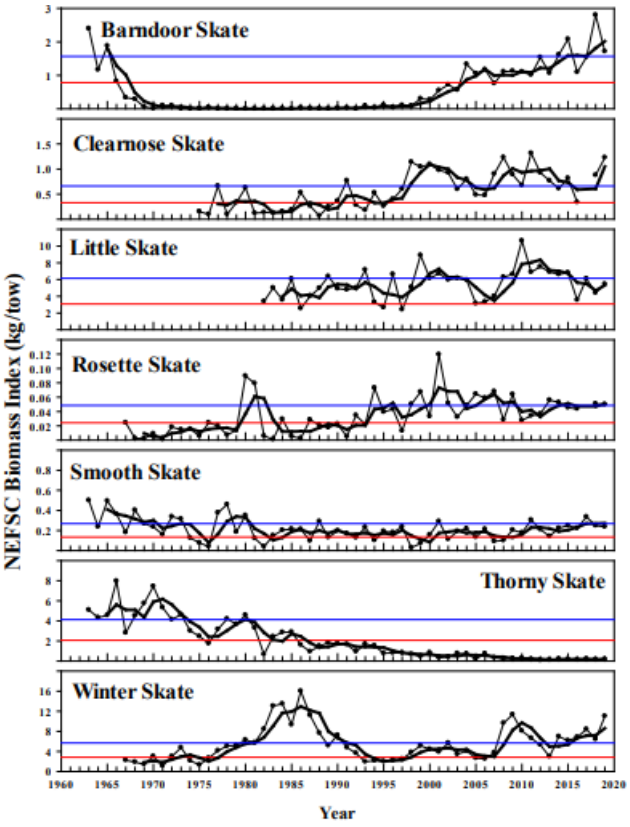

Figure 1: Northeast Fisheries Science Center survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the management biomass thresholds and targets. From (Sosebee 2020).

Factor 1.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For winter skate, the 2017 to 2019 average index is above the 2016 to 2018 index by 19.2% (Sosebee 2020). Because the stock is not undergoing overfishing, fishing mortality is considered a low concern.

Justification:

The fishing mortality reference points are based on changes in survey biomass indices. If the 3-year moving average of the survey biomass index for a skate species declines by more than the average CV of the survey time series, then fishing mortality is assumed to be greater than F_{MSY}, and overfishing is occurring for that skate species (Sosebee 2020).

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. 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.

To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch. 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

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.

WINTER SKATE			
REGION / METHOD	**SUB SCORE**	**DISCARDS+BAIT / LANDINGS**	**SCORE**
Northwest Atlantic | Bottom trawls | United States	1.414	0.950: 20-40%	Red (1.343)
Northwest Atlantic | Set gillnets | United States	1.000	0.950: 20-40%	Red (0.950)

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 | BOTTOM TRAWLS | UNITED STATES				
SUB SCORE: 1.414		DISCARD RATE: 0.950		**SCORE: 1.343**
SPECIES	**INHERENT VULNERABILITY**	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Yellowtail flounder	2.000: Medium	2.000: High Concern	1.000: High Concern	Red (1.414)
Atlantic cod	1.000: High	2.000: High Concern	1.000: High Concern	Red (1.414)

Atlantic sturgeon	1.000: High	1.000: Very High Concern	2.330: Moderate Concern	Red (1.526)
Spiny dogfish	1.000: High	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Witch flounder	1.000: High	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Blackback	3.000: Low	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Ocean pout	1.000: High	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Atlantic halibut	1.000: High	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Thorny skate	1.000: High	2.000: High Concern	3.670: Low Concern	Yellow (2.709)
Windowpane flounder	2.000: Medium	2.000: High Concern	3.670: Low Concern	Yellow (2.709)
Clearnose skate	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Little skate	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Rosette skate	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Silver hake	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Smooth skate	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Winter skate	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Barndoor skate	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Long-finned pilot whale	1.000: High	3.000: Moderate Concern	5.000: Very Low Concern	Green (3.873)
Atlantic white-sided dolphin	1.000: High	3.000: Moderate Concern	5.000: Very Low Concern	Green (3.873)
Short-beaked common dolphin	1.000: High	3.000: Moderate Concern	5.000: Very Low Concern	Green (3.873)
American plaice	1.000: High	4.000: Low Concern	5.000: Very Low Concern	Green (4.472)
Haddock	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

Scup	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

NORTHWEST ATLANTIC | SET GILLNETS | UNITED STATES				
SUB SCORE: 1.000	DISCARD RATE: 0.950		**SCORE: 0.950**	
SPECIES	**INHERENT VULNERABILITY**	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
North Atlantic right whale	1.000: High	1.000: Very High Concern	1.000: High Concern	Red (1.000)
Yellowtail flounder	2.000: Medium	2.000: High Concern	1.000: High Concern	Red (1.414)
Atlantic cod	1.000: High	2.000: High Concern	1.000: High Concern	Red (1.414)
Atlantic sturgeon	1.000: High	1.000: Very High Concern	2.330: Moderate Concern	Red (1.526)
Atlantic halibut	1.000: High	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Windowpane flounder	2.000: Medium	2.000: High Concern	2.330: Low Concern	Red (2.159)
Spiny dogfish	1.000: High	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Blackback	3.000: Low	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Witch flounder	1.000: High	2.000: High Concern	2.330: Moderate Concern	Red (2.159)
Loggerhead turtle	1.000: High	1.000: Very High Concern	5.000: Very Low Concern	Yellow (2.236)
Fin whale	1.000: High	1.000: Very High Concern	5.000: Very Low Concern	Yellow (2.236)
Leatherback turtle	1.000: High	1.000: Very High Concern	5.000: Very Low Concern	Yellow (2.236)
Green turtle	1.000: High	1.000: Very High Concern	5.000: Very Low Concern	Yellow (2.236)
Kemp's ridley turtle	1.000: High	1.000: Very High Concern	5.000: Very Low Concern	Yellow (2.236)
Humpback whale	1.000: High	3.000: Moderate Concern	2.330: Moderate Concern	Yellow (2.644)
Thorny skate	1.000: High	2.000: High Concern	3.670: Low Concern	Yellow (2.709)

Atlantic blacktip shark	1.000: High	2.000: High Concern	3.670: Low Concern	Yellow (2.709)
Goosefish	1.000: High	4.000: Low Concern	2.330: Moderate Concern	Yellow (3.053)
Bull shark	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Atlantic wolffish	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Harbor porpoise	1.000: High	3.000: Moderate Concern	3.670: Low Concern	Green (3.318)
Little skate	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Clearnose skate	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Rosette skate	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Smooth skate	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Barndoor skate	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Winter skate	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
White hake	1.000: High	4.000: Low Concern	5.000: Very Low Concern	Green (4.472)
Haddock	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Pollock	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

For Criterion 2, a species was included and assessed if it made up >5% of the catch in the gillnet or trawl fisheries in the U.S. Northeast and Mid-Atlantic regions, because these are the fisheries that land 5% or more of total U.S. winter skate landings. A species was also included if it was overfished, depleted, a stock of concern, endangered, threatened, IUCN Near Threatened, a U.S. MMPA strategic species, and/or subject to overfishing *and* if winter skate fisheries caused (or could have caused) >1% of the species' total mortality across all fisheries. To determine catch percentages, an analysis was conducted of NOAA landings data for fisheries that land winter skate.

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Inherent Vulnerability
(same as Factor 1.1 above)

Factor 2.2 - Abundance
(same as Factor 1.2 above)

Factor 2.3 - Fishing Mortality
(same as Factor 1.3 above)

American plaice

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States

High

American plaice has a high inherent vulnerability (66 out of 100) {FishBase, 2013}.

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States

Low Concern

Based on the 2017 American plaice stock assessment, spawning stock biomass (SSB) in 2016 was estimated to be 13,351 mt, which is 99% of the biomass target for this stock (SSB_{MSY} proxy = 13,503; see Figure 2) {Terceiro 2017}. According to the NMFS first quarter 2018 update, Georges Bank American plaice is not overfished and in year 4 of a 10-year rebuilding plan (NMFS 2018c). Because the stock is not overfished, and abundance is more than 75% above the biomass target, abundance is considered a low concern.

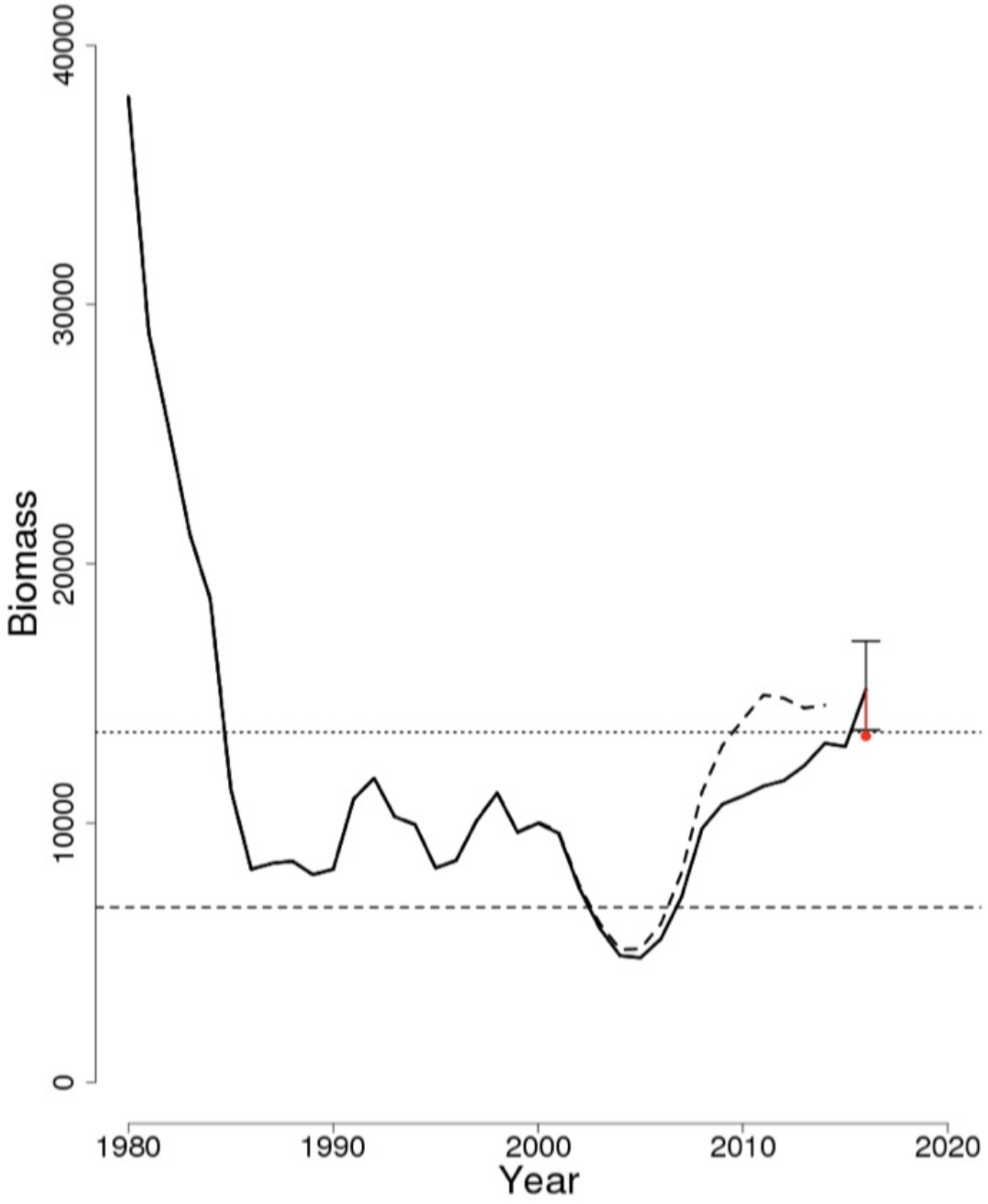

Figure 2: Trends in SSB of Gulf of Maine–Georges Bank American plaice between 1980 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{THRESHOLD}$ (1/2 SSB_{MSY} proxy; horizontal dashed line) as well as SSB_{TARGET} (SSB_{MSY} proxy; horizontal dotted line) based on the 2017 assessment (Terceiro 2017).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Very Low Concern

Based on the 2017 American plaice stock assessment, the 2016 fully selected fishing mortality was estimated to be 0.111, which is 51% of the overfishing threshold proxy (F_{MSY} proxy = 0.216) {Terceiro 2017}. Therefore, the stock is not undergoing overfishing and fishing mortality is considered a very low concern.

Atlantic blacktip shark

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Blacktip shark has a high vulnerability. FishBase lists it as "high" with a score of 55 out of 100 (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

High Concern

The most recent assessment of blacktip shark in the Atlantic was completed in 2020; however, uncertainty in the results led to the stock status being undetermined (SEDAR 2020). Blacktip shark is listed as "Vulnerable" by the International Union for the Conservation of Nature (IUCN) (Rigby et al. 2020), so Seafood Watch considers abundance a high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Low Concern

Fishing mortality on Atlantic blacktip shark is unknown, as is stock status. There is a targeted fishery for Atlantic blacktip shark in the mid-Atlantic and it is also caught as by-catch in gillnets and longlines. The skate gillnet fishery does not target Atlantic blacktip shark and is not a substantial contributor to blacktip shark mortality; by-catch numbers are not high. The impact of the mid-Atlantic skate fishery on Atlantic blacktip shark is scored a low concern. The New England skate fishery does not overlap with the blacktip shark population.

Atlantic cod

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Atlantic cod has a high to very high vulnerability (71 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
Based on the 2017 Georges Bank Atlantic cod stock assessment, the stock status of Georges Bank cod cannot be quantitatively determined due to a lack of biological reference points associated with the "Plan B smooth" approach (Legault 2017a). But, it is considered to be overfished due to poor stock condition (Legault 2017a). The survey biomass in 2017 (the arithmetic average of the 2017 NEFSC spring and 2016 NEFSC fall surveys smoothed using a loess) was estimated to be 7.237 kg/tow (see Figure 3)(Legault 2017a). According to the NMFS first quarter 2019 update, Georges Bank Atlantic cod is overfished and in year 15 of a 23-year rebuilding plan (NMFS 2019).

Based on the 2017 Gulf of Maine Atlantic cod stock assessment, spawning stock biomass (SSB) of Gulf of Maine cod in 2016 was estimated to be 3,046 mt under the M = 0.2 model and 3,262 mt under the M-ramp model scenario, which is 8% and 5%, respectively, of the biomass target, SSB_{MSY} proxy (40,604 mt and 59,714 mt) (Palmer 2017a). According to the NMFS first quarter 2019 update, Gulf of Maine Atlantic cod is overfished and in year 5 of a 10-year rebuilding plan (NMFS 2019). Because Georges Bank and Gulf of Maine cod stocks are overfished, abundance is considered a high concern.

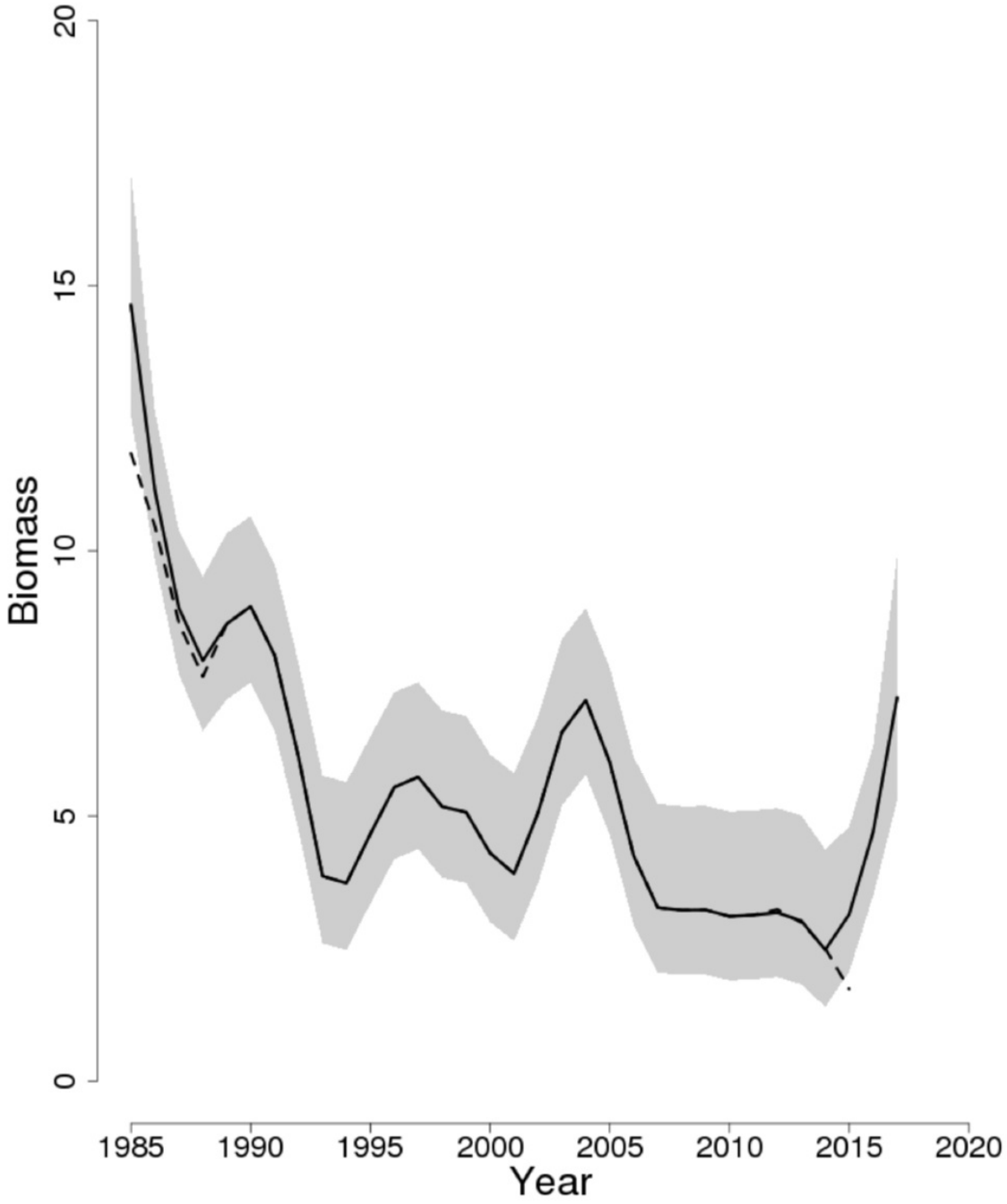

Figure 3: Trends in smoothed survey biomass (kg/tow) of Georges Bank Atlantic cod between 1985 and 2017 from the current (solid line) and previous (dashed line) assessment, based on the 2017 assessment. The approximate 90% lognormal confidence intervals are shown (Legault 2017a).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Northwest Atlantic | Set gillnets | United States

High Concern

Based on the 2017 Georges Bank Atlantic cod stock assessment, the 2016 relative exploitation rate (2016 catch divided by 2016 smoothed survey biomass) was estimated to be 0.174 {Legault 2017a}. But, the recommended fishing level is unknown. According to the NMFS first quarter 2019 update, Georges Bank Atlantic cod is undergoing overfishing and in year 15 of a 23-year rebuilding plan, where the management action is focusing on reducing mortality (NMFS 2019).

Based on the 2017 Gulf of Maine Atlantic cod stock assessment, the 2016 fully selected fishing mortality was estimated to be 0.228 and 0.237, which is 131% and 134% of the F proxy (F; 0.174 and 0.177) under the M = 0.2 model and the M-ramp model scenarios, respectively (Palmer 2017a). Because both Georges Bank and Gulf of Maine stocks are undergoing overfishing, fishing mortality is considered a high concern.

Atlantic halibut

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
The inherent vulnerability of Atlantic halibut is very high (88 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
Based on the 2015 Atlantic halibut stock assessment, spawning stock biomass (SSB) in 2014 was estimated to be 96,464 mt, which is 199% of the biomass target (SSB_{MSY} proxy = 48,509; see Figure 4) (NEFSC 2015a). But, the assessment indicated that the model used was highly uncertain due to the high sensitivity to initial biomass, and that the survey data used was "noisy" due to the low number of animals caught in the surveys (NEFSC 2015a). Therefore, stock status for this species cannot be determined based on the current assessment and is unknown (NEFSC 2015a). According to the NMFS first quarter 2018 update, Atlantic halibut is overfished and in year 14 of a 52-year rebuilding plan (NMFS 2018c). This factor is considered a high concern, because Atlantic halibut is also listed as a species of concern under the Endangered Species Act (ESA) (NMFS 2017a).

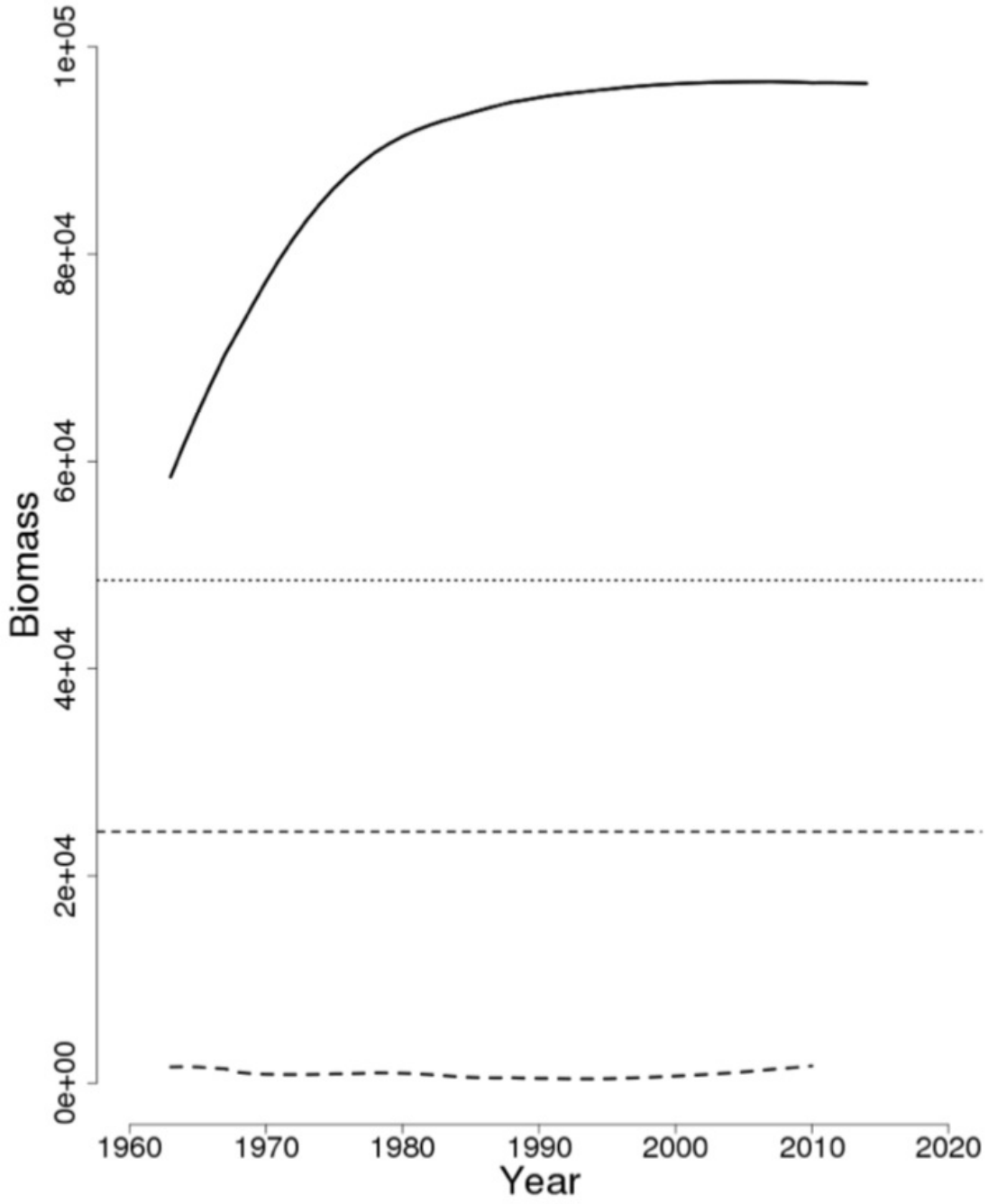

Figure 4: Estimated trends in the biomass of Atlantic halibut between 1963 and 2014 from the current (solid line) and previous (dashed line) assessment and the corresponding $B_{THRESHOLD}$ = 1/2 B_{MSY} proxy (horizontal dashed line) as well as B_{TARGET} (B_{MSY} proxy; horizontal dotted line) based on the 2015 assessment {NEFSC 2015}.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderate Concern

Based on the 2015 Atlantic halibut stock assessment, the 2014 fully selected fishing mortality was estimated to be 0.001, which is 1% of the overfishing threshold proxy (F_{MSY} proxy = 0.073) (NEFSC 2015a). According to the NMFS first quarter 2018 update, Atlantic halibut is not undergoing overfishing (NMFS 2018c). Because there is no 2017/2018 stock assessment update to support the NMFS FSSI listing, the Atlantic halibut stock is likely severely depleted, and the model used in the 2015 stock assessment has been deemed unreliable, this factor is scored a moderate concern.

Atlantic sturgeon

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Atlantic sturgeon has a high inherent vulnerability (85 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Very High Concern
All U.S. populations of Atlantic sturgeon are listed as "Endangered" or "Threatened" under the Endangered Species Act (ESA) (NMFS 2012a). U.S. populations of Atlantic sturgeon are divided into five distinct population segments (DPS) for management purposes (NOAA Fisheries 2012b). The Gulf of Maine DPS is currently listed as "Threatened" by the ESA, while the four DPS south of Cape Cod are currently listed as "Endangered" (NOAA Fisheries 2012b). Little is known about stock status: reliable data are difficult to collect because many river systems have few fish and are difficult to sample {ASFMC 2017}. Although accurate stock assessments are difficult to conduct, some states conduct long-term monitoring of Atlantic sturgeon via fishery-independent surveys (see Figure 5) {ASFMC 2017}. The figure contains data from New Jersey and North Carolina surveys and provides an example of local conditions, with both surveys indicating an increase in the number of sturgeon in these areas {ASFMC 2017}. Because all populations of Atlantic sturgeon are threatened or endangered, Seafood Watch deems this factor a very high concern.

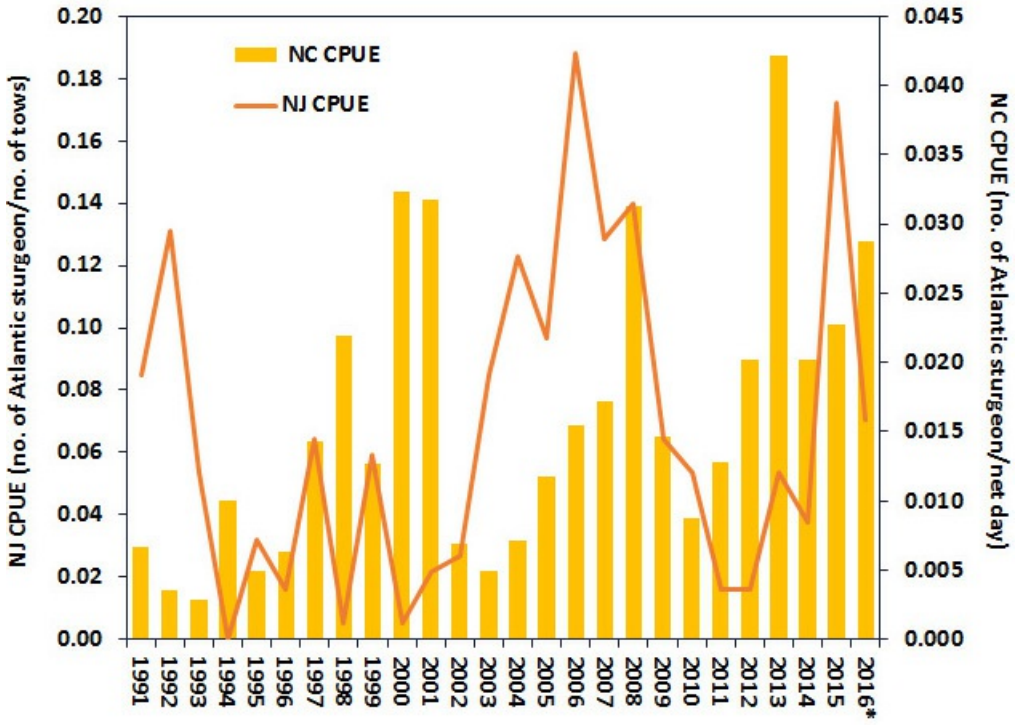

Figure 5: Atlantic sturgeon fishery-independent catch per unit effort (CPUE) in New Jersey's coastal waters and North Carolina's Albemarle Sound. Data from (ASMFC 2017).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Moderate Concern

A variety of threats including directed harvest, commercial fisheries by-catch, and habitat destruction have contributed to the dramatic declines in Atlantic sturgeon populations since the mid-1800s (Atlantic Sturgeon Status Review Team (ASSRT) 2007). In late 1997 and early 1998, the Atlantic States Marine Fisheries Commission (ASMFC) and the federal government issued a moratorium on Atlantic sturgeon fishing to allow stocks to rebuild, which is projected to take at least 40 years (ASMFC 2012). The 2007 status review of Atlantic sturgeon, which recommended the listing of five distinct population segments (DPS) of Atlantic sturgeon under the ESA, found commercial fisheries by-catch to be a significant threat in each DPS (Atlantic Sturgeon Status Review Team (ASSRT) 2007). In 2012, four of the DPSs were listed as "Endangered," while the Gulf of Maine segment was listed as "Threatened." Bottom gillnet fisheries were found to have the greatest impact, while trawl gear used to fish in the northern part of the range were not a high concern for Atlantic sturgeon (Atlantic Sturgeon Status Review Team (ASSRT) 2007). According to the ASSRT (2007), "[M]ortality of Atlantic sturgeon captured by trawls seems to be low, with most surveys reporting 0% mortality. Overall, trawls do not seem to pose a significant threat to Atlantic sturgeon." Although many surveys

reported 0% mortality, records of sturgeon being caught in trawls do exist and, because there is no evidence to demonstrate that these impacts are sustainable, Seafood Watch considers the impact of trawls on Atlantic sturgeon to be unknown relative to a sustainable level. Therefore, fishing mortality is a moderate conservation concern.

Northwest Atlantic | Set gillnets | United States

Moderate Concern

The most recent stock assessment for Atlantic sturgeon predicted overall take for both bottom trawl gear and gillnets. From 2000 to 2015, total by-catch from bottom trawls ranged from 624 to 1,518 fish, with an average of 4% recorded as dead {ASMFC 2017b}. Total by-catch from sink and drift gill nets ranged from 253 to 2,715 fish, with an average of 30% resulting in annual dead discards. Little change in dead discard numbers has been noted since 2000 {ASMFC 2017b}. Statistical uncertainty surrounds these estimates regarding whether or not they exceed the determined threshold for total mortality {ASMFC 2017b}; therefore, a score of moderate concern was awarded.

Atlantic white-sided dolphin

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States

High

This marine mammal species has a high vulnerability (Seafood Watch Criteria document, p. 9). The life history characteristics of marine mammals, including high age at maturity, low fecundity (single births), and low reproductive rates (every 1–5 years), make their populations vulnerable to high mortality rates. Higher than average mortality of marine mammals is frequently human-caused and can include mortality from ship or boat strikes and fisheries by-catch. Marine mammal populations (and those of other long-lived taxa) are especially vulnerable to mortality of adults (the reproductively active portion of the population) because it takes years, if not decades, for a calf to reach maturity and become reproductively active.

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States

Moderate Concern

According to the most current marine mammal stock assessment report, the best estimate of abundance for the North Atlantic white-sided dolphin stock was 93,233 (CV = 0.71), with a minimum population size of 54,443 {Hayes et al. 2020}. The status of this population relative to the optimum sustainable population (OSP) in the U.S. Atlantic EEZ is unknown, and a trend analysis has not been conducted for this species {Hayes et al. 2020}. The International Union for the Conservation of Nature (IUCN) considers this species as "Least Concern" {Hammond et al. 2008a}, and because status and trend analysis are unknown, abundance is considered a moderate concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Very Low Concern

The total annual estimated average fishery-related mortality or serious injury to the western North Atlantic white-sided dolphin stock during 2013 to 2017 was 26 (CV = 0.20), with a potential biological removal (PBR) of 544 {Hayes et al. 2020}. The Northeast bottom trawl is the primary contributor, accounting for 81% (21/26 individuals) of the total by-catch across all fisheries, with the Northeast sink gillnet fishery accounting for 11% (2.8/26 individuals) {Hayes et al. 2020}. Because the PBR is not exceeded, and the bottom trawl fishery takes less than 10% of the PBR, fishing mortality is considered a very low concern.

Atlantic wolffish

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Atlantic wolffish has a high to very high inherent vulnerability (67 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

High Concern

The most recent assessment of Atlantic wolffish was summarized in the groundfish assessment updates in 2017, which indicated that SSB2016 was estimated at 652 mt. This was the equivalent of 40% of SSB_{MSY} proxy, which was 1,612 mt. The stock was therefore overfished {NEFSC 2017}; abundance is considered a high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

F_{2010} was estimated to be 0.002 and F_{MSY} proxy = 0.22, which means overfishing was not occurring {NEFSC 2017}. Fishing mortality is considered a very low concern.

Barndoor skate

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Barndoor skate has a high inherent vulnerability (77 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern
For barndoor skate, the 2017 to 2019 NEFSC autumn average survey biomass index of 2.02 kg/tow is above the biomass threshold reference point (0.78 kg/tow) and 102% above the B_{MSY} proxy (1.57 kg/tow; see Figure 6) (Sosebee 2020). Because the stock is not overfished, but there is uncertainty associated with using the survey index as a proxy for abundance, a score of low concern is given (rather than very low concern).

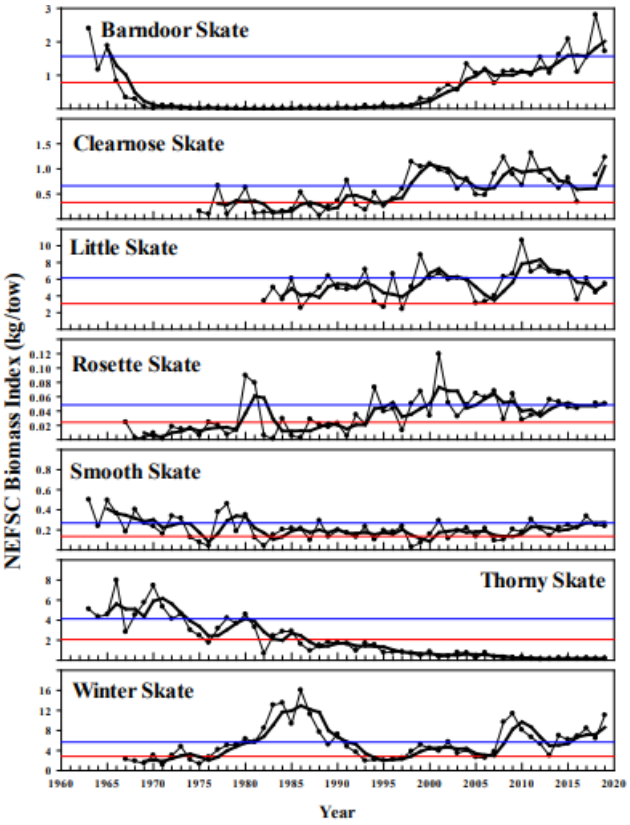

Figure 6: Northeast Fisheries Science Center survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the management biomass thresholds and targets. From (Sosebee 2020).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For barndoor skate, the 2017 to 2019 average index is above the 2016 to 2018 index by 11.4% (Sosebee 2020). Because the stock is not undergoing overfishing, but there is uncertainty in the use of survey indices, fishing mortality is considered a low concern (rather than a very low concern).

Justification:

The fishing mortality reference points are based on changes in the 3-year survey biomass indices. If there is a decline in the 3-year moving average of the survey biomass index that is greater than the average CV of the survey time series, then fishing mortality is assumed to be greater than F_{MSY}, and overfishing is occurring for that skate species (Sosebee 2020).

Blackback

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low
Blackback/winter flounder has a low inherent vulnerability (34 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
Blackback, or winter flounder, from three different stocks may be caught in the set gillnet fishery for skate: Georges Bank, Gulf of Maine, and Southern New England/Mid-Atlantic.

Based on the 2017 Georges Bank blackback/winter flounder stock assessment, spawning stock biomass (SSB) in 2016 was estimated to be 3,946 mt, which is 52% of the biomass target for an overfished stock (SSB_{MSY} = 7,600 with a threshold of 50% of SSB_{MSY}) {Hendrickson 2017}. According to the NMFS first quarter 2018 update, Georges Bank blackback/winter flounder is not overfished and is in year 8 of a 7-year rebuilding plan (NMFS 2018c).

Based on the 2020 Gulf of Maine blackback/winter flounder stock assessment update, biomass (30+ cm mt) in 2019 was estimated to be 2,862 mt, and biomass status is unknown (NOAA 2020c). Biomass is estimated from survey area-swept for non-overlapping strata from three different fall trawl surveys: Maine New Hampshire (MENH), Massachusetts Division of Marine Fisheries (MDMF), and Northeast Fisheries Science Center (NEFSC), using an updated survey gear catchability (q) estimate of 0.87 (on the wing spread) from the sweep study {Miller et al. 2017}(Nitschke 2017), but biomass-based reference points cannot be determined from this method. According to the NMFS first quarter 2022 update, Gulf of Maine blackback/winter flounder overfished status is also unknown (NMFS 2022).

The 2017 Southern New England/Mid-Atlantic blackback/winter flounder stock assessment showed that spawning stock biomass (SSB) in 2016 was 4,360 mt, which was 18% of the biomass target of 24,687 mt, as well 36% of the biomass threshold of an overfished stock ($SSB_{THRESHOLD}$ = 12,343.5 mt) (NEFSC 2017f).

Because of the overfished condition of the Southern New England/Mid-Atlantic stocks of blackback/winter flounder, abundance is ranked a high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderate Concern

Based on the 2017 Georges Bank blackback/winter flounder stock assessment, the 2016 fully selected fishing mortality (F) was estimated to be 0.117, which is 22% of the overfishing threshold (F_{MSY} = 0.522) {Hendrickson 2017}. According to the NMFS first quarter 2018 update, Georges Bank blackback/winter flounder is in year 8 of a 7-year rebuilding plan (NMFS 2018c).

Based on the 2017 Gulf of Maine blackback/winter flounder stock assessment, the 2016 30+ cm exploitation rate was estimated to be 0.086, which is 37% of the overfishing exploitation threshold proxy (E_{MSY} proxy = 0.23) (Nitschke 2017).

The 2017 Southern New England/Mid-Atlantic blackback/winter flounder stock assessment indicated that the 2016 fully selected fishing mortality (F_{FULL}) on fully selected ages 4 and 5 was 0.21, which was 62% of the overfishing threshold (F_{MSY} = 0.34) (NEFSC 2017f). The SNE/MA blackback/winter flounder stock shows an overall declining trend in SSB over the time series (1981 to 2016), with current estimates near the time series low (NEFSC 2017f). The stock was in a 10-year rebuilding plan, but did not meet its rebuilding target in 2014, in part due to low recruitment {NEFSC 2015}. In 2014, NOAA Fisheries partly implemented Framework Adjustment 50 to revise the rebuilding end date to 2023. It is possible that, although fishing mortality is below MSY, it may be above the level that will allow recovery under current environmental conditions. The stock remains vulnerable to heavy fishing pressure and habitat degradation, and has low genetic variability that hinders its recovery {NEFSC 2015}. But, estimates of fishing mortality have remained steady since 2012 and recruitment has been increasing since an all-time low in 2013 and is currently above the 10-year average (and the highest since 2008) (NEFSC 2017f). Because overfishing is not occurring, but recovery of the stock has not yet been achieved, we consider fishing mortality a moderate concern.

Overfishing is not occurring on any of the blackback stocks; however, there is uncertainty regarding the impact of fishing on the Southern New England/Mid-Atlantic blackback/winter flounder stock due to the lack of recovery, so fishing mortality is scored a moderate concern.

Bull shark

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Bull shark has a high inherent vulnerability (88 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

High Concern

Stock status is unknown and inherent vulnerability is high. Bull shark is listed as "Near Threatened" on the International Union for the Conservation of Nature (IUCN) Red List (Rigby et al. 2021).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Fishing mortality is unknown, but the skate fishery is not a substantial contributor to mortality and does not target the large coastal shark complex. Most sharks that are caught as by-catch are caught in pelagic longline fisheries, and less so in mid-Atlantic gillnet fisheries. The New England skate fishery does not overlap with bull shark.

Clearnose skate

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Clearnose skate has a high inherent vulnerability (57 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern
For clearnose skate, the 2017 to 2019 NEFSC autumn average biomass index of 1.05 kg/tow is above the biomass threshold reference point (0.33 kg/tow) and the B_{MSY} proxy (0.66 kg/tow; see Figure 7) (Sosebee 2020). Because the stock is not overfished, but there is uncertainty in using a survey index as a proxy for biomass relative to MSY, abundance is scored a low concern (rather than very low concern).

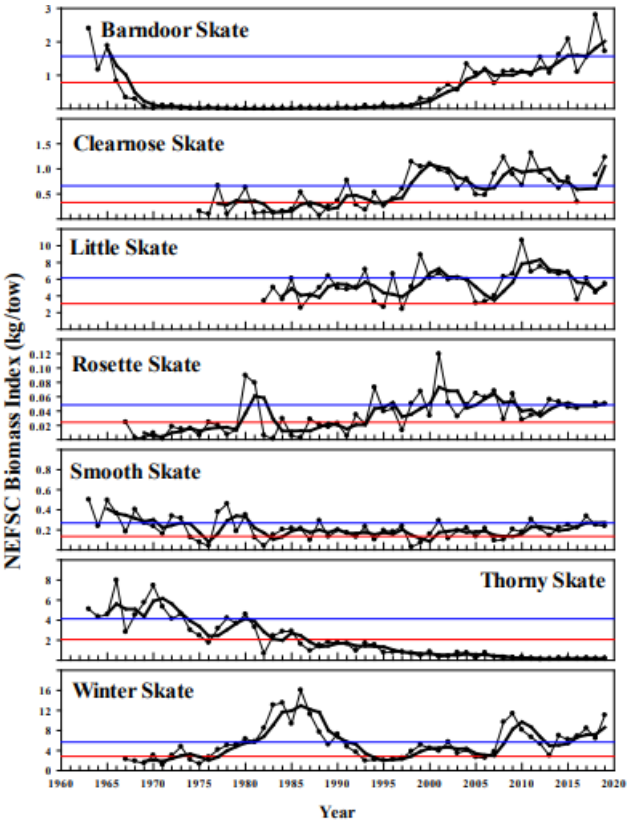

Figure 7: Northeast Fisheries Science Center survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the management biomass thresholds and targets. From (Sosebee 2020).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For clearnose skate, the 2017 to 2019 index is above the 2016 to 2018 index by 73.1% (Sosebee 2020). Because the stock is not undergoing overfishing, but there is uncertainty in the use of survey indices, fishing mortality is considered a low concern (rather than very low concern).

Justification:

The fishing mortality reference points are based on changes in the 3-year survey biomass indices. If there is a decline in the 3-year moving average of the survey biomass index that is greater than the average CV of the survey time series, then fishing mortality is assumed to be greater than F_{MSY}, and overfishing is occurring for that skate species (Sosebee 2020).

Fin whale

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers marine mammals to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9). The life history characteristics of marine mammals, including high age at maturity, low fecundity (single births), and low reproductive rates (every 1–5 years), make their populations vulnerable to high mortality rates. Higher than average mortality of marine mammals is frequently human-caused and can include mortality from ship or boat strikes and fisheries by-catch. Marine mammal populations (and those of other long-lived taxa) are especially vulnerable to mortality of adults (the reproductively active portion of the population) because it takes years, if not decades, for a calf to reach maturity and become reproductively active.

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Very High Concern

The best abundance estimate available for the western North Atlantic fin whale stock is 6,802, with a minimum population size of 5,573 (Hayes et al. 2021). This is the estimate derived from the sum of the 2016 NOAA shipboard and aerial surveys and the 2016 Canadian Northwest Atlantic International Sightings Survey (NAISS) (Hayes et al. 2021). The surveys do not overlap, so the estimates from the two surveys were combined (Hayes et al. 2021), extending the range of the survey from Newfoundland to Florida and resulting in a significant increase in the population estimate relative to the 2011 NOAA survey (Hayes et al. 2021). The status of this stock relative to the optimum sustainable population (OSP) in the U.S. Atlantic EEZ is unknown, as are population trends (Hayes et al. 2021). The International Union for the Conservation of Nature (IUCN) Red List classifies the fin whale as "Vulnerable" to extinction, and the Endangered Species Act (ESA) lists this species as "Endangered" {Cooke 2018b}{USFWS 2017}, and it is listed on CITES Appendix I {NOAA 2017a} and as MMPA "Depleted" throughout its range {NOAA 2017b}. Because of the IUCN, ESA, and MMPA listings, abundance is considered a very high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

The total annual estimated average fishery-related mortality or serious injury (SIM) to the western North Atlantic fin whale stock during 2014 to 2018 was 1.55, with a potential biological removal (PBR) of 11 (Hayes et al. 2021). This value includes incidental fishery interaction records, 0.95 (0

U.S./0.95 unknown but first reported in U.S. waters/0.6 Canadian waters); and records of vessel collisions, 0.8 (all U.S.) (Hayes et al. 2021). But, the total level of human-caused mortality and serious injury is unknown, because NMFS records represent coverage of only a portion of the area surveyed for the population estimate for the stock (Hayes et al. 2021). The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is likely biased low (Hayes et al. 2021).

According to the List of Fisheries, the Northeast sink gillnet fishery is a Category I fishery, because previous estimates suggested that fishery-specific annual mortality and serious injury to fin whale was greater than or equal to 50% of the PBR {LOF 2017b}. In addition, fin whale is a strategic stock because it is listed as "Endangered" under the Endangered Species Act (ESA). Because the PBR is not exceeded, and the gillnet fishery contributes SIMs that are less than 10% of PBR, a score of low concern is given.

Goosefish

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Goosefish (monkfish) has a high inherent vulnerability (72 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Low Concern

According to the most recent operational assessment in 2016, which used survey indices to estimate abundance and biomass, there was a lack of current biological reference points that would allow for stock status determination (Richards 2016)(NMFS 2017a). The 2016 assessment does not include an update to the SAW-50 SCALE model used previously (in 2013) because the method for aging goosefish failed a validation test completed in 2016, thus invalidating the growth model (Richards 2016)(NMFS 2017a). In the 2016 assessment, survey indices were used as proxies for stock abundance, and relative exploitation rates were used as proxies for trends in fishing mortality rates, but neither of these quantities has been used as a basis for proxies for biological reference points (Richards 2016)(NMFS 2017a).

Therefore, the most current abundance estimates are from 2013, which determined that both the northern and southern stock biomass are above targets (NEFSC 2013). But, because it appears that neither the 2013 nor the 2016 stock assessment results is appropriate for determining whether abundance is at a sustainable level, a productivity-susceptibility analysis (PSA) was calculated.

Goosefish has medium inherent vulnerability according to the productivity-susceptibility analysis (PSA = 2.91; see detailed scoring below); and because there are two positive data-limited indicators (NEFSC survey indices are either stable or increasing, landings have decreased substantially, and the size structure is reasonably stable), abundance is scored a low concern.

Justification:

Productivity-Susceptibility Analysis:

Scoring Guidelines

1. Productivity score (P) = average of the productivity attribute scores (p1, p2, p3, p4 (finfish only), p5 (finfish only), p6, p7, and p8 (invertebrates only))

2. Susceptibility score (S) = product of the susceptibility attribute scores (s1, s2, s3, s4), rescaled as

follows: S = [(S1 × S2 × S3 × S4) – 1/40] + 1.

3. Vulnerability score (V) = the Euclidean distance of P and S using the following formula: V = v(P^2 + S^2)

Vulnerability (V) = v(P^2 + S^2)

V = v(1.75^2 + 2.325^2)

V = 2.91 (medium vulnerability)

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)	Reference(s)
Average age at maturity	4.5 years	1	{Steimle et al. 1999}
Average maximum age	10 years	2	{Steimle et al. 1999}
Fecundity	300,000 to 2,780,000 eggs/year	1	{Steimle et al. 1999}
Average maximum size (fish only)	100 cm	2	{Steimle et al. 1999}
Average size at maturity (fish only)	55 cm	2	{Steimle et al. 1999}
Reproductive strategy	Broadcast spawner	1	{Froese and Pauly 2018}
Trophic level	4.4	3	(Choi et al. 2008)
Density dependence (invertebrates only)	-	-	
Habitat quality	Moderately altered	2	SFW default value
Total Productivity (average)		**1.75**	

Susceptibility attribute	Relevant information	Score (1 = low risk, 2 = medium risk, 3 = high risk)	Reference(s)
Areal overlap (considers all fisheries)	The Northern goosefish stock is concentrated in the GoM and Georges Bank cod, pollock, and haddock fishing areas.	3	{Richards 2013}
Vertical overlap (considers all fisheries)	Usual depth range of inshore to 900 m; groundfish fishery operates between 10 and 200 m.	3	{Richards 2013}
Selectivity of fishery (specific to fishery under assessment)	Goosefish is incidentally encountered and is not likely to escape the gear, but conditions under "high risk" do not apply.	2	SFW default
Post-capture mortality (specific to fishery under assessment)	Unknown	3	SFW default
Total Susceptibility (multiplicative)		2.325	

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Moderate Concern

The 50th SAW Assessment Summary Report estimates fishing mortality at F = 0.10 per year in the NMA and F = 0.07 per year in the SMA; F is below $F_{THRESHOLD}$, which is currently set equal to F_{MAX} (F = 0.44 for NMA and F = 0.37 for SMA) (NEFSC 2013). Nevertheless, there is high uncertainty surrounding these estimates, especially considering that the SCALE model from the 2013 operational assessment has since been rejected due to F BRPs (biological reference points) being considered inappropriate for this species (Richards 2016). And, although the most current assessment in 2016 used relative exploitation rates as proxies to estimate trends in fishing mortality rates, these have not been used as proxies for fishing mortality BRPs (Richards 2016). Because there is uncertainty surrounding these estimates, fishing mortality is considered a moderate concern.

Green turtle

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers turtles to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Very High Concern

The North Atlantic distinct population segment (DPS) of green sea turtle is listed as "Threatened" under the Endangered Species Act (ESA) (Federal Register 2016), so abundance is considered a very high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Green sea turtle has been observed captured in the pelagic driftnet, longline, shrimp trawl, and Mid-Atlantic trawl and gillnet fisheries. The most recent biological opinion for the Atlantic skate fishery used data from the Sea Turtle Disentanglement Network (STDN) to estimate that 10 green sea turtles will interact with gillnet fisheries in the U.S. Atlantic region over a 5-year period, resulting in 8 mortalities (NMFS 2021a). It is uncertain what the impact of fishing activities in the region is on the North Atlantic DPS of green sea turtle; however, it is not anticipated that skate fisheries will appreciably affect U.S. green sea turtle populations because the estimated number of mortalities is <0.1% of the nesting population, based on recent nesting numbers (8,426 in Florida and 30,052 in Costa Rica) (NMFS 2021a). Because skate fisheries are not expected to negatively affect green sea turtle populations, a score of very low concern is given.

Haddock

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Haddock has a high inherent vulnerability (63 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Very Low Concern
There are two different stocks of haddock that may be encountered in the set gillnet fishery for skate: Gulf of Maine and Georges Bank. Based on the 2017 Gulf of Maine haddock stock assessment, spawning stock biomass (SSB) in 2016 was estimated to be 47,821 mt, which is 706% of the biomass target (SSB_{MSY} proxy = 6,769; see Figure 8) (Palmer 2017b). Based on the 2017 Georges Bank haddock stock assessment, spawning stock biomass (SSB) in 2016 was estimated to be 290,324 mt, which is 278% of the biomass target (SSB_{MSY} proxy = 104,312; see Figure 9) (Brooks 2017). Because both stocks are above the relevant target reference points, abundance is scored a very low concern.

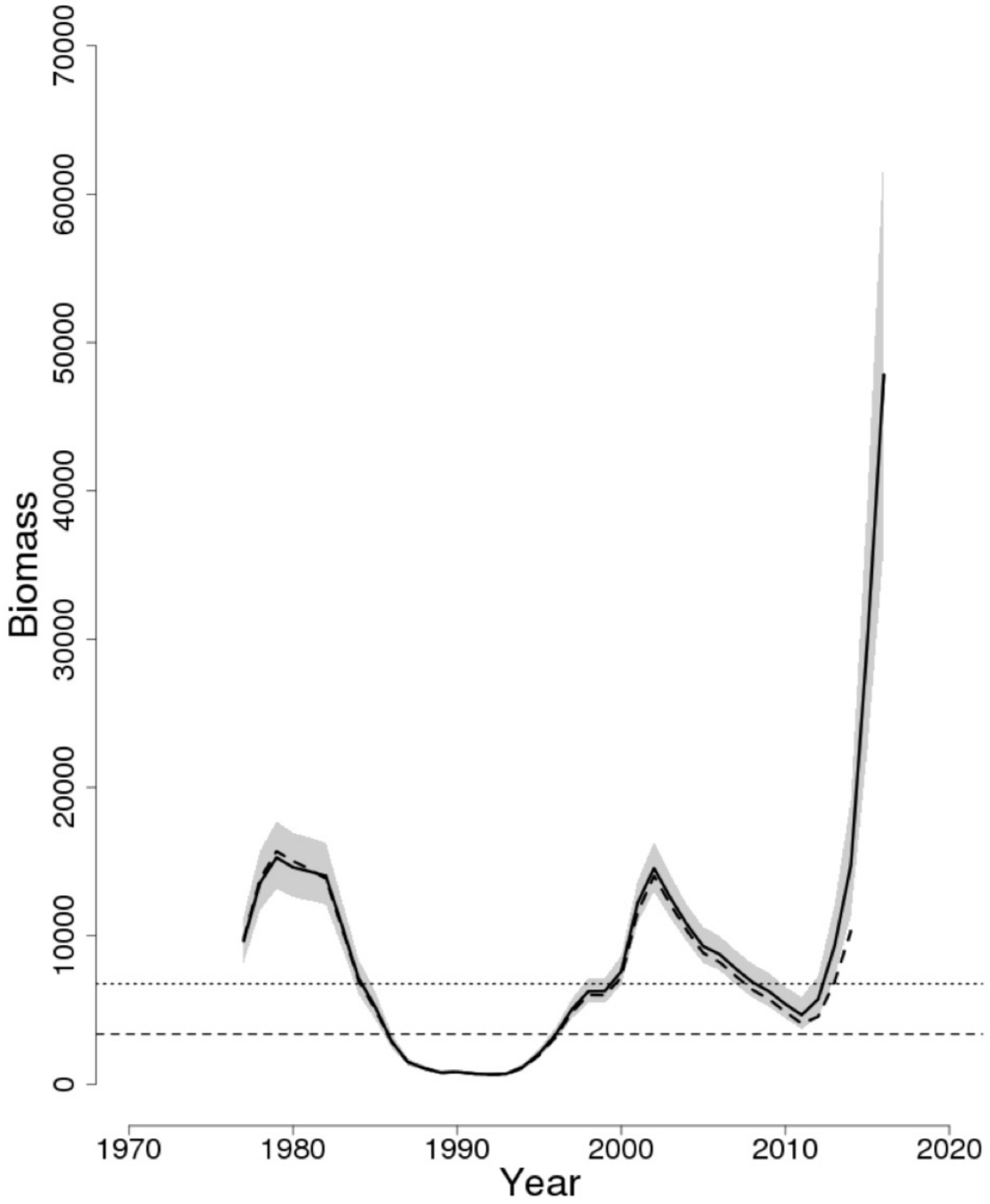

Figure 8: Trends in spawning stock biomass (SSB) of Gulf of Maine haddock between 1977 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{THRESHOLD}$ (1/2 SSB_{MSY} proxy; horizontal dashed line) as well as SSB_{TARGET} (SSB_{MSY} proxy; horizontal dotted line) based on the 2017 assessment. The approximate 90% lognormal confidence intervals are shown (Palmer 2017b).

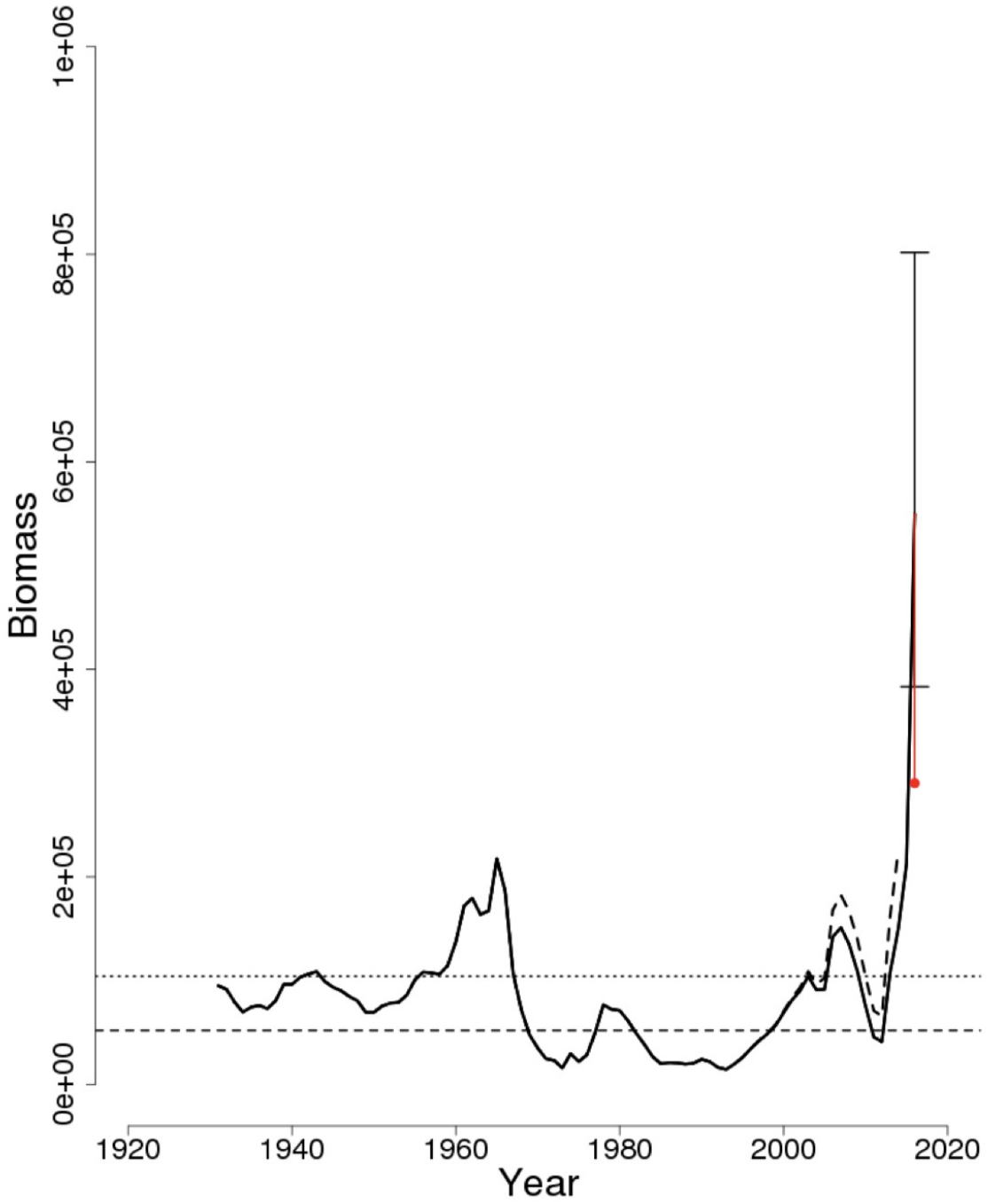

Figure 9: Trends in spawning stock biomass of Georges Bank haddock between 1931 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{THRESHOLD}$ (1/2 SSB_{MSY} proxy; horizontal dashed line) as well as SSB_{TARGET} (SSB_{MSY} proxy; horizontal dotted line) based on the 2015 assessment (Brooks 2017).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Very Low Concern

Based on the 2017 Gulf of Maine haddock stock assessment, the 2016 fully selected fishing mortality was estimated to be 0.137, which is 30% of the overfishing threshold proxy (F_{MSY} proxy = $F_{40\%}$ = 0.455; see Figure 10) (Palmer 2017b). Based on the 2017 Georges Bank haddock stock assessment, the 2016 numbers-weighted average fishing mortality on ages 5 to 7 was estimated to be 0.309, which is 88% of the overfishing threshold proxy (F_{MSY} proxy = 0.353; see Figure 11) (Brooks 2017). Because overfishing is not occurring on either stock, this factor is ranked a very low concern.

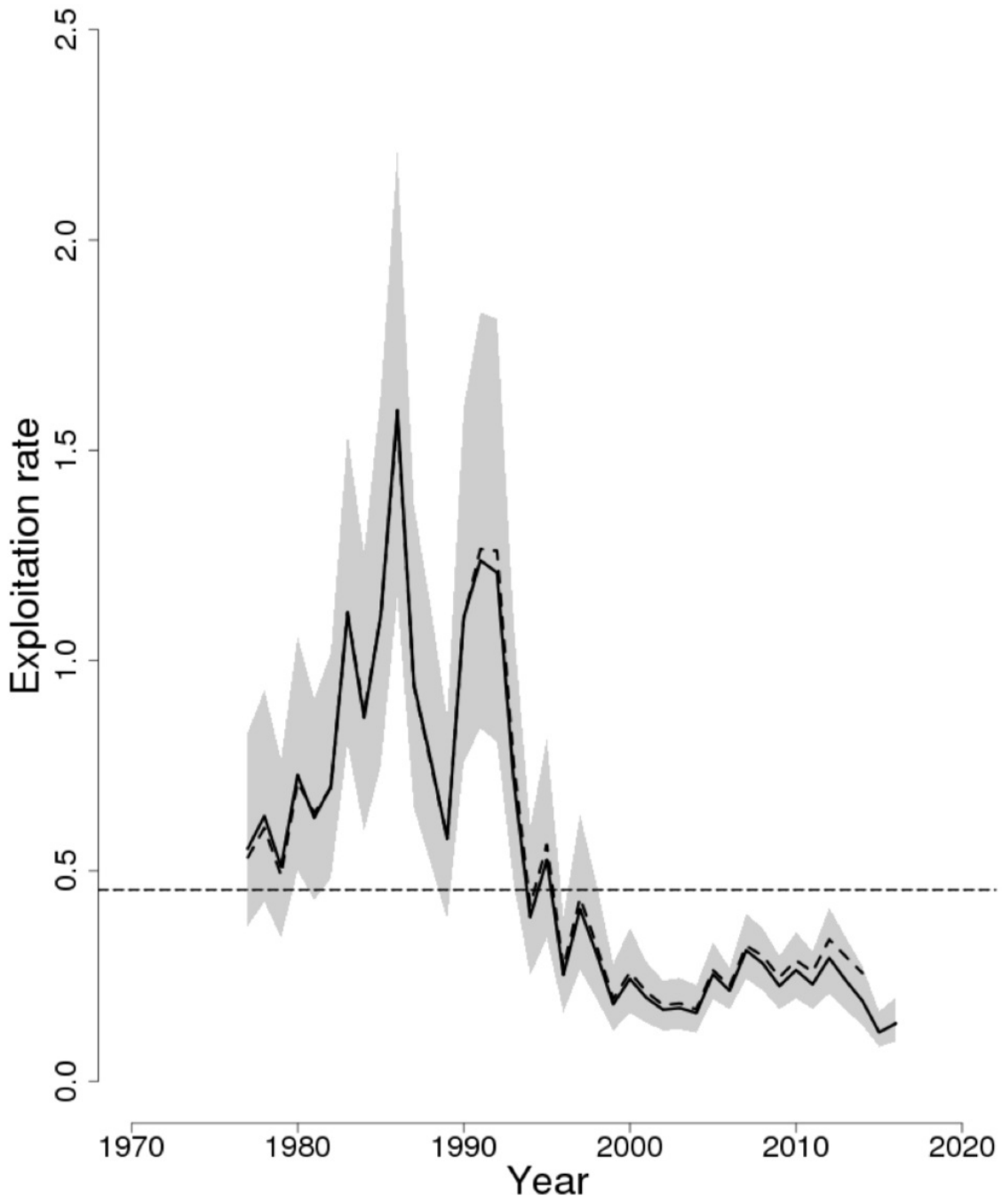

Figure 10: Trends in the fully selected fishing mortality (F) of Gulf of Maine haddock between 1977 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{THRESHOLD}$ (F_{MSY} proxy = 0.455; horizontal dashed line) from the 2017 assessment model. The approximate 90% lognormal confidence intervals are shown (Palmer 2017b).

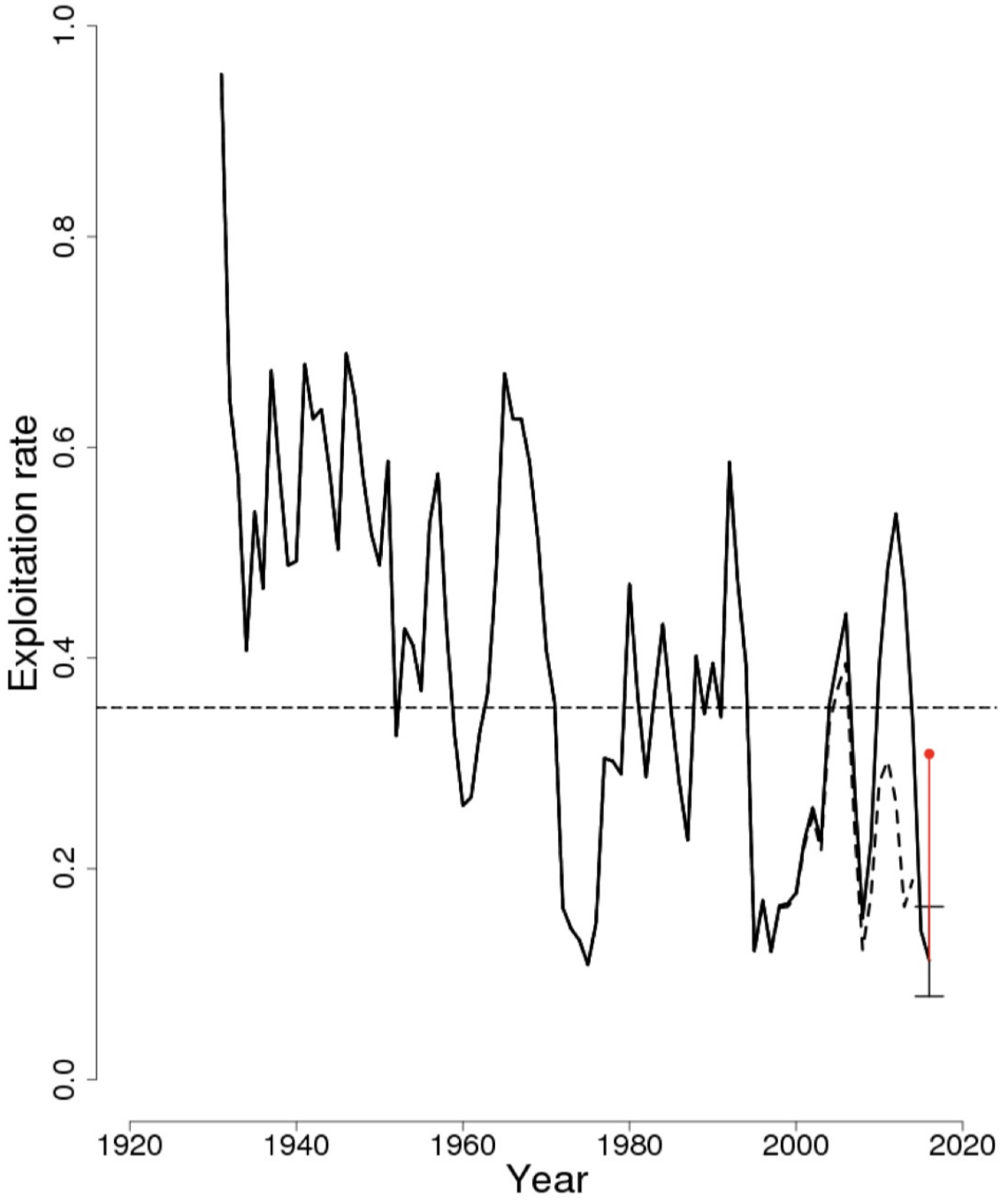

Figure 11: Trends in the numbers-weighted fishing mortality (F_{5-7}) of Georges Bank haddock between 1931 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{THRESHOLD}$ (F_{MSY} proxy = 0.353; horizontal dashed line) based on the 2015 assessment (Brooks 2017).

Harbor porpoise

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers marine mammals to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9). The life history characteristics of marine mammals, including high age at maturity, low fecundity (single births), and low reproductive rates (every 1–5 years), make their populations vulnerable to high mortality rates. Higher than average mortality of marine mammals is frequently human-caused and can include mortality from ship or boat strikes and fisheries by-catch. Marine mammal populations (and those of other long-lived taxa) are especially vulnerable to mortality of adults (the reproductively active portion of the population) because it takes years, if not decades, for a calf to reach maturity and become reproductively active.

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Moderate Concern

The best current abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is 95,543 (CV = 0.31), with a minimum population size of 74,034, which is from a 2016 U.S. shipboard and aerial survey combined with a DFO Canada aerial survey of the Bay of Fundy and Scotian Shelf {Hayes et al. 2021}. But, the surveyed area may not have covered the entire area of the stock's habitat at the appropriate time of the year, and the current abundance estimate did not account for availability bias due to the submergence of animals. Without a correction for availability bias, the abundance estimate is expected to be biased low {Hayes et al. 2021}. The status of this population relative to the optimum sustainable population (OSP) in the U.S. Atlantic EEZ is unknown, and a trend analysis has not been conducted for this species {Hayes et al. 2021}. The International Union for the Conservation of Nature (IUCN) considers this species a "Least Concern" {Hammond et al. 2008b}, and because the status and trend analysis are unknown, abundance is considered a moderate concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Low Concern

The total annual estimated average fishery-related mortality or serious injury to the harbor porpoise stock during 2014 to 2018 was 150 harbor porpoises (CV = 0.14) from U.S. fisheries, with a potential biological removal (PBR) of 851 (Hayes et al. 2021). The Northeast sink gillnet fishery is by far the primary contributor, accounting for 88% (132/150 individuals) of the total by-catch across all

fisheries {Hayes et al. 2021}. But, because total U.S. fisheries mortality or serious injury does not exceed PBR, and mortality or serious injury for the bottom gillnet fishery specifically is less than 50% of the PBR, fishing mortality is considered a low concern.

Humpback whale

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers marine mammals to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9). The life history characteristics of marine mammals, including high age at maturity, low fecundity (single births), and low reproductive rates (every 1–5 years), make their populations vulnerable to high mortality rates. Higher than average mortality of marine mammals is frequently human-caused and can include mortality from ship or boat strikes and fisheries by-catch. Marine mammal populations (and those of other long-lived taxa) are especially vulnerable to mortality of adults (the reproductively active portion of the population) because it takes years, if not decades, for a calf to reach maturity and become reproductively active.

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

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}. According to the International Union for the Conservation of Nature (IUCN), this species is listed as "Least Concern," with an increasing population trend {Reilly et al. 2018a}. Globally, humpback whale is considered "Least Concern" by the 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 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

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 that it is likely that annual average mortality and serious injury exceeds the potential biological removal (PBR) (22 whales); however, 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 coast-wide elevated mortality levels in the United States observed from strandings; however, it is likely that these mortalities are due to vessel strikes (NOAA 2021). It is estimated that 48–65% of the Gulf of Maine humpback stock have experienced a previous entanglement, based on scarring {Robbins & Mattila 2001}.

The majority of entanglements are not identifiable to fishery, so the proportion of entanglement due to the U.S. gillnet fisheries is unclear. Annual serious injury and mortality during 2013–2017 from unidentified U.S. gillnet interactions was 0.35 (1.6% of PBR), and from unidentified gillnet interactions first seen in U.S. waters but unassigned to country was 0.75 (3.4% of PBR), while those 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 United States 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 are not identifiable to a fishery, so the proportion of entanglement due to gillnet fisheries is unclear. Data are lacking regarding fisheries' interactions with the other feeding groups in the western Atlantic humpback whale population. Because known fisheries mortality does not exceed PBR, but with concern that total fishing mortality likely exceeds PBR and uncertainty in the proportion of contribution from the gillnet fisheries, fishing mortality is considered a moderate concern.

Kemp's ridley turtle

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers turtles to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Very High Concern

The Kemp's ridley turtle is listed as "Endangered" under the Endangered Species Act (ESA) {NMFS & USFWS 2015}. Although there had been signs of recovery between 1995 and 2009, the number of nests has been decreasing in recent years, leading NMFS and USFWS to recommend that the recovery priority be increased due to an increased risk of extinction {NMFS & USFWS 2015}. Because of the poor status of Kemp's ridley turtle, abundance is considered a very high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Kemp's ridley turtle has been observed captured in the bottom trawl and gillnet fisheries. The most recent biological opinion for the Atlantic skate fishery used information from (Murray 2018) and data from the Sea Turtle Disentanglement Network (STDN) to estimate that 239 Kemp's ridley turtles will interact with gillnet fisheries in the U.S. Atlantic region over a 5-year period, resulting in 187 mortalities (NMFS 2021a). It is uncertain what the impacts of fishing activities in the region are on the Kemp's ridley turtle population. But, it is not anticipated that skate fisheries will appreciably affect the population because the estimated number of mortalities is <0.2% of the nesting population, based on a recent study of the adult population (22,341 from {Wibbels & Bevan 2019}) (NMFS 2021a). Because skate fisheries are not expected to negatively affect Kemp's ridley turtle populations, a score of very low concern is given.

Leatherback turtle

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers turtles to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Very High Concern

The Northwest Atlantic distinct population segment (DPS) of leatherback turtle is listed as "Endangered" under the Endangered Species Act (ESA) and is experiencing a decreasing trend in nesting numbers {NMFS & USFWS 2020}. The rate of decrease in nesting sites has been more pronounced in recent years (2008–2017) {NMFS & USFWS 2020}. Because of the endangered status of leatherback turtle in the Northwest Atlantic, abundance is scored a very high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Leatherback turtle has been observed captured in the bottom trawl, gillnet, and pot/trap fisheries. The most recent biological opinion for the Atlantic skate fishery used information from (Murray 2020) and data from the Sea Turtle Disentanglement Network (STDN) to estimate that 52 leatherback turtles will interact with gillnet fisheries in the U.S. Atlantic region over a 5-year period, resulting in 41 mortalities (NMFS 2021a). It is uncertain what the impact of fishing activities in the region is on the leatherback turtle population; however, it is not anticipated that skate fisheries will appreciably affect the population, because the estimated number of mortalities is ≈0.1% of the population (20,659) (NMFS 2021a). Because skate fisheries are not expected to negatively affect leatherback turtle populations, a score of very low concern is given.

Little skate

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Medium
Little skate has a moderate inherent vulnerability (44 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern
For little skate, the 2017 to 2019 NEFSC spring average biomass index of 5.32 kg/tow is above the biomass threshold reference point (3.07 kg/tow), but below the B_{MSY} proxy (6.15 kg/tow; see Figure 12) (Sosebee 2020). Because the stock is not overfished, and biomass is greater than 75% of the biomass target, abundance is considered a low concern.

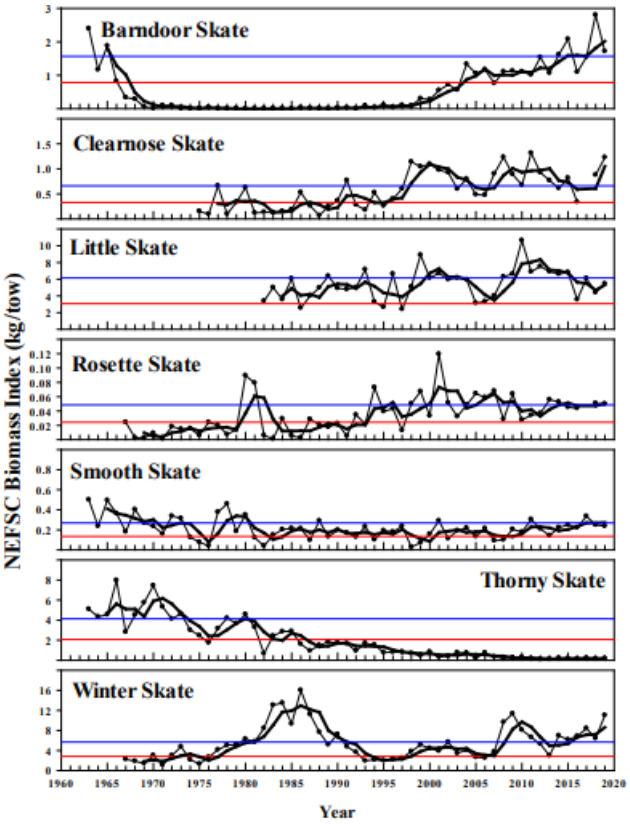

Figure 12: Northeast Fisheries Science Center survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the management biomass thresholds and targets. From (Sosebee 2020).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For little skate, the 2017 to 2019 average index is above the 2016 to 2018 average by 13.4% (Sosebee 2020). Because the stock is not undergoing overfishing, fishing mortality is considered a low concern.

Justification:

The fishing mortality reference points are based on changes in the 3-year survey biomass indices. If there is a decline in the 3-year moving average of the survey biomass index that is greater than the average CV of the survey time series, then fishing mortality is assumed to be greater than F_{MSY}, and overfishing is occurring for that skate species (Sosebee 2020).

Loggerhead turtle

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers turtles to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Very High Concern

Loggerhead turtle is listed under the Endangered Species Act (ESA) as "Threatened" in the Northwest Atlantic distinct population segment (DPS), and "Endangered" or "Threatened" in every other DPS {NOAA 2018d}. It is also listed as a CITES Appendix I species {NOAA 2018d}. Because of these current listings, a score of very high concern is awarded.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Loggerhead turtle is known to interact with bottom trawl, gillnet, and pot/trap fisheries. The most recent biological opinion for the Atlantic skate fishery used information from (Murray 2018) and data from the Sea Turtle Disentanglement Network (STDN) to estimate that 1,036 loggerhead turtles will interact with gillnet fisheries in the U.S. Atlantic region over a 5-year period, resulting in 808 mortalities (NMFS 2021a). It is uncertain what the impact of fishing activities in the region is on the loggerhead turtle population; however, it is not anticipated that skate fisheries will appreciably affect the population because the estimated number of 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 skate fisheries are not expected to negatively affect loggerhead turtle populations, a score of very low concern is given.

Long-finned pilot whale

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States

High

Seafood Watch considers marine mammals to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9). The life history characteristics of marine mammals, including high age at maturity, low fecundity (single births), and low reproductive rates (every 1–5 years), make their populations vulnerable to high mortality rates. Higher than average mortality of marine mammals is frequently human-caused and can include mortality from ship or boat strikes and fisheries by-catch. Marine mammal populations (and those of other long-lived taxa) are especially vulnerable to mortality of adults (the reproductively active portion of the population) because it takes years, if not decades, for a calf to reach maturity and become reproductively active.

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States

Moderate Concern

The best available estimate for long-finned pilot whale in the western North Atlantic is 39,215 individuals (CV = 0.30), with a minimum population size of 30,627 {Hayes et al. 2020}. This estimate is from the U.S. summer 2016 surveys combined with the DFO Canada summer 2016 survey, providing coverage from Virginia to Labrador {Hayes et al. 2020}. The status of this stock relative to the optimum sustainable population (OSP) in the U.S. Atlantic EEZ is unknown, and there are insufficient data to determine population trends. The International Union for the Conservation of Nature (IUCN) considers this species as "Least Concern" {Minton et al. 2018}, so abundance is considered a moderate concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Very Low Concern

The total annual observed average fishery-related mortality or serious injury during 2013 to 2017 was 21 for long-finned pilot whale (CV = 0.15), with a potential biological removal (PBR) of 306 {Hayes et al. 2020}. The Northeast bottom trawl fishery is the primary contributor, accounting for 71% (15/21 individuals) of the total by-catch across all fisheries {Hayes et al. 2020}. Because the PBR is not exceeded, and the bottom trawl fishery accounts for less than 10% of the PBR, fishing mortality is considered a very low concern.

North Atlantic right whale

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Seafood Watch considers marine mammals to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9). The life history characteristics of marine mammals, including high age at maturity, low fecundity (single births), and low reproductive rates (every 1–5 years), make their populations vulnerable to high mortality rates. Higher than average mortality of marine mammals is frequently human-caused and can include mortality from ship or boat strikes and from fisheries by-catch. Marine mammal populations (and those of other long-lived taxa) are especially vulnerable to mortality of adults (the reproductively active portion of the population) because it takes years, if not decades, for a calf to reach maturity and become reproductively active.

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Very High Concern

The western Atlantic stock of North Atlantic right whale is listed as "Endangered" under the Endangered Species Act (ESA) and is considered "Critically Endangered" by the International Union for the Conservation of Nature (IUCN) (Cooke 2020). 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}. The population has been declining since 2011 and calving rates have been low. From 2017 to 2019, calving rates averaged four per season, <33% of the previous annual average. But, calving increased in 2020 with 10 calves sighted, and 1 involved in a vessel strike (Pace et al. 2017)(NOAA 2020b). The cause of reduced productivity is unknown, but it is likely attributed to several factors that contribute to declining North Atlantic right whale health, including climate-related shifts in prey distribution, anthropogenic noise, pollution, vessel strikes, and entanglement in fishing gear (Pace et al. 2017)(NOAA 2019c). Because North Atlantic right whale is considered "Critically Endangered" by the IUCN, abundance is rated a very high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

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. 2022). 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 skate 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 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, 29% 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 (Sharp et al. 2019)(Sharp et al. 2019 Supplemental Information).

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 NARW 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 in 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. 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.

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 13).

The Northeast sink gillnet fishery is classified as a Category I fishery by NOAA (NMFS 2018c). Because cumulative fisheries mortality and serious injury far exceeds PBR, and entanglement due to unknown fisheries (of which the skate gillnet fishery may be a part) is considered a significant contributor, the impact of the skate gillnet fishery cannot be considered sustainable due to significant uncertainty in entanglement sources, so fisheries mortality is rated 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). The primary prey (*Calanus finmarchicus*) of the North Atlantic right whale currently remains in highest abundance in the western Gulf of Maine (Record et al. 2019).

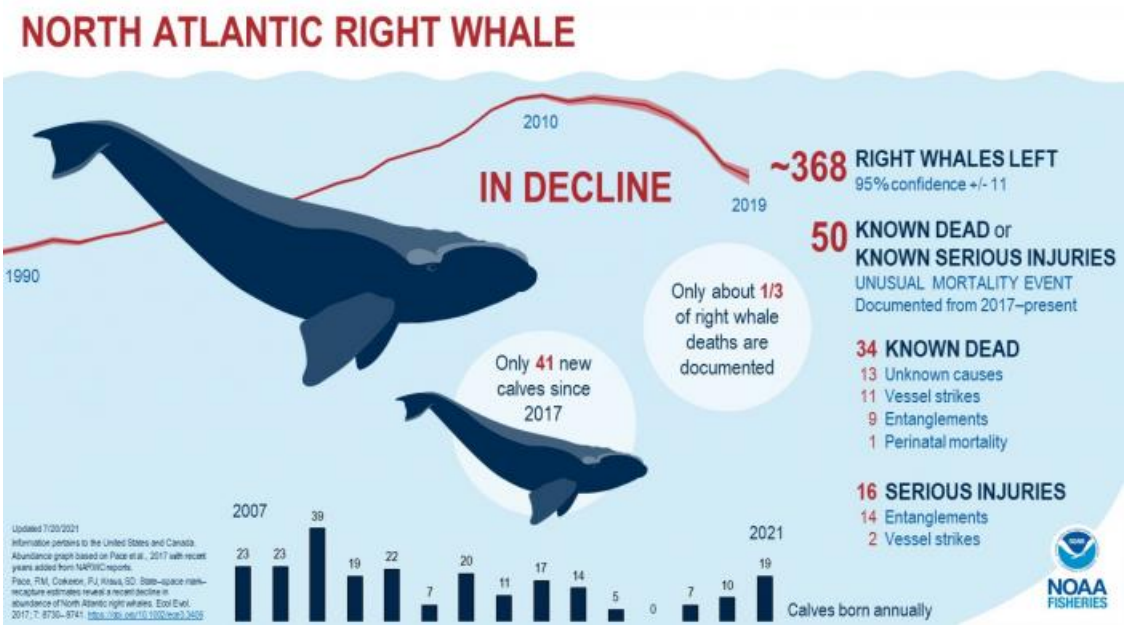

Figure 13: An infographic showing best estimates of current North Atlantic right whale population numbers and causes of death during the current Unusual Mortality Event, 2017 to present. (NOAA 2021)

Ocean pout

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States

High

Ocean pout has a high inherent vulnerability (67 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States

High Concern

Based on the 2017 ocean pout stock assessment, the biomass proxy (B) in 2016 was estimated to be 0.223 (kg/tow), which is 5% of the biomass target (B_{MSY} proxy = 4.94) (Wigley 2017a). According to the NMFS first quarter 2018 update, ocean pout is overfished and in year 14 of a 10-year rebuilding plan (NMFS 2018c). Therefore, abundance is scored a high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Moderate Concern

Based on the 2017 ocean pout stock assessment, the 2016 fully selected fishing mortality was estimated to be 0.221, which is 29% of the overfishing threshold proxy (F_{MSY} proxy = 0.76) (Wigley 2017a). Nevertheless, biomass is still decreasing, and further studies have been suggested to explore why this stock is not rebuilding as expected. Because there is a possibility that fishing mortality is preventing the rebuilding of the stock, fishing mortality is scored a moderate concern.

Pollock

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

Atlantic pollock has a high inherent vulnerability (59 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Based on the 2017 pollock stock assessment, spawning stock biomass (SSB) in 2016 was estimated to be 183,907 mt under the base model and 72,889 mt under the "flat sel" sensitivity model, which is 174% and 120%, respectively, of the biomass target, an SSB_{MSY} proxy of SSB at $F_{40\%}$ (105,510 and 60,738 mt; see Figure 14) (Linton 2017a). Because pollock is not overfished and SSB is above the biomass target, abundance is scored a very low concern.

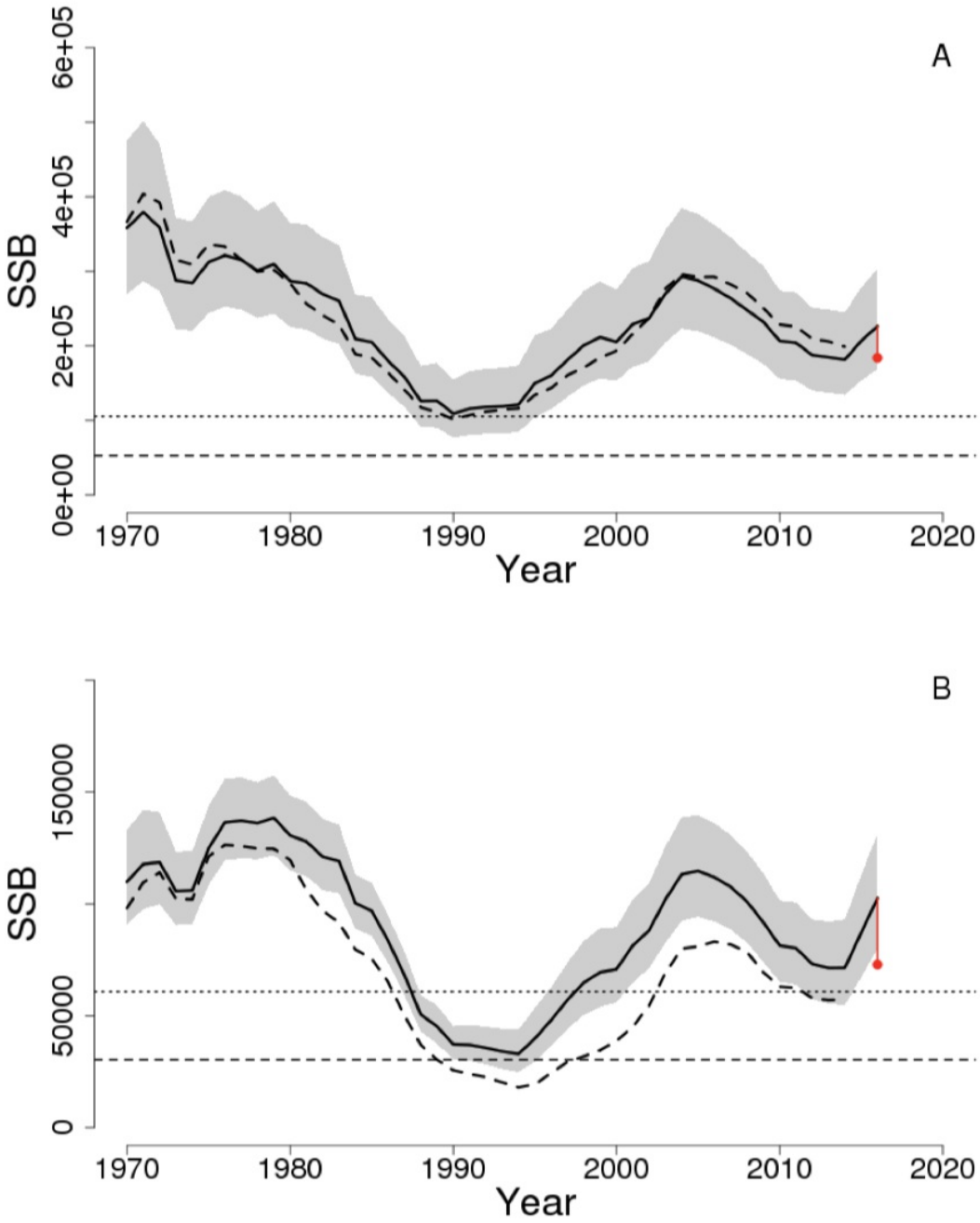

Figure 14: Estimated trends in the spawning stock biomass of pollock between 1970 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{THRESHOLD}$ (0.5 × SSB_{MSY} proxy; horizontal dashed line) as well as SSB_{TARGET} (SSB_{MSY} proxy; horizontal dotted line) based on the 2017 assessment models base (A) and flat sel sensitivity (B). The approximate 90% lognormal confidence intervals are shown (Linton 2017a).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Based on the 2017 pollock stock assessment, 2016 age 5 to 7 average fishing mortality (F) was estimated to be 0.036 under the base model and 0.079 under the "flat sel" sensitivity model, which is 14% and 32%, respectively, of the overfishing threshold, an F_{MSY} proxy of $F_{40\%}$ (0.26 and 0.249) (Linton 2017a). Because pollock is not undergoing overfishing, fishing mortality is scored a very low concern.

Rosette skate

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Medium
Rosette skate has a moderate inherent vulnerability (54 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern
For rosette skate, the 2017 to 2019 NEFSC autumn average biomass index of 0.050 kg/tow is above the biomass threshold reference point (0.024 kg/tow) and the B_{MSY} proxy (0.048 kg/tow; see Figure 15) (Sosebee 2020). Because the stock is not overfished, but there is uncertainty associated with using the survey index as a proxy for abundance, a score of low concern is given (rather than very low concern).

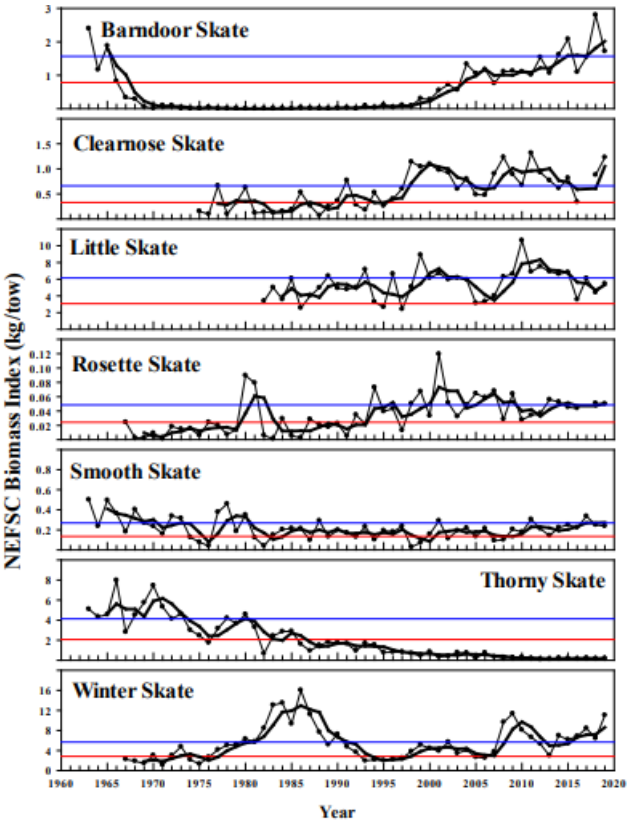

Figure 15: Northeast Fisheries Science Center survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the management biomass thresholds and targets. From (Sosebee 2020).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For rosette skate, the 2017 to 2019 index is above the 2016 to 2018 index by 6.4% (Sosebee 2020). Because the stock is not undergoing overfishing, but there is uncertainty in the use of survey indices, fishing mortality is considered a low concern (rather than very low concern).

Justification:

The fishing mortality reference points are based on changes in the 3-year survey biomass indices. If there is a decline in the 3-year moving average of the survey biomass index that is greater than the average CV of the survey time series, then fishing mortality is assumed to be greater than F_{MSY}, and overfishing is occurring for that skate species (Sosebee 2020).

Scup

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States

Medium

Scup has a moderate inherent vulnerability (38 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States

Very Low Concern

The most recent stock assessment update has been conducted in 2019, with data from 2018 (NEFSC 2020). Abundance data have been consistently collected over the years {NMFS & NEFSC 2017}. Because there is a recent stock assessment and update for scup, which has been published by the Northeast Fisheries Science Center, and spawning stock biomass (SSB) has been well above the target reference threshold set for the scup fishery, abundance for this fishery has been scored a very low concern.

Justification:

In 2018, the SSB was 186,578 mt, which was higher than the updated SSB_{MSY} or $SSB_{40\%}$, indicating that the stock is not overfished (NEFSC 2020). The fishing mortality on the fully selected age 3 fish was 0.158 in 2018, which is lower than the updated biological reference point of F_{MSY} or $F_{40\%}$, indicating that the stock is not being overfished (NEFSC 2020). The fishery is being well managed by NOAA Fisheries, the Mid-Atlantic Fishery Management Council, and the Atlantic States Marine Fisheries Commission. Nevertheless, the fishery needs to be closely watched in the future because SSB is projected to further decrease unless recruitment to the stock increases (NEFSC 2020).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Very Low Concern

Fishing mortality on the fully selected age 3 fish was 0.158 in 2018, which is lower than the updated biological reference point of F_{MSY} or $F_{40\%}$ (0.215), indicating that the stock is currently not being overfished (NEFSC 2020). The fishery is being well managed by NOAA Fisheries, the Mid-Atlantic Fishery Management Council, and the Atlantic States Marine Fisheries Commission. Nevertheless, fishing mortality needs to be closely monitored in the future because SSB is projected to further decrease unless recruitment to the stock increases (NEFSC 2020). Because it is probable that the fishing mortality from all sources is below the biological target reference point of F_{MSY} or $F_{40\%}$ that

has been set specifically for the scup fishery, fishing mortality has been deemed a very low concern.

Justification:
In the early 1990s, fishing pressure was high and the scup spawning stock biomass was low {NMFS & NEFSC 2017}. Consequently, the stock was overfished and overfishing was occurring. Gradually, the fishing pressure on the stock was reduced from the mid-1990s to 2000 and beyond. The stock likely responded to the reduced fishing pressure due to management strategies put in place between 2005 and 2009.

Per the 2018 assessment, fishing mortality on the fully selected age 3 fish was 0.158, which is lower than the updated biological reference point of $F_{40\%}$, which was set to 0.215, indicating that the stock is not experiencing overfishing (NEFSC 2020). But, managers must be cautious in the future to ensure that fishing pressure does not increase.

Short-beaked common dolphin

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States

High

Seafood Watch considers marine mammals to have a high vulnerability to fishing activities (Seafood Watch criteria document, p. 9). The life history characteristics of marine mammals, including high age at maturity, low fecundity (single births), and low reproductive rates (every 1–5 years), make their populations vulnerable to high mortality rates. Higher than average mortality of marine mammals is frequently human-caused and can include mortality from ship or boat strikes and fisheries by-catch. Marine mammal populations (and those of other long-lived taxa) are especially vulnerable to mortality of adults (the reproductively active portion of the population) because it takes years, if not decades, for a calf to reach maturity and become reproductively active.

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States

Moderate Concern

The current best abundance estimate for short-beaked common dolphin in the Northwest Atlantic is 172,947 (CV = 0.21), with a minimum population size of 145,216 (Hayes et al. 2021). This estimate is derived from 2016 shipboard and aerial surveys in the United States and Canada and covers most of the population's range. The status of short-beaked common dolphin relative to the optimum sustainable population (OSP) in the U.S. Atlantic EEZ is unknown, and population trends have not been investigated (Hayes et al. 2021). The International Union for the Conservation of Nature (IUCN) considers this species a "Least Concern" {Braulik et al. 2021}, and because status and trend analysis are unknown, abundance is considered a moderate concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Very Low Concern

The total annual estimated average fishery-related mortality or serious injury to the short-beaked common dolphin stock during 2014 to 2018 was 399 (CV = 0.10), with a potential biological removal (PBR) of 1,452 (Hayes et al. 2021). The Northeast bottom trawl fishery accounted for only 4.3% of the total U.S. fishery-related serious injury and mortality (17/399 individuals), whereas the Northeast sink gillnet fishery accounted for 24.6% (98/399 individuals) (Hayes et al. 2021). Because PBR is not exceeded, and the bottom trawl fishery accounts for less than 10% of the PBR, fishing mortality is considered a very low concern.

Silver hake

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States

Medium

Silver hake (whiting) has a moderate inherent vulnerability (54 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States

Low Concern

In the 2017 silver hake stock assessment, both the northern stock (Gulf of Maine and Northern Georges Bank) and the southern stock (Southern Georges Bank and Mid-Atlantic) were deemed not overfished. "Silver hake is overfished when the 3-year moving average of the fall survey weight per tow (i.e., the biomass threshold) is less than one half the B_{MSY} proxy, where the B_{MSY} proxy is defined as the average observed from 1973–1982. The recent estimates of the biomass thresholds are 3.21 kg/tow for the northern stock and 0.83 kg/tow for the southern stock" (NEFSC 2011). The northern stock's 3-year mean biomass index was 19.92 kg/tow, which was above the management threshold (3.21 kg/tow) and the management target (6.42 kg/tow), which means it is not overfished {Alade & Traver 2018}. The southern stock's 3-year mean biomass index was 1.05 kg/tow, which was above the management threshold (0.83 kg/tow) and below the target (1.65 kg/tow), which means it is not overfished {Alade & Traver 2018}, although the 3-year average had been declining and approaching the threshold reference point. Because the southern stock is below the management target, abundance is scored a low concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States

Low Concern

Based on the 2017 stock assessment, overfishing was not occurring on either stock. "Overfishing occurs when the ratio between the catch and the arithmetic fall survey biomass index from the most recent 3 years exceeds the overfishing threshold. The most recent estimates of the overfishing threshold are 2.78 kt/kg for the northern stock and 34.19 kt/kg for the southern stock of silver hake" (NEFSC 2011). The northern stock's 3-year mean exploitation index was 0.149 kt/kg, which was below the overfishing threshold (2.78 kt/kg) {Alade & Traver 2018}. The southern stock's 3-year mean exploitation index was 5.85 kt/kg, which was below the overfishing threshold (34.17 kt/kg) {Alade & Traver 2018}. Because overfishing is not occurring but there is some uncertainty associated with using survey indices as a proxy for F_{MSY}, fishing mortality is scored a low concern.

Smooth skate

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Medium
Smooth skate has a moderate inherent vulnerability (49 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern
For smooth skate, the 2017 to 2019 NEFSC autumn average biomass index of 0.27 kg/tow is above the biomass threshold reference point (0.134 kg/tow) and meets the B_{MSY} proxy (0.27 kg/tow; see Figure 16) (Sosebee 2020). Because the stock is not overfished and biomass meets the target biomass, but there is uncertainty in the use of survey indices, abundance is considered a low concern (rather than very low concern).

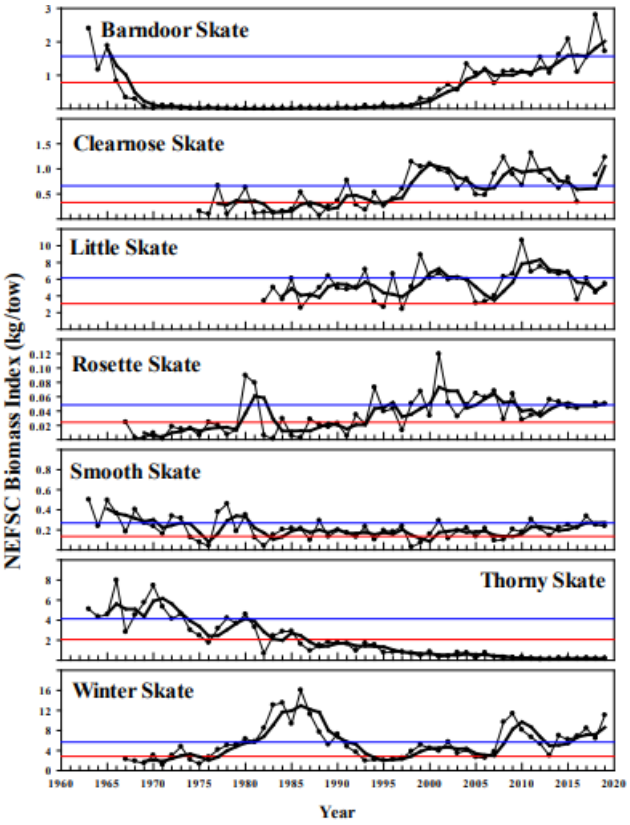

Figure 16: Northeast Fisheries Science Center survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the management biomass thresholds and targets. From (Sosebee 2020).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For smooth skate, the 2017 to 2019 index is consistent with the 2016 to 2018 index (Sosebee 2020). Because the stock is not undergoing overfishing, but there is uncertainty in the use of survey indices, fishing mortality is considered a low concern (rather than very low concern).

Justification:

The fishing mortality reference points are based on changes in survey biomass indices. If the 3-year moving average of the survey biomass index for a skate species declines by more than the average CV of the survey time series, then fishing mortality is assumed to be greater than F_{MSY} and overfishing is occurring for that skate species (Sosebee 2020).

Spiny dogfish

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Spiny dogfish has a high inherent vulnerability (69 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
The most recent publicly available stock assessment for spiny dogfish is from 2011, so the results are not considered appropriate as an indicator of current abundance. In the absence of an up-to-date stock assessment, abundance is assessed using the vulnerability score from Factor 2.1; abundance is scored a high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderate Concern
The most recent publicly available stock assessment is from 2011 and is no longer considered a reliable indicator of fishing mortality for this stock. Thus, the impact of fisheries relative to a sustainable level is considered unknown and scored a moderate concern.

Thorny skate

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Thorny skate has a high inherent vulnerability (70 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
For thorny skate, the 2017 to 2019 NEFSC autumn average biomass index of 0.18 kg/tow is well below the biomass threshold reference point (2.06 kg/tow; see Figure 17) (Sosebee 2020). Because the stock is overfished, abundance is considered a high concern.

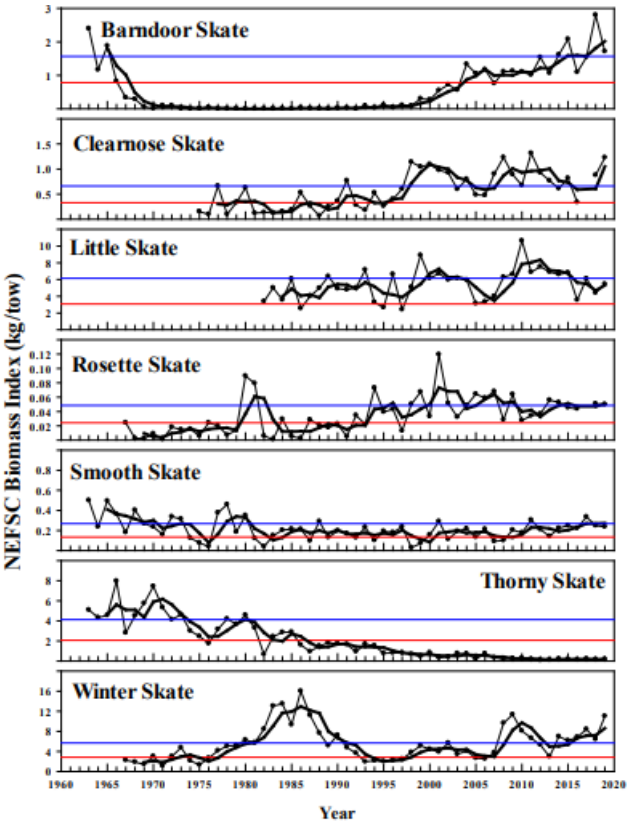

Figure 17: Northeast Fisheries Science Center survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the management biomass thresholds and targets. From (Sosebee 2020).

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern

For thorny skate, the 2017 to 2019 index is higher than the 2016 to 2018 index by 11.4% (Sosebee 2020). Because the stock is not undergoing overfishing, but there is uncertainty in the use of survey indices, fishing mortality is considered a low concern (rather than very low concern).

Justification:

The fishing mortality reference points are based on changes in survey biomass indices. If the 3-year moving average of the survey biomass index for a skate species declines by more than the average CV of the survey time series, then fishing mortality is assumed to be greater than F_{MSY}, and overfishing is occurring for that skate species (Sosebee 2020).

White hake

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Set gillnets | United States

High

White hake has a high inherent vulnerability (72 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Set gillnets | United States

Low Concern

Based on the 2017 white hake stock assessment, spawning stock biomass (SSB) in 2016 was estimated to be 21,276 mt, which is 69% of the biomass target (SSB_{MSY} proxy = 30,948) {Sosebee 2017a}. The white hake stock is not overfished, but because it is below the biomass target, abundance is scored a low concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Set gillnets | United States

Very Low Concern

Based on the 2017 white hake stock assessment, the 2016 fully selected fishing mortality was estimated to be 0.066, which is 36% of the overfishing threshold proxy (F_{MSY} proxy = 0.1839) {Sosebee 2017a}. The white hake stock is not undergoing overfishing; therefore, fishing mortality is scored a very low concern.

Windowpane flounder

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Medium
Windowpane flounder has a moderate inherent vulnerability (43 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
There are two stocks of windowpane flounder that may be encountered by the fishery: the northern stock (Gulf of Maine and Georges Bank) and southern stock (Southern New England and Mid-Atlantic). The northern stock of windowpane flounder is overfished. Based on the 2017 northern windowpane flounder stock assessment, the mean NEFSC fall bottom trawl survey index from years 2014, 2015, and 2016 (a 3-year moving average is used as a biomass index, B) was 0.359 kg/tow, which is lower than the $B_{THRESHOLD}$ of 1.030 kg/tow {NEFSC 2017g}. Based on the 2017 southern windowpane flounder stock assessment, the mean NEFSC fall bottom trawl survey index from years 2014, 2015, and 2016 (a 3-year moving average is used as a biomass index, B) was 0.329 kg/tow, which is higher than the $B_{THRESHOLD}$ of 0.126 kg/tow (NEFSC 2017h). Because the northern stock of windowpane flounder is overfished, abundance is ranked a high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Low Concern
Overfishing is not occurring on the northern stock of windowpane flounder. Based on the 2017 stock assessment, the 2016 relative fishing mortality was estimated to be 0.222 kt per kg/tow, which is lower than the F_{MSY} of 0.340 kt per kg/tow {NEFSC 2017g}. But, the population has not recovered and there is uncertainty regarding the appropriateness of the current level of fishing mortality. Based on the 2017 southern windowpane flounder stock assessment, the 2016 relative fishing mortality was estimated to be 1.733 kt per kg/tow, which is lower than the F_{MSY} proxy of 1.918 kt per kg/tow (NEFSC 2017h). Because fishing mortality is below the appropriate reference point for both stocks, windowpane flounder is rated a low concern.

Witch flounder

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High
Witch flounder (grey sole) has a high inherent vulnerability (68 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
Based on the 2017 witch flounder stock assessment, the exploitable biomass in 2016 was estimated to be 14,563 mt {Wigley 2017b}. The stock status is considered to be overfished, and stock condition remains poor {Wigley 2017b}. According to the NMFS first quarter 2018 update, witch flounder is overfished and in year 8 of a 7-year rebuilding plan (NMFS 2018c). Although there is no biomass reference point defined, the stock is in poor condition and considered to be overfished; therefore, abundance is scored a high concern.

Justification:
Exploitable biomass is defined as the arithmetic average of the 2016 NEFSC spring and 2015 NEFSC fall surveys population biomass estimates and converted to exploitable biomass using 0.9, based on examination of survey and fishery selectivity patterns {Wigley 2017b}. The overfished and overfishing occurring NMFS stock status determinations for witch flounder are based on the 2016 assessment. There are no biomass or fishing mortality reference points in this stock assessment; however, stock condition was and remains poor {Wigley 2017b}.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderate Concern
Based on the 2017 witch flounder stock assessment, the 2016 exploitation rate was estimated to be 0.035 {Wigley 2017b}. Overfishing is unknown due to a lack of biological reference points associated with the empirical approach, but the stock condition remains poor {Wigley 2017b}. Because it is unclear whether or not the stock is undergoing overfishing, fishing mortality is scored a moderate concern.

Justification:
The exploitation rate is defined as the catch divided by the 2016 exploitable biomass {Wigley 2017b}.

Yellowtail flounder

Factor 2.1 - Inherent Vulnerability

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Medium
Yellowtail flounder has a moderate inherent vulnerability (37 out of 100) (FishBase 2013).

Factor 2.2 - Abundance

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
There are two stocks of yellowtail flounder that may be encountered by the fishery: the Georges Bank stock and the Cape Cod–Gulf of Maine stock. The most recent biomass estimate for Georges Bank yellowtail flounder is 2,077 mt, based on the 2019 NMFS fall bottom trawl survey and the 2020 DFO spring survey (the 2020 NMFS spring bottom trawl survey was not conducted due to the COVID-19 pandemic) (TRAC 2020). There is no biological reference point available for the biomass of Georges Bank yellowtail flounder; however, the current biomass reflects a 97% decrease in survey abundance since 2010 (TRAC 2020). According to the NMFS second quarter 2021 update, Georges Bank yellowtail flounder is overfished and in year 15 of a 26-year rebuilding plan (NMFS 2021).

Based on the 2017 Cape Cod–Gulf of Maine yellowtail flounder stock assessment, spawning stock biomass (SSB) in 2016 was estimated to be 1,191 mt, which is 26% of the biomass target (SSB_{MSY} proxy = 4,640) (Alade 2017). Because the Cape Cod–Gulf of Maine stock is overfished and the Georges Bank stock has declined greatly over the last decade, abundance is scored a high concern.

Factor 2.3 - Fishing Mortality

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

High Concern
The Transboundary Management Guidance Committee (TMGC) has implemented a strategy that seeks to minimize the risk of exceeding the fishing mortality reference for the Georges Bank stock, F_{REF} = 0.25 (TRAC 2020). At present, there is no assessment model, so current fishing mortality cannot be determined. The current catch is low relative to the estimated biomass from surveys, resulting in a low relative F; fishing is not believed to be a major contributor to current stock status. But, total catches are uncertain because some elements are poorly understood (e.g., research catch

is not included, and fisher behavior has been found to change on observed trips). This uncertainty makes it difficult to estimate fishing mortality and total mortality (TRAC 2020). According to the NMFS second quarter 2021 update, Georges Bank yellowtail flounder is being overfished and is in year 15 of a 26-year rebuilding plan (NMFS 2021).

Based on the 2017 Cape Cod–Gulf of Maine yellowtail flounder stock assessment, the 2016 fully selected fishing mortality was estimated to be 0.314, which is 115% of the overfishing threshold proxy (F_{MSY} proxy = 0.273) (Alade 2017). Because there is significant uncertainty regarding the impact of fishing on Georges Bank yellowtail flounder, and NMFS considers overfishing to be occurring on both the Georges Bank and Cape Cod–Gulf of Maine stocks, a score of high concern is given.

Factor 2.4 - Modifying Factor: Discards and Bait Use

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

20-40%
The discard to landings ratios in the fisheries are as follows {NMFS 2011b}:
Sink gillnet: 22.8%;
Bottom trawl: 47.8%.

Justification:
The discard to landings ratios above are calculated averages from the Northeast Region fisheries characteristics of the U.S. National By-catch Report. They represent a ratio of the full discard biomass to the full biomass of landings of all species in the fishery.

Criterion 3: Management Effectiveness

Management is separated into management of retained species (harvest strategy) and management of nonretained species (bycatch strategy). The final score for this criterion is the geometric mean of the two scores.

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 either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical

Criterion 3 Summary

FISHERY	HARVEST STRATEGY	BYCATCH MANAGEMENT STRATEGY	SCORE
Northwest Atlantic | Bottom trawls | United States	3.000	3.000	**Yellow (3.000)**
Northwest Atlantic | Set gillnets | United States	3.000	1.000	**Red (1.732)**

Factor 3.1 Summary

FISHERY	STRATEGY	RECOVERY	RESEARCH	ADVICE	ENFORCE	TRACK	INCLUSION
Northwest Atlantic | Bottom trawls | United States	Moderately Effective	Moderately Effective	Highly effective	Highly effective	Highly effective	Moderately Effective	Highly effective
Northwest Atlantic | Set gillnets | United States	Moderately Effective	Moderately Effective	Highly effective	Highly effective	Highly effective	Moderately Effective	Highly effective

Factor 3.2 Summary

FISHERY	ALL SPECIES RETAINED?	CRITICAL?	STRATEGY	RESEARCH	ADVICE	ENFORCE
Northwest Atlantic | Bottom trawls | United States	No	No	Moderately Effective	Moderately Effective	Highly effective	Highly effective
Northwest Atlantic | Set gillnets | United States	No	No	Ineffective	Moderately Effective	Highly effective	Moderately Effective

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - Harvest Strategy

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.'

- *5 (Very Low Concern)—Rated as 'highly effective' for all seven subfactors considered*
- *4 (Low Concern)—Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective.'*
- *3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'*
- *2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective.'*
- *1 (Very High Concern)—Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective.'*
- *0 (Critical)—No management exists when there is a clear need for management (i.e., fishery catches threatened, endangered, or high concern species), OR there is a high level of Illegal, unregulated, and unreported fishing occurring.*

Subfactor 3.1.1 – 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? To achieve a highly effective rating, there must be appropriate management goals, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Subfactor 3.1.2 – Recovery of Species of Concern
Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/ endangered species or to limit fishery's impact on these species and what is their likelihood of success? To achieve a rating of Highly Effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.

Subfactor 3.1.3 – Scientific Research and Monitoring
Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species? To achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.

Subfactor 3.1.4 – Management Record of Following Scientific Advice
Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.

Subfactor 3.1.5 – 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.

Subfactor 3.1.6 – Management Track Record
Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels? A Highly Effective rating is given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.

Subfactor 3.1.7 – 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 and includes stakeholder input.

Factor 3.2 - Bycatch Strategy

Four subfactors are evaluated: Management Strategy and Implementation, Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.' Unless reason exists to rate Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations differently, these rating are the same as in 3.1.

- *5 (Very Low Concern)—Rated as 'highly effective' for all four subfactors considered*
- *4 (Low Concern)—Management Strategy rated 'highly effective' and all other subfactors rated at least 'moderately effective.'*
- *3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'*
- *2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy but some other factors rated 'ineffective.'*
- *1 (Very High Concern)—Management exists, but Management Strategy rated 'ineffective.'*
- *0 (Critical)—No bycatch management even when overfished, depleted, endangered or threatened species are known to be regular components of bycatch and are substatntially impacted by the fishery*

Subfactor 3.2.1 – Management Strategy and Implementation
Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and how successful are these management measures? To achieve a Highly Effective rating, the primary bycatch species must be known and there must be clear goals and measures in place to minimize the impacts on bycatch species (e.g., catch limits, use of proven mitigation measures, etc.)

Subfactor 3.2.2 – Scientific Research and Monitoring
Considerations: Is bycatch in the fishery recorded/documented and is there adequate monitoring of bycatch to measure fishery's impact on bycatch species? To achieve a Highly Effective rating, assessments must be conducted to determine the impact of the fishery on species of concern, and an

adequate bycatch data collection program must be in place to ensure bycatch management goals are being met

Subfactor 3.2.3 – Management Record of Following Scientific Advice
Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g., do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.

Subfactor 3.2.4 – Enforcement of Management Regulations
Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations? To achieve a Highly Effective rating, there must be consistent enforcement of regulations and verification of compliance.

Factor 3.1.1 - Mgmt Strategy / Implement

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderately Effective
The New England Fishery Management Council (NEFMC) manages the northeast skate complex under a fishery management plan (FMP) that has been in effect since 2003. This FMP prohibits possession of thorny, smooth, and barndoor skates due to their poor stock statuses, provides annual catch limits (ACLs) for skate wings and the bait fishery, requires reporting, and provides mechanisms for monitoring and enforcing these fisheries. The 2012–2013 update made changes to the allowable biological catch (ABC), the ACL, the annual catch target (ACT), and the total allowable landings (TAL). The ACT is set at 37,826 mt, which means that the TAL is 24,088 mt after deducting the discard rate to account for by-catch results. The skate wing TAL is 66.5% of the entire complex's TAL, which equates to 15,538 mt. As of January 2014, the NEFMC was in the process of developing Framework 2, which includes an updated ABC, ACL, ACT, and TAL based on the most recent science, and the updated ABC will likely be significantly lower than the 2012–2013 ABC (pers. comm., T. Curtis December 2013).

The directed fishery for skate is the bottom trawl fishery, but it is also incidentally caught with sink gillnets and scallop dredges. Winter skate wings are mostly landed as part of the multispecies groundfish fishery and less so by goosefish and limited-access general category scallop vessels. Skates can be misidentified but, even though reliable landing information by skate species is not available, estimates from data taken from 2005 to 2010 show that the prohibitions on possession of thorny, barndoor, and smooth skates are 98% effective and that mislabeling is not a large problem in U.S. ports. Enforcement agents are trained to correct mislabeled skate products (Federal Register 2011).

Vessels fishing for winter skate wings must have a federally issued skate permit. They may also have a permit to fish for either Atlantic sea scallop, northeast multispecies, or goosefish, or be a limited-

access multispecies vessel that fishes as part of an approved sector (Federal Register 2010). Possession limits differ depending on which permits they have. When 85% of the TAL for skate wings has been landed, the possession limit for all these vessels is reduced to the incidental limit of 500 lb. of wings, or 1,135 lb. whole weight for the remainder of the fishing year, provided that this does not prevent the total TAL from being landed.

To help the thorny skate stock recover and assure that the other skate stocks maintain healthy biomass levels, the skate FMP focuses on controlling landings by prohibiting thorny skate from being retained and by reducing catches of winter skate (NEFMC 2007). In addition, the sea scallop, goosefish, and groundfish FMPs have the potential to affect the skate fishery, because all these fisheries spatially overlap with the skate fishery and have relatively high levels of incidental catch of skates (NEFMC 2009b). All adjustments to these FMPs have focused on reducing overall fishing effort, so they cumulatively have likely had a positive effect on skate abundance (NEFMC 2009b).

Factor 3.1.2 - Recovery of Stock Concerns

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderately Effective

Winter skate is not a stock of concern, but it is mostly caught as an incidental species in the northeast groundfish fishery, which also targets several species that are overfished and/or experiencing overfishing. In addition, winter skate is only one of seven skate species in the northeast skate complex. Thorny skate, which is included in the skate complex, is overfished and experiencing overfishing.

Because the primary goal of the Magnuson-Stevens Act is to provide for the conservation and management of fisheries, the act prohibits overfishing, and it mandates the development and implementation of rebuilding plans for overfished stocks. Rebuilding plans are required to be as short as possible, generally not exceeding 10 years, and take into account the status and biology of the stock, the needs of fishing communities, the interaction of the stock within the marine ecosystem, other environmental factors, and international agreements in which the United States participates (MSA § 304(e)(4) (NMFS 2010b).

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Factor 3.1.3 - Scientific Research / Monitoring

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Highly effective

The Northeast Fisheries Science Center has identified specific research priorities for skates in 2010–2014. These are identifying further stock definition, movements, mixing, and migration; better understanding life history parameters of age, growth, maturity, and fecundity; researching composition and extent of discards and by-catch in the skate fishery, as well as discard mortality rates by gear type; improving reporting, including proper species identification; identifying fishing practices and gear modifications that could improve species and size selectivity of gear; determining the influence of physical factors on range and distribution; and examining trophic interactions between skates and other bottom-dwelling species in the same habitat (NEFMC 2009). The Northeast Fisheries Observer Program assigns observers to vessels of all fisheries in the northeast, and the groundfish trawl fishery in New England also participates in an at-sea observer monitoring program that included observers on 2–10% of trips during the period from 2005 to 2008 (NMFS 2011). Currently, observer coverage targets are 25% for sector vessels and 17% for common pool vessels. As of March 2013, the average observer coverage on sector vessels was estimated at 20.5% for the 2012–13 fishing year, with coverage of 11% for the common pool (NEFOP 2013).

Factor 3.1.4 - Scientific Advice

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Highly effective

The NEFMC and Mid-Atlantic Fishery Management Council (MAFMC) have good records of incorporating scientific advice into their policies and management decisions, and the NEFMC's Science and Statistical Committee (SSC) is quick to utilize the latest information with which to update the skate FMP and multispecies FMP {Trzcinski 2010}. For example, when meeting to set the new acceptable biological catch (ABC) for winter skate in December 2013, the SSC approved and revised the discard mortality estimate for little, smooth, thorny, and winter skates caught by trawl gear. The estimate for winter skate discard mortality went from an assumed rate of 50% to 9%. Little skate discard mortality changed to 22%, smooth to 60%, and thorny to 23% (NEFMC 2013). The estimated mortality for skates caught with gillnets stayed at an assumed 50%.

Factor 3.1.5 - Enforce

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Highly effective

A variety of enforcement measures are in place in the New England groundfish fishery. All vessels fishing in the multispecies fishery are required to be fitted with a vessel monitoring system (VMS) (Federal Register 2006), which allows fishery officers to monitor the location of each vessel from a remote location. VMS enables fishery managers to not only monitor where catches are being taken, but also enforce spatial closures, of which there are a number in the Northwest Atlantic.

Enforcement of fishery legislation at sea is a cooperative operation between coastal states and the NOAA Office of Law Enforcement (OLE) and the United States Coast Guard. OLE officers conduct dockside inspections and inspect fish processing plants (OLE webpage), while the Coast Guard occasionally inspects vessels at sea. OLE enforces fisheries legislation including minimum landing sizes, retention of prohibited species, and gear restrictions. Violation of such management measures can result in criminal or civil actions and fines, loss of quota, or imprisonment for more serious cases.

Under Amendment 16 of the Multispecies Fishery Management Plan, accountability measures (AMs) were established (Federal Register 2010). AMs are required to ensure accountability within the fishery and to prevent overfishing. Proactive AMs are designed to prevent annual catch limits (ACL) from being exceeded, whereas reactive AMs are designed to correct any overages if they occur (Federal Register 2012). AMs can result in a reduction or complete loss of quota for a sector that regularly or greatly exceeds its quota (Federal Register 2010). It is thought that loss of a community pool will encourage a greater level of self-management, improving compliance throughout the fishery. In the event that the total allowable level of landings (TAL) or ACL for the skate wing fishery is exceeded in any year, the AMs reduce future TALs, reduce the buffer between the ACL and ACT for the fishing year after the ACL is exceeded, and hold the regional administrator accountable for doing so (Federal Register 2010).

Factor 3.1.6 - Track Record

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderately Effective

Winter skate has not been overfished since before 1999, and cuts to groundfish limits greatly reduce the chances that overfishing will occur. Because skate species managed under the skate FMP are caught in fisheries that target other species managed under other FMPs, there are impacts on the stocks that may be outside the control of the skate FMP; however, the same management body is responsible for these fisheries. Because some skate species are overfished and yet to recover, track record is considered moderately effective.

Factor 3.1.7 - Stakeholder Inclusion

Northwest Atlantic | Bottom trawls | United States

Northwest Atlantic | Set gillnets | United States

Highly effective

The NEFMC and MAFMC have an open and transparent policy that allows stakeholder participation and feedback through meetings and scoping hearings throughout their affected areas. Both councils utilize industry advisory panels that provide information during the development of FMPs. Public meeting schedules for the NEFMC and MAFMC are online, at: http://www.nefmc.org/calendar/index.html and http://www.mafmc.org/meetings/meetings.htm (respectively).

Factor 3.2.1 - Mgmt Strategy / Implement

Northwest Atlantic | Bottom trawls | United States

Moderately Effective

The main by-catch concerns in the fisheries landing skates are the capture of depleted groundfish stocks (including, but not limited to, cod, yellowtail flounder, and thorny skate) and marine mammals (including, but not limited to, North Atlantic right whale and harbor porpoise). The Northeast Skate Complex FMP contains several guidelines for reducing harmful interactions between fishing gear and associated catch, particularly for marine mammals and sea turtles. All vessels fishing for skate wings (specifically, under multispecies, spiny dogfish, and goosefish FMPs) must adhere to the regulatory measures of the Harbor Porpoise Take Reduction Plan (HPTRP) and the Atlantic Large Whale Take Reduction Plan {ALWTRP, NEFMC and MAFMC 2011}.

The HPTRP was established in 1999 to reduce the number of harbor porpoises that were injured or killed by gillnets (NOAA Fisheries 2012d). It focuses on area closures to reduce interactions during certain times of the year or in certain areas (including one in October 2012) (NMFS 2012d) and the use of "pingers" on gillnets (to deter porpoises from approaching the nets). The HPTRP was updated by NMFS in 2010 to expand both seasonal closures and the areas in which pingers are required (NOAA Fisheries 2012d). The use of pingers, in particular, has been shown to substantially decrease by-catch of harbor porpoises (Palka et al. 2008b). Law enforcement and the gillnet fishing industry are currently working together to increase the compliance and effectiveness of pinger use.

The ALWTRP focuses on preventing negative interactions between large whales and fishing gear, and is not unique to the groundfish, dogfish, or goosefish fishery. Protective measures focus on gear modifications, such as sinking instead of floating lines, and area closures, including the institution of short-term closures to protect North Atlantic right whale in the Gulf of Maine (Higgins and Salvador 2010)(NOAA Fisheries 2012d). The by-catch management strategy is considered moderately effective until all these measures have been implemented and shown effectiveness.

Northwest Atlantic | Set gillnets | United States

Ineffective

The main by-catch concerns in the fisheries landing skates are the capture of depleted groundfish

stocks (including, but not limited to, cod, yellowtail flounder, and thorny skate) and marine mammals (including, but not limited to, North Atlantic right whale and harbor porpoise). The Northeast Skate Complex FMP contains several guidelines for reducing harmful interactions between fishing gear and associated catch, particularly for marine mammals and sea turtles. All vessels fishing for skate wings (specifically, under multispecies, spiny dogfish, and goosefish FMPs) must adhere to the regulatory measures of the Harbor Porpoise Take Reduction Plan (HPTRP) and the Atlantic Large Whale Take Reduction Plan {ALWTRP, NEFMC and MAFMC 2011}.

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The Atlantic Large Whale Take Reduction Plan (ALWTRP) was developed under the MMPA in 1997 to reduce mortality and serious injury (SIM) to whales due to incidental take in U.S. commercial fisheries that interact with strategic stocks (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. have been 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 the potential biological removal (PBR), and to a level approaching zero (the Zero Mortality Rate Goal). Many 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), because annual mortality and serious injury due to entanglement continues to exceed PBR (NOAA 2019c). The impacts of introducing regulations such as the "sinking groundline rule" in 2009 and the "vertical line rule" (50 Federal Register 2014) in 2015 are not fully understood, due to limited data and analyses (the latest marine mammal stock assessments consider data from 2014 to 2018). But, for most entanglement interactions, gear is not recovered or is unidentifiable (77% of entanglements between 2000 and 2018) and, although the skate gillnet fishery has not been identified specifically in recent interactions, most interactions cannot be attributed to a specific fishery (NOAA 2019c). In 2014, a whale carcass was found south of Nantucket entangled in what was most likely gillnet gear (Sharp et al. 2019){Sharp et al. 2019 Supplemental}.

A batched biological opinion published in May 2021 considers the impact of fisheries in U.S. federal waters on species listed under the Endangered Species Act (ESA) (NMFS 2021a). 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 0.8) (Table 1). 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 time frame consistent with the Seafood

Watch Fisheries Standard with respect to the Marine Mammal Protection Act (MMPA). 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 1: 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 rule-making 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/SIs, on average annually, to 2.69. Implementation for certain measures will begin in 2021; others will be phased over time.
2	2023	NMFS implements rule-making to reduce M/SI in federal gillnet and other pot/trap (i.e., other than lobster and Jonah crab fisheries included in Phase 1) fisheries 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 rule-making 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 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 one 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 July 2022, a District Court ruled that the 2021 Final Rule and 2021 Biological Opinion were invalid, partly because of 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}.

Current management measures to prevent by-catch are insufficient, given the potential impacts of the fishery on endangered North Atlantic right whale, and the planned framework to implement risk reduction measures is not anticipated to reduce the impact of U.S. fisheries to below PBR until 2030 (NMFS 2021a). Therefore, the by-catch strategy is rated ineffective.

Justification:

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 whale 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 8.15 SIMs per year from 2014 to 2018), particularly on SIMs from unknown sources (5.1 SIMs), remain far above the levels that would allow the population to recover (PBR = 0.8) (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 Conservation Framework: specifically, risks related to entanglements that do not result in SIMs {Steward 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 {Steward 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.

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 North Atlantic right whale in Massachusetts state waters effective from May 1, 2021 (Massachusetts Register 2022). A seasonal closure has been implemented prohibiting 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 North Atlantic right whale 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, 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).

* Under the U.S. Marine Mammal Protection Act, an "Unusual Mortality Event" (UME) is defined as "a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response."

Factor 3.2.2 - Scientific Research / Monitoring

Northwest Atlantic | Bottom trawls | United States

Moderately Effective

Research is ongoing on the reduction of by-catch through the use of trawl gear modifications, such as the haddock separator trawl, otherwise known as the Ruhle Trawl or "Eliminator Trawl." This gear modification is based on the knowledge that haddock scare upward while cod do not. According to one study (Skrobe et al. 2010), use of the modified trawl significantly reduced by-catch species that remain low on the seafloor, such as flounders and cod. This gear most likely also reduces unwanted skate by-catch, because it is effective at targeting species that are startled upward, off the seafloor.

Fishery observers are required in groundfish fisheries (except handgear) under the Multispecies FMP and by the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) (NMFS 2011). Observers are trained biologists who collect data on fishing activities onboard commercial vessels, to provide robust data to support science and management programs. Observers in the Northeast Fisheries Observer Program (NEFOP) record weights of kept and discarded fish and crustacean species on observed hauls, as well as biological information (length, age, sex, and tags) from all species caught, including marine mammals and seabirds.

All vessels fishing in the multispecies fishery are required to be fitted with a vessel monitoring system (VMS) (Federal Register 2006){ECFR 2014}, which allows fishery officers to remotely monitor the location of each vessel. VMS enables fishery managers not only to monitor where catches are being taken, but also to enforce spatial closures, of which there are a number in the northwest Atlantic.

Under Amendment 16 of the Multispecies Fishery Management Plan, accountability measures (AMs) were established (Federal Register 2010). AMs are required to ensure accountability within the fishery and to prevent overfishing. Proactive AMs are designed to prevent allowable catch limits (ACLs) from being exceeded, whereas reactive AMs are designed to correct any overages if they occur (Federal Register 2012). AMs can result in a reduction or complete loss of quota for a sector that regularly or greatly exceeds its quota (Federal Register 2010). It is thought that loss of a community pool will encourage a greater level of self-management, thus improving compliance throughout the fishery.

The most recent AM was triggered due to overages in the 2016 fishing year. The end of year showed that three stocks had overages: Gulf of Maine cod, Georges Bank cod, and witch flounder; a combination of catch from both recreational and state commercial vessels contributed to cod overages, and catch from state commercial vessels contributed to witch flounder overages {GARFO 2018b}. Framework 57 was implemented to reduce the new trimester quota (to account for these overages) starting on 1 May 2018 {GARFO 2018b}.

NOAA fisheries has set enforcement priorities for 2018 to 2022, outlining needs for patrol outreach and investigation in an effort to deter and detect observer harassment, reporting and permitting compliance, by-catch management, incursions into closed or protected areas, monitoring and enforcement of illegal sales, and gear compliance, in addition to maintaining control over illegal, unreported, and unregulated (IUU) fishing and over seafood fraud {NOAA 2018i}.

But, there have been instances of significant overages that were undiscovered for substantial periods, indicating that gaps in monitoring may still be a concern {Federal Register 2018c}, and NOAA OLE has been curtailed in the last decade. Thus, this factor is scored moderately effective.

Justification:
Standard by-catch reporting methodology (SBRM) indicates that a simple percent observer coverage is not appropriate; instead, the appropriate metric of coverage is the coefficient of variation (CV), or the ratio of the square root of the variance of the by-catch estimate (i.e., standard error) to the estimate itself. SBRM establishes a standard level of precision of CV = 0.3 (Federal Register 2008).

Northwest Atlantic | Set gillnets | United States

Moderately Effective
A number of studies have been conducted to reduce the interactions of marine mammals and sea turtles with gillnets, which have resulted in the implementation of new guidelines regarding the use of pingers on gillnets (Culik et al. 2001).

Fishery observers are required in groundfish fisheries (except handgear) under the Multispecies FMP and by the MMPA and ESA (NMFS 2011). Observers are trained biologists who collect data on fishing activities onboard commercial vessels, to provide robust data to support science and management programs. Observers in the Northeast Fisheries Observer Program (NEFOP) record weights of kept and discarded fish and crustacean species on observed hauls, as well as biological information (length, age, sex, and tags) from all species caught, including marine mammals and seabirds.

Currently, observer coverage targets are 25% for sector vessels and 17% for common pool vessels. As of March 2013, the average observer coverage on sector vessels was estimated at 20.5% for the 2012–13 fishing year, with coverage of 11% for the common pool (NEFOP 2013). Observer coverage has decreased since the 2010–11 season; however, current levels of observer coverage are higher than in 2006–2008, when the average was below 10% for groundfish trawl and gillnet fisheries in the Northeast (NMFS 2011). Because of the rarity of some by-catch species, the same level of observer coverage that is sufficient for monitoring retained species may not always be sufficient for monitoring by-catch species; similarly, a given level of coverage may be sufficient for a large fishery but not for a small one. The level of observer coverage aims to ensure precision in the catch levels of each managed stock, based on a methodology set out in the Standard By-catch Reporting Methodolgy (SBRM). The SBRM was vacated by the courts because it contained discretions to be made that allowed observer coverage to be below that required to meet an acceptable level of precision (CV <30), based on budget reasons. The questions surrounding the observer program and the appropriate level of coverage prevent the management system from achieving the highest possible score for scientific research and monitoring. Thus, this factor is scored moderately effective.

Justification:
Standard by-catch reporting methodology (SBRM) indicates that a simple percent observer coverage is not appropriate; instead, the appropriate metric of coverage is the coefficient of variation (CV), or the ratio of the square root of the variance of the by-catch estimate (i.e., standard error) to the

estimate itself. SBRM establishes a standard level of precision of CV = 0.3 (Federal Register 2008).

Factor 3.2.3 - Scientific Advice

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Highly effective
Scientific advice appears to be followed, particularly regarding the use of pingers and area closures, to decrease marine mammal takes.

Factor 3.2.4 - Enforce

Northwest Atlantic | Bottom trawls | United States

Highly effective
A variety of enforcement measures are in place in the New England groundfish fishery. All vessels fishing in the multispecies fishery are required to be fitted with a vessel monitoring system (VMS) (Federal Register 2006), which allows fishery officers to monitor the location of each vessel from a remote location. VMS enables fishery managers to monitor where catches are being taken and to enable enforcement of spatial closures, of which there are a number in the Northwest Atlantic.

Enforcement of fishery legislation at sea is a cooperative operation between coastal states, the NOAA Office of Law Enforcement (OLE), and the United States Coast Guard. OLE officers conduct dockside inspections and inspect fish processing plants (NOAA OLE 2022), while the Coast Guard occasionally inspects vessels at sea. OLE enforces fisheries legislation including minimum landing sizes, retention of prohibited species, and gear restrictions. Violation of such management measures can result in criminal or civil actions and fines, loss of quota, or imprisonment for more serious cases.

Amendment 16 of the Multispecies Fishery Management Plan established accountability measures (AMs) to ensure accountability within the fishery and to prevent overfishing (Federal Register 2010). Proactive accountability measures are designed to prevent allowable catch limits (ACL) from being exceeded, whereas reactive accountability measures are designed to correct any overages (Federal Register 2012). Accountability measures can result in a reduction or complete loss of quota for a sector that regularly or greatly exceeds its quota (Federal Register 2010). It is thought that the loss of a community pool will encourage a greater level of self-management, improving compliance throughout the fishery (Federal Register 2010).

Northwest Atlantic | Set gillnets | United States

Moderately Effective
The multispecies northeast fisheries participate in vessel monitoring systems (VMS), which transmit time and position data to allow enforcement to detect fishing vessels that may be fishing in closed

areas. Enforcement of fishing regulations is provided at sea by the U.S. Coast Guard and onshore by the National Marine Fisheries Service and state agencies. But, there are some concerns over whether or not enforcement is adequate with the use of "pingers" on gillnets.

Enforcement may be somewhat weaker for by-catch species than for retained species. For instance, when a study demonstrated the effectiveness of acoustic pingers in reducing harbor porpoise by-catch (Kraus et al. 1997), a take reduction plan was subsequently implemented in the fishery, and harbor porpoise by-catch decreased from above 1,500 animals per year before 1996 to below 500 animals per year during 1999–2001. But, within several years of implementation, compliance decreased, and by-catch of harbor porpoises started to increase (Orphanides 2012)(Orphanides 2012b). Outreach activities increased in 2006–07 to remind fishers about TRP requirements, and compliance subsequently increased, so by-catch started decreasing again (NMFS 2011), reaching a mean serious injury and annual mortality of 511 animals during 2005–2009 (Waring et al. 2013). But concerns about compliance remain.

Recently published data from 2009 to 2010 suggest that acoustic pinger deployment rates in the Gulf of Maine were just 43%, with full compliance (accounting for functionality as well) at only 6.7% (Orphanides 2012). Although observed deployment rates were higher in 2011–2012 (73% for Southern New England and 80% for the Gulf of Maine), improvement is still needed. Target by-catch rates for harbor porpoises continue to be exceeded, which is believed to be due to inadequate compliance with deployment regulations as well as malfunctioning pingers (Orphanides 2012b).

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 (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management 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 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 | Bottom trawls | United States	Moderate Concern	Minimal Mitigation	Moderate Concern	**Yellow (2.598)**
Northwest Atlantic | Set gillnets | United States	Low Concern	Minimal Mitigation	Moderate Concern	**Yellow (3.122)**

Criterion 4 Assessment

SCORING GUIDELINES

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

- *5 (None) - Fishing gear does not contact the bottom*
- *4 (Very Low) - Vertical line gear*
- *3 (Low)—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. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally (*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*
- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—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 - Mitigation of Gear Impacts

- *+1 (Strong Mitigation)—Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.*
- *+0.5 (Moderate Mitigation)—20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.*
- *+0.25 (Low Mitigation)—A few measures are in place (e.g., vulnerable habitats protected but other habitats not protected); there are some limits on fishing effort/intensity, but not actively being reduced*
- *0 (No Mitigation)—No effective measures are in place to limit gear impacts on habitats*

Factor 4.3 - Ecosystem-Based Fisheries Management

- *5 (Very Low Concern)—Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g., large proportion of fishery area is protected with marine reserves, and abundance is maintained at sufficient levels to provide food to predators)*
- *4 (Low Concern)—Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. Measures are in place to minimize potentially negative ecological effect if hatchery supplementation or fish aggregating devices (FADs) are used.*
- *3 (Moderate Concern)—Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species, OR negative ecological effects from hatchery supplementation or FADs are possible and management is not place to mitigate these impacts*
- *2 (High Concern)—Fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.*
- *1 (Very High Concern)—Use of hatchery supplementation or fish aggregating devices (FADs) in the fishery is having serious negative ecological or genetic consequences, OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.*

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

Northwest Atlantic | Bottom trawls | United States

Moderate Concern

Winter skate is found most commonly over sand and gravel substrate, and occasionally over mud (NOAA 2003), which are all more resilient to disturbance from fishing activities than hard substrates such as rock. As a result, it can be inferred that winter skate is mostly caught with gears fishing on these types of substrate. Seafood Watch considers the impacts of trawls on sand, gravel, and mud habitats to be of moderate conservation concern.

Justification:

Concern over the effects of trawling on benthic ecosystems grew during the 1990s, and a host of

scientific papers have since documented the damage to benthic communities resulting from these fishing methods. (For reviews, see Watling and Norse 1998, and Thrush and Dayton 2002.)

Bottom trawls remove an extensive amount of biomass, and they destroy biogenic habitat structures such as sponges and tubes {Schwinghamer, P., D. C. Gordon, T. W. Rowell, J. Prena, D. L. McKeown and G. Sonnichsen 1988}{Thrush, S. F. and P. K. Dayton 2002}{Watling, L. and E. A. Norse 1998}{Dinmore, T. A., D. E. Duplisea, B. D. Rackham, D. L. Maxwell and S. Jennings 2003}. These impacts led to the comparison of dredging with forest clearcutting {Watling, L. and E. A. Norse 1998}(Zeller and Russ 2004). As with forest clearing, benthic ecosystems can be slow to recover, and recovery times will vary with the exact species, habitat, and depth considered {Watling, L. and E. A. Norse 1998}{Dinmore, T. A., D. E. Duplisea, B. D. Rackham, D. L. Maxwell and S. Jennings 2003}.

The Georges Bank has been trawled for decades, and the impacts on the benthic megafauna on gravel habitat have been studied by Collie et al. (1997). They found an abundance of organisms, and biomass and species diversity were significantly greater at nontrawled sites than at trawled sites {Collie J.S., G.A. Escanero, P.C. Valentine 1997}.

In addition to the removal of biomass and biogenic structures, mobile fishing gears (i.e., trawls) alter physical habitat. Even in sandy areas, where dredge impacts are expected to be minimal, experimental dredging has revealed significant changes to the physical habitat, such as the loss of topographic relief {Schwinghamer, P., D. C. Gordon, T. W. Rowell, J. Prena, D. L. McKeown and G. Sonnichsen 1988}.

Northwest Atlantic | Set gillnets | United States

Low Concern

Winter skate is found most commonly over sand and gravel substrate, and occasionally over mud (NOAA 2003), which are all more resilient to disturbance from fishing activities than hard substrates such as rock. As a result, it can be inferred that winter skate is mostly caught with gears fishing on these types of substrate. Impacts on the seabed are expected to be limited to the impact of anchors on the substrate and minimal amounts of scouring during setting and hauling nets.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Northwest Atlantic | Bottom trawls | United States

Minimal Mitigation

The alteration of marine habitats due to fishing gear can be decreased through the reduction of fishing effort or spatial closures that protect vulnerable habitats. There are a number of permanent and temporary spatial closures in place in the Gulf of Maine and Georges Bank. There are seven permanent closures in place to protect essential fish habitat (EFH) from the impacts of bottom trawling, established under Amendment 13 of the multispecies FMP (NEFMC 2004).

There are an additional five year-round closures designated through the multispecies FMP, along with five rolling closures in the Gulf of Maine and a seasonal closure on Georges Bank. These closures are primarily designed to protect important spawning grounds and juvenile fish.

Justification:
The requirement for fisheries management plans to minimize the adverse effects of fishing on essential fish habitat was set forth in the Sustainable Fisheries Act of 1996 (SFA). Amendment 11 of the multispecies FMP established EFH for the species covered by the plan and established areas where bottom-tending gears were to be prohibited, to protect the marine habitats (NEFMC and NMFS 1998).

To mitigate and minimize potential damage to EFH, NEFMC has implemented spatial closures, introduced limited permit schemes, and placed restrictions on the gears that can be used when trawling (Orphanides and Magnusson 2007). In addition to the year-round and rolling closures mentioned above, there are also restricted gear areas (RGAs) that provide protection from particular gear types; e.g., the Inshore Restricted Roller Gear Area.

Approximately 20% of the Georges Bank and Gulf of Maine seabed is protected from trawling activities through the variety of closures, although only 9.7% of the seabed is permanently protected through EFH closures (NOAA 2013d). Framework Adjustment (FA) 48 to the MSFMP provides sectors with the opportunity to request exemptions to year-round fishing mortality area closures, which has raised concerns among fishing industry stakeholders and environmental groups pertaining to impacts on seabed habitat. But, the rule set forth in FA48 prevents an exemption from being made to areas that overlap with closures created to protect essential fish habitat (Federal Register 2013).

Northwest Atlantic | Set gillnets | United States

Minimal Mitigation
There are ongoing measures to reduce fishing effort within the skate, goosefish, Northeast multispecies, and sea scallop FMPs. In addition, there are five year-round closures designated through the multispecies FMP, five rolling closures in the Gulf of Maine, and a seasonal closure on Georges Bank. These closures are primarily designed to protect important spawning grounds and juvenile fish.

There are few benthic areas protected specifically from gillnet fishing. This has not been considered necessary because the impacts to bottom habitat from gillnet gear has been determined by the NEFMC to be minimal. Therefore, there is minimal mitigation of fishing gear impacts.

Factor 4.3 - Ecosystem-based Fisheries Management

Northwest Atlantic | Bottom trawls | United States
Northwest Atlantic | Set gillnets | United States

Moderate Concern

The groundfish gillnet fishery does catch some exceptional species, but there are efforts underway to assess the ecological roles that they play in the ecosystem. Ecosystem-based fisheries management (EBFM) in the United States has been given recent attention with the National Ocean Policy, established under Presidential Order on July 19, 2010 (White House 2010). The New England Fishery Management Council (NEFMC) is beginning to implement a 5-year strategy transitioning to ecosystem-based management of fisheries; although the Mid-Atlantic Fishery Management Council (MAFMC) has not yet framed a comparable strategy, it is expected to do so shortly. Such management would replace individual management plans with holistic, integrated plans for defined ecological regions, with predator-prey relationships, competition, habitat status and gear impacts, and protected species all taken into account under the umbrella plan. Efforts are underway by the New England Fishery Management Council to develop ecosystem-based fishery management (EBFM) in three phases: establish goals and objectives; identify management and scientific requirements to implement EBFM in the region; and implement EBFM using quota-based management in all ecosystem production units (NEFMC 2011c). The impacts on the ecosystem and food web are considered to be moderate until implementation of the plan is underway.

Acknowledgements

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.

Seafood Watch would like to thank five anonymous reviewers for graciously reviewing this report for scientific accuracy.

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Appendix A: Report Review and Update

This report was reviewed and updated in September 2022 for any significant stock status or management updates to the fishery. Additional data and scientific information were found that significantly affected some of the ratings.

The overall recommendation for winter skate caught in the U.S. gillnet fishery was downgraded to Avoid. The overall rating for winter skate caught in the U.S. bottom trawl fishery remains a Good Alternative.

The most recent stock assessment for winter skate was reviewed and used to update the scores for Factors 1.2 and 1.3, resulting in an upgrade in the score for Factor 1.3 from moderate concern to low concern.

The most recent stock status information was used to update answers for Factors 2.1 and 2.2 for North Atlantic right whale. This did not result in a change in the score for either factor.

Information on recent entanglements of North Atlantic right whale resulting in serious injury was considered with respect to the effectiveness of management measures implemented in U.S. fisheries to minimize the impact on this endangered marine mammal. The cumulative impact of fishing mortality, the potential for the U.S. gillnet fishery for skate to contribute to this excessive fishing mortality, and the failure of management measures to prevent entanglement leading to serious injury or mortality of North Atlantic right whale resulted in a score of ineffective (a downgrade from the previous moderately effective score).

Red criterion scores for Criteria 2 and 3 result in an overall rating of Avoid for skate caught using gillnets in U.S. waters.