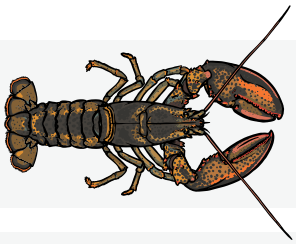
Gulf of Maine Responsibly Harvested®

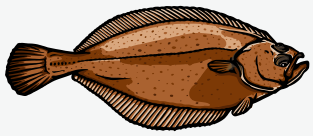
Verified Species

Gulf of Maine Research Institute

This document contains assessment reports for the following verified species. Links to additional reports are listed at the end of this page. For a quick access to each report, click on a species name.

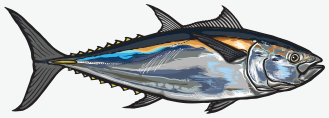


American Lobster*
Homarus americanus



American Plaice
Hippoglossoides platessoides

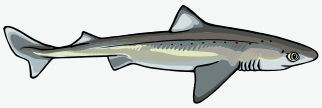
Atlantic Mackerel
Scomber scombrus



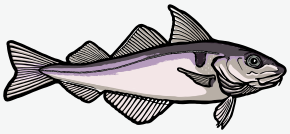
Atlantic Bluefin Tuna
Thunnus thynnus

Atlantic Pollock
Pollachius virens

Atlantic Sea Scallops
Placopecten magellanicus

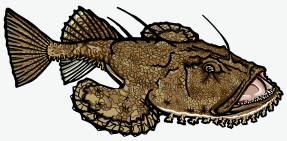


Atlantic Spiny Dogfish**
Squalus acanthias

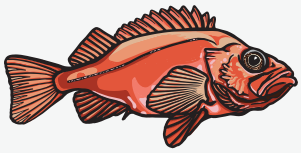


Haddock
Melanogrammus aeglefinus

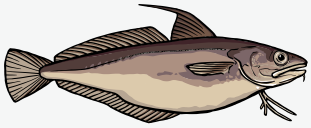
Farmed Kelp (Maine)
Saccharina angustissima
Alaria esculenta
Laminaria digitate



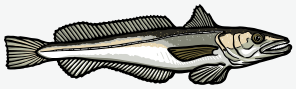
Monkfish
Lophius americanus



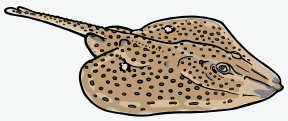
Redfish
Sebastes fasciatus



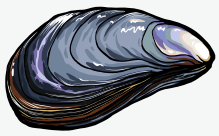
White Hake
Urophycis tenuis



Whiting (Silver Hake)
Merluccius bilinearis



Winter Skate
Leucoraja ocellata



Farmed Blue Mussels (Maine)
Mytilus edulis

** Additional Marine Stewardship Council (MSC) Canadian certification for American Lobster available at:*
https://fisheries.msc.org/en/fisheries/bay-of-fundy-scotian-shelf-and-southern-gulf-of-st.-lawrence-lobster-trap/@@view
*** Atlantic Spiny Dogfish Marine Stewardship Council (MSC) certification available at:*
https://fisheries.msc.org/en/fisheries/us-atlantic-spiny-dogfish/@@view

Gulf of Maine Research Institute
Responsibly Harvested Seafood from the Gulf of Maine Region

Report on
Gulf of Maine and Georges Bank American Lobster

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *The American lobster fishery is managed jointly through ASMFC, Maine, New Hampshire, Massachusetts, and NMFS. The fishery is managed under Amendment 3 to the Interstate Fishery Management Plan (ISFMP), which utilizes the best available science to set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *The GOM and GB stocks of lobster are not depleted and overfishing is not occurring.*

☒ Sufficient data exists to determine harvest levels.

- *The 2009 stock assessment set biomass and abundance indices utilizing fisheries dependent and independent data collected from state and federal sources. The ASMFC then uses these data to determine harvest levels. It is not considered a data poor fishery.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *American lobster harvest is monitored by 100% federal dealer reporting, a minimum of 10% harvester reporting, in addition to state requirements.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of American lobster.*

Verified as of March, 2011

I. Definition of American Lobster

American lobster (*Homarus americanus*) is harvested from off the coast of Maine, south to North Carolina. Traps are the predominant gear type employed in the fishery and accounted for an average of 98% of the total landings from 1981 and 2007 (ASMFC 2009).**Error! Bookmark not defined.**

Three stock units have been identified based on regional differences in life history parameters: Gulf of Maine (GOM), Georges Bank (GBK), and Southern New England (SNE). Each stock supports both an inshore and offshore component; however, the GOM and SNE fisheries are primarily inshore while the GBK fishery is primarily offshore. This report covers the GOM and GBK stocks as these stocks occur within the harvesting area boundary for GMRI's *Gulf of Maine Responsibly Harvested* branding program.

II. Description of the Management Authority and Regulatory Process

The Atlantic States Marine Fisheries Commission (ASMFC) manages the lobster fishery in state waters, in conjunction with the respective coastal states, while the National Marine Fisheries Service (NMFS) (under the authority of the Atlantic Coastal Fisheries Cooperative Management Act) manages the fishery in federal waters.

The GOM and GBK biological stock units are subdivided into seven lobster conservation management areas (LCMAs) for management purposes. The LCMAs and stock assessment areas are depicted in Figure 1. In each of these areas, Lobster Conservation Management Teams (LCMTs), which are composed of industry representatives, advise the American Lobster Management Board and recommend changes to the Interstate Fisheries Management Plan (ISFMP) within their area. A 21-member Lobster Advisory Panel of lobstermen also participates in the ASMFC decision-making process. To determine appropriate harvest levels and review the health of the fishery, the ASMFC employs an 8-member Lobster Technical Committee comprised of state fishery managers. The management recommendations developed by this process are then forwarded to the federal and state governments with a recommendation that the government takes action on these measures in the form of regulations. The federal government is obligated by statute to support the ASMFC's ISFMP and overall fishery management efforts and in this capacity determines the regulations. Within NMFS, the State, Federal, and Constituent Programs Office coordinates this process.

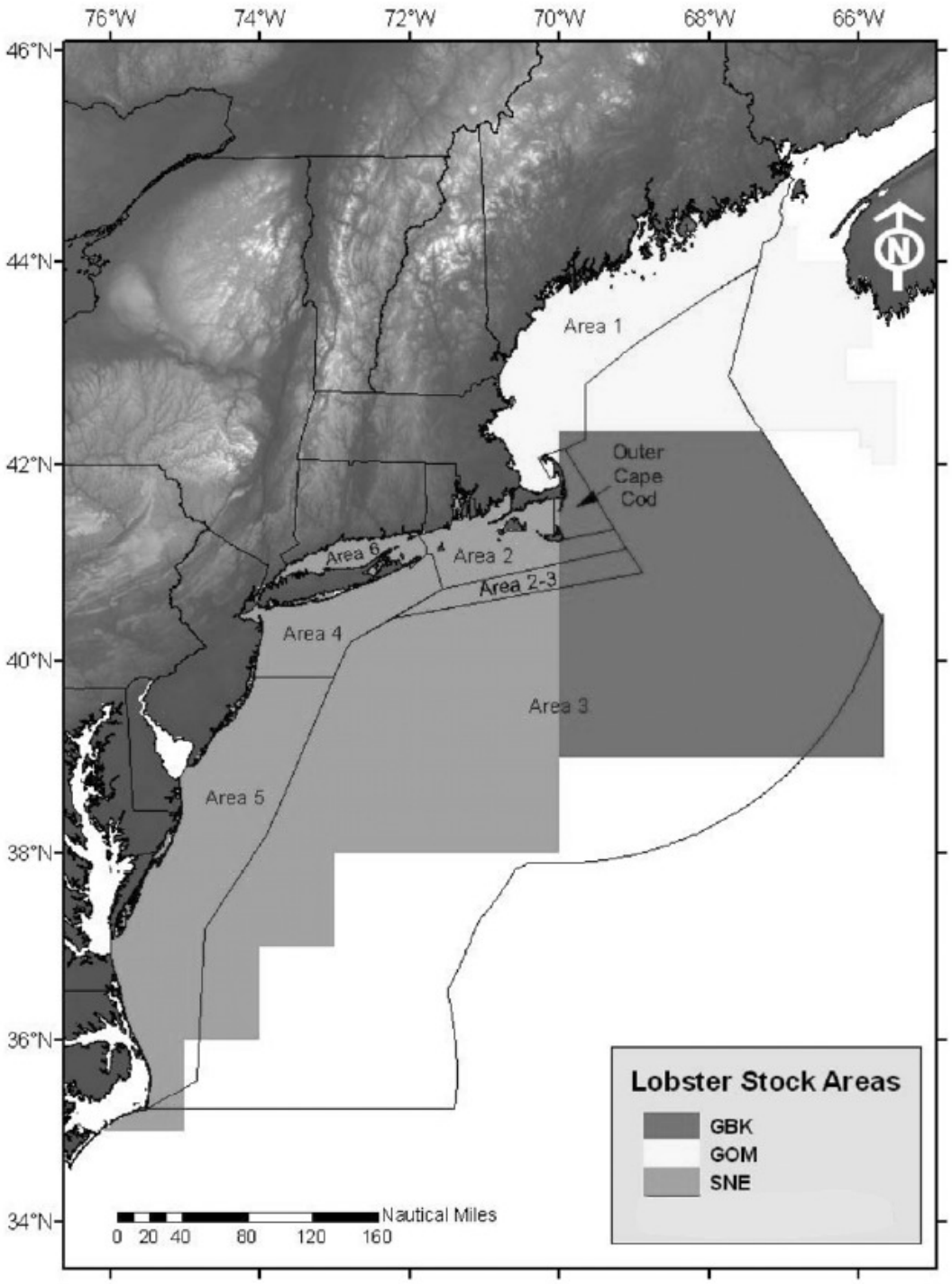


Figure 1. American lobster conservation management areas and biological stock assessment areas.

The scope of this report is limited to the GOM and GBK stocks, which include both state (0-3 nautical miles [nm]) and federal waters (3-200 nm) within LCMAs 1 and 3, as well as the Outer Cape Cod Management Area. Therefore, both federal and state regulations are described. It should be noted, however, that if a fisherman holds both a state and

federal license, he is required to operate under the most restrictive regulation, referred to as "the most restrictive rule."

Maine

In Maine, the Maine Department of Marine Resources (DMR) implements the ISFMP in state waters, in addition to developing state-specific regulations and governance structure. State laws are located in *Title 12: Conservation, Part 9: Marine Resources* and regulations are codified in *Chapter 25: Lobster and Crab*. Maine state waters are divided into seven lobster management zones, labeled as Zones A to G from east to west (see Figure 2). These zones are established by the DMR Lobster and Crab Regulations, and each zone is represented by a Lobster Management Policy Council (or zone council). They are chartered to execute referenda on specific fishing policies to reduce fishing effort. Fishing effort reductions may include a maximum number of lobster traps that may be fished by an individual license holder or two or more lobster license holders who fish from the same boat; the maximum number of traps on a trawl line; the time of day when lobster fishing may occur; limited entry (exit/entry ratios); and controlled entry with options to specify requirements for apprentice fishermen. The results of the referenda are submitted to the Commissioner of ME DMR for promulgating as regulations. The Commissioner is obliged to promulgate successful referenda without alteration assuming that the proposal meets a "reasonableness" test.

The Lobster Advisory Council (LAC), which is separate from the seven Lobster Management Policy Councils but comprised in part of representatives from those councils, has specific statutory responsibilities related to advising the commissioner on activities of the department that relate to the lobster industry. It may review lobster research programs and make recommendations, and it may consider disputes between the zone councils and make recommendations. It also makes recommendations regarding the use of specific funds.

New Hampshire

In New Hampshire, the Department of Fish and Game (DFG) implements the ISFMP in state waters, and develops state-specific regulations. Additional regulations for harvesting lobsters in state waters are codified in *Title XVIII, Chapter 211: Fish, Shellfish, Lobsters, and Crabs*. Unlike Maine, New Hampshire does not have an additional management infrastructure other than the ASMFC process.

Massachusetts

In Massachusetts, the Division of Marine Fisheries (DMF) implements the ISFMP in state waters, and develops state-specific regulations. Additional regulations for harvesting lobsters in state waters are codified in *CMR 322: Division of Marine Fisheries*. While not specific to the lobster fishery, the Massachusetts Marine Fisheries Advisory Commission, which is a nine member board that represents recreational and commercial fishing interests from various parts of the Massachusetts coast, promulgates these state regulations. Commissioners are appointed by the governor to three-year terms, and attend monthly business meetings as well as quarterly public hearings. Regulatory changes and

public proposals are approved or disapproved by a majority vote at the Commission's monthly business meetings.

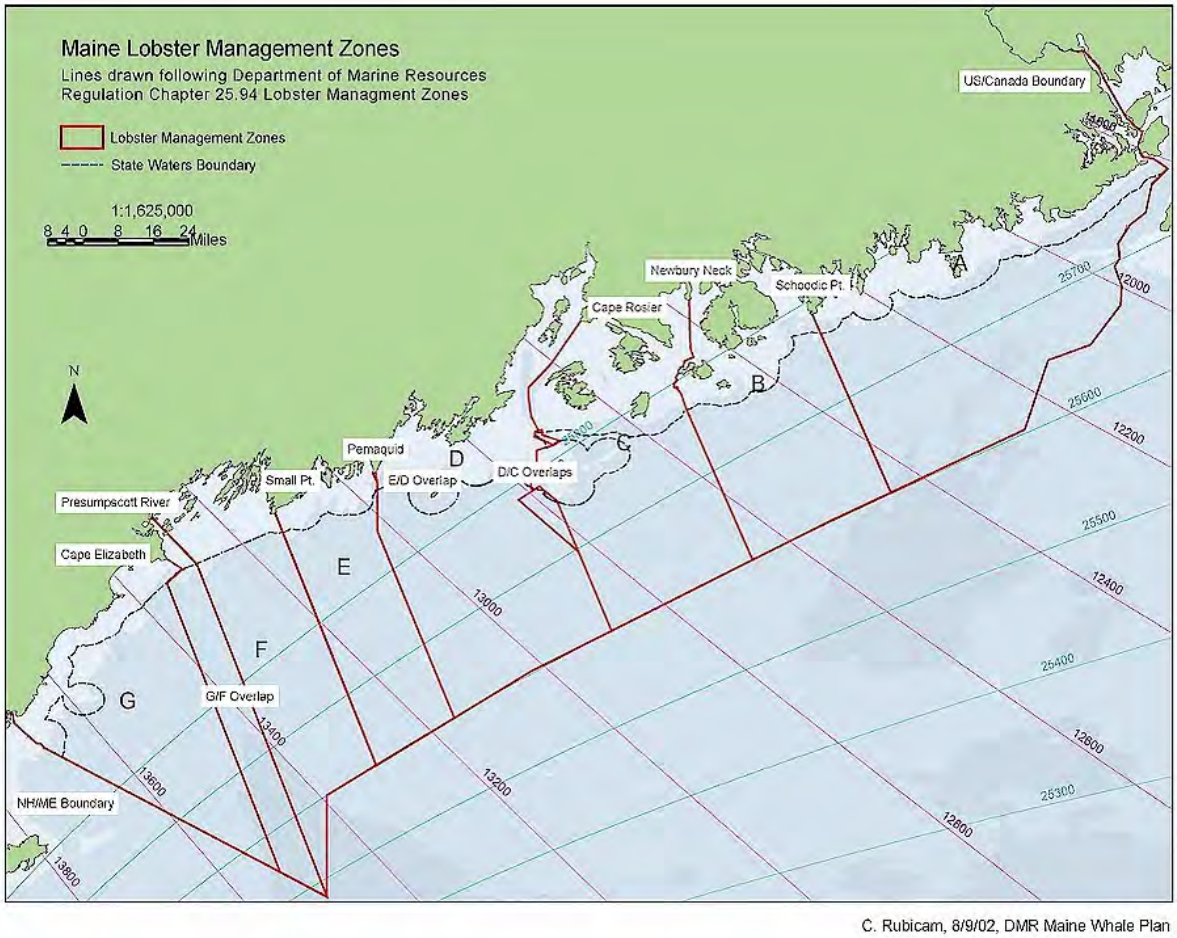


Figure 2. Maine LobsterManagement Zones

III. American Lobster Data

The most recent 2009 American lobster stock assessment utilized the University of Maine statistical catch-at-length model to estimate abundance and mortality of male and female lobster by size for each stock unit (ASMFC 2009). The Collie-Sissenwine model (CSM) used in the 2006 assessment was updated as well for continuity purposes. Other stock status indicators of mortality, abundance, and fishery performance were taken into consideration. Biomass and abundance indices are calculated using fisheries dependent and independent data collected from state (Maine, New Hampshire and Massachusetts) and federal sources.

Current abundance of the GOM stock is at a record high, and recruitment has steadily increased since 1997; however, recent effort levels are the highest observed since 1982. According to ASMFC, GOM constituted approximately 76% of the U.S. landings between 1981 and 2007, and approximately 87% of landings since 2002. Landings in the GOM between 1981 and 1989 averaged 14,600 mt, then increased from 1990 (19,200 mt)

to a peak in 2006 (37,300 mt). Landings averaged 33,000 mt from 2000-2007.**Error! Bookmark not defined.**

Current abundance of the GBK stock is also at a record high, and recruitment is high, yet exploitation rates are at a record low. This stock constituted an average of 5% of the landings from 1981 to 2007. Between 1981 and 2002, landings from the GBK fishery remained stable (average 1,300 mt). Landings almost doubled between 2003 and 2007 with a high of 2,400 mt landed in 2005 and have remained well above the time series mean.**Error! Bookmark not defined.**

The following excerpt from the 2009 *American Lobster Stock Assessment Report* provides background information on the process for determining stock status and the actual status of the GOM and GBK stocks of American Lobster.

> This assessment recommends revisions to the set of reference points used in the previous assessment (ASMFC 2006) for management of American lobster stocks (Table 1 below). Revised reference points include median reference abundance and median exploitation rate thresholds for sexes combined over the fixed time period of 1982-2003 in GOM and GBK...The assessment further recommends that stock status be determined by comparing the average reference abundance and average exploitation rate for sexes combined during the most recent three years to stock-specific threshold values.

Variable	GOM	GBK	SNE
Effective exploitation			
Effective exploitation threshold	0.49	0.51	0.44
Recent effective exploitation 2005-2007	0.48	0.3	0.32
Effective exploitation below threshold?	YES	YES	YES
Reference abundance			
Abundance threshold	72,030,500	1,912,355	25,372,700
Recent abundance 2005-2007	116,077,000	4,698,670	14,676,700
Abundance above threshold?	YES	YES	NO

Table 1. Revised threshold reference points with stock status variables for lobster in each stock area (annual effective exploitation rate and reference abundance in number of lobster).

Based on these reference points, "overfishing" would occur if the average effective exploitation rate during 2005-2007 were higher than the stock-specific median threshold. A stock would be "depleted" if average reference abundance during 2005-2007 fell below the median threshold level. In either of these cases, corrective management action should be implemented.

The GOM stock is in favorable condition based on the recommended reference points. The stock is above the reference abundance threshold and slightly below the effective exploitation threshold. Therefore the GOM lobster stock is not depleted and overfishing is not occurring.

The GBK stock is in a favorable condition based on the recommended reference points. The stock is above the reference abundance threshold and below the effective exploitation threshold. Therefore the GBK lobster stock is not depleted and overfishing is not occurring.**Error! Bookmark not defined.**

IV. Interstate Fishery Management Plan for American Lobster

Currently, American lobster is managed under Amendment 3 to ISFMP and Addenda I-XV. The plan is designed to minimize the chance of population collapse due to recruitment failure. According to the 2009 *American Lobster Stock Assessment Report*, "The goal of Amendment 3 is to have a healthy American lobster resource and management regime, which provides for sustained harvest, maintains appropriate opportunities for participation, and provides for cooperative development of conservation measures by all stakeholders." Amendment 3 develops the overarching goals and objectives for management of the fishery, as well as management measures like trap specifications, trap limits, minimum size limits, and v-notching requirements. The addenda revise or replace these specific measures as needed. For example, Addendum X established an expanded coast-wide mandatory reporting and data collection program, and Addendum XV maintains the historic level of trap fishing effort and curtails an increase of new federal lobster vessels fishing within the federal waters of LMCA 1 by limiting the entry of vessels which have not fished with traps in Area 1 in the past from fishing in Area 1 with traps in the future. As mentioned above, specific management measures developed in the Amendment and addenda are implemented by NMFS through rulemaking.

The most recent federal regulations for the American lobster fishery were published on July 29, 2009 (74 FR 37530) and implemented 30 days later. These management measures include regulations which implement a mandatory federal lobster dealer electronic reporting requirement, minimum and maximum carapace length limits in several LCMAs, a modification of the v-notch definition for protection of egg-bearing females, gear restrictions (trap size, gear marking requirements, escape vents, and ghost panels), trap limits, and several area-specific limited entry programs.

Additional state-specific regulations are referenced in Section II; however, as mentioned above, if a fisherman holds both a state and federal license, he is required to operate under the most restrictive regulation, referred to as "the most restrictive rule."

V. Monitoring

NMFS requires Federal dealers to report 100% of landings per trip on a harvester basis. As of January 1, 2010, all Federal lobster dealers are required to provide trip-level electronic reports on a weekly basis (74 FR 37530; July 2009). There is a minimum requirement for 10% of harvesters to report effort data (trap hauls, soak time, etc.) through logbook returns. The Atlantic Coastal Cooperative Statistics Program (ACCSP), in partnerships with Atlantic coast marine fisheries agencies, developed a trip-by-trip

reporting standard so data collected by the states and the federal government could be pooled together. The remainder of this section describes the state-specific monitoring and reporting requirements.

Maine
In Maine, DMR administers a Commercial Lobster Port Sampling Program, which collects catch and effort data directly from lobstermen as they land their catch. Ten lobster dealers are selected at random each month, from April through December. The Sea Sampling Program places trained observers onto commercial lobster boats. Catch and effort information is collected and biological data is recorded for each lobster caught. The number of legal, sublegal and illegal lobsters are counted, measured and sexed (DMR 2010). Ten percent of permit holders are selected each year for monthly catch and effort reporting on a trip-level basis. Dealers are required to report landings to the state on a monthly basis.

New Hampshire
New Hampshire has two separate reporting categories for permit holders based on landed pounds from the previous fishing year. Permit holders who harvest less than 1,000 lbs are required to submit annual reports that summarize catch and effort data by month. Permit holders who harvest more than 1,000 lbs are required to submit monthly catch reports on a trip-level basis. If permit holders are submitting a federal fishing vessel trip report (FVTR), then they can submit the FVTR to the New Hampshire DFG in lieu of a state report. Dealers are required to submit monthly transaction reports unless they are joint state and federal dealers, in which case they are required to report weekly under federal regulations (Zobel, R., personal communication, June 2010).

Massachusetts
In the Commonwealth of Massachusetts, commercial permit holders must report trip-level information monthly for all marine species landed under the authority of their Massachusetts commercial permit. These reports are submitted to the Massachusetts DMF unless the permit holder also has a federal permit and is already reporting under a separate program, such as the federal FVTR program. Dealers buying from state permit holders are required to submit weekly reports to DMF for all transactions with harvesters. Federal dealers are required to comply with the federal weekly reporting guidelines and are exempt from submitting a state weekly report to DMF (DMF 2010).

VI. Enforcement

In general, enforcement of Amendment 3 of the ISFMP for American lobster and federal regulations are coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG)

and various other federal agencies, fishery management councils, and non-governmental organizations. Federal and state law enforcement agents ensure compliance with minimum and maximum size requirements, gear restrictions, trap limits, and dealer reporting requirements.

VII. Other

Depending on the dealer, it could be difficult to distinguish between lobster harvested by traps or pots and those harvested incidentally by trawlers or gillnetters. Therefore, this section of the report provides information and rationale for the inclusion of lobsters harvested by legal, non-trap methods (commonly referred to as *dragged lobsters*) in this review.

Federal and state management of lobster focuses on the directed lobster pot/trap fisheries. While there are no targeted trawl fisheries for lobster within the GOM and GBK stock areas, trawl vessels in Massachusetts and New Hampshire are permitted to land a limited number of lobsters per trip. Provided that fishermen in these states have a federal commercial lobster permit, they may land up to 100 lobsters per day or 500 lobsters for any fishing trip five days or longer. This incidental catch must be harvested in federal waters by legal, non-trap methods, including trawl gear and gillnets. Maine prohibits the landing of offshore dragged lobsters for sale in the state.

Because these lobsters are harvested by legal, non-trap methods in federal waters, they are managed under Amendment 3 to the Interstate Fishery Management Plan (ISFMP) for American Lobster, and federal regulations apply. Addendum X to the ISFMP requires 100% mandatory dealer reporting. Therefore, all lobsters landed, even if they were not harvested by traps or pots, are reported by dealers. In Massachusetts, state law requires all vessels landing lobsters to have a Massachusetts landings permit, and all landings (state and federal) are reported by dealers. These reports are utilized in the stock assessments for lobster, and thus are taken into consideration when the ASMFC determines the status of the stock. Finally, the same protocols are adhered to for monitoring and compliance with federal regulations, regardless if the lobster was harvested by a directed trap/pot fishery or by a dragger or gillnetter.

VIII. References

Atlantic States Marine Fisheries Commission (ASMFC). 2009. American Lobster Stock Assessment Report for Peer Review. www.asmfc.org/speciesDocuments/lobster/annualreports/stockassmtreports/2009LobsterStockAssessmentReport.pdf

Maine Department of Marine Resources (DMR). 2010. Lobster Research, Monitoring, and Assessment Program. http://www.maine.gov/dmr/rm/lobster/research.htm

Massachusetts Division of Marine Fisheries (DMF). 2010. Massachusetts Trip-Level Reporting for Commercial Fishermen. http://www.mass.gov/dfwele/dmf/commercialfishing/trip_level.htm

Zobel, Renee, Marine Fisheries Division. New Hampshire Department of Fish and Game. 2010. Personal communication, June 2010.

Gulf of Maine Research Institute
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Gulf of Maine Research Institute
Responsibly Harvested Seafood from the Gulf of Maine Region

Report on
Gulf of Maine – Georges Bank American Plaice (*Hippoglossoides platessoides)*

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.
- *American plaice is managed by NMFS and NEFMC, and regulated by the Northeast Multispecies Fishery Management Plan, which utilizes the best available science to inform the management process, and to ultimately set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.
- *According to the most recent assessment update, the American plaice spawning stock biomass is at 83% of SSB_{MSY}. The stock is not overfished and overfishing is not occurring. This stock is in a rebuilding plan with a target date of 2024.*

☒ Sufficient data exists to determine harvest levels.
- *The Groundfish Assessment Review Meeting III (2012) utilized fisheries-dependent and –independent data to determine stock status and biological reference points, which are assessed through the Council process. A 2015 assessment update incorporated the most up-to-date fisheries data. Ultimately, the Council sets the harvest levels based on this data, which incorporate uncertainty. American plaice is not considered a data poor species.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.
- *GOM-GB American plaice catch is monitored through vessel trip reports (VTRs), observers, dealer reports, and for sectors, additional at-sea monitoring. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.
- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of GOM-GB American plaice.*

I. Definition of Gulf of Maine – Georges Bank American Plaice

American plaice (*Hippoglossoides platessoides*) is distributed along the Northwest Atlantic continental shelf extending from Labrador to Rhode Island. American plaice, also known as dab, is generally found in waters below 17°C and depths between 45m and 175m. It is a large-mouthed, "right-handed" flounder and its preferred habitat type is a substrate of sand or gravel. Most individuals reach sexual maturity at age 4, spawning in spring between March and May. It is a relatively slow grower, with 3 year-old fish normally between 22-28cm in length. The principal commercial fishing gear type used to catch American place is the otter trawl, accounting for more than 95% of catches; recreational and foreign catches are insignificant in the Gulf of Maine – Georges Bank fishery (NEFMC, 1998).

Off the U.S. coast, American plaice is managed as a single stock that inhabits both the Gulf of Maine and Georges Bank regions (Figure 1). The National Marine Fisheries Service (NMFS) manages this stock, which corresponds to statistical areas 511-515, 521-526, 551, 552, 561, and 562. This report covers the entire Gulf of Maine – Georges Bank American plaice stock.

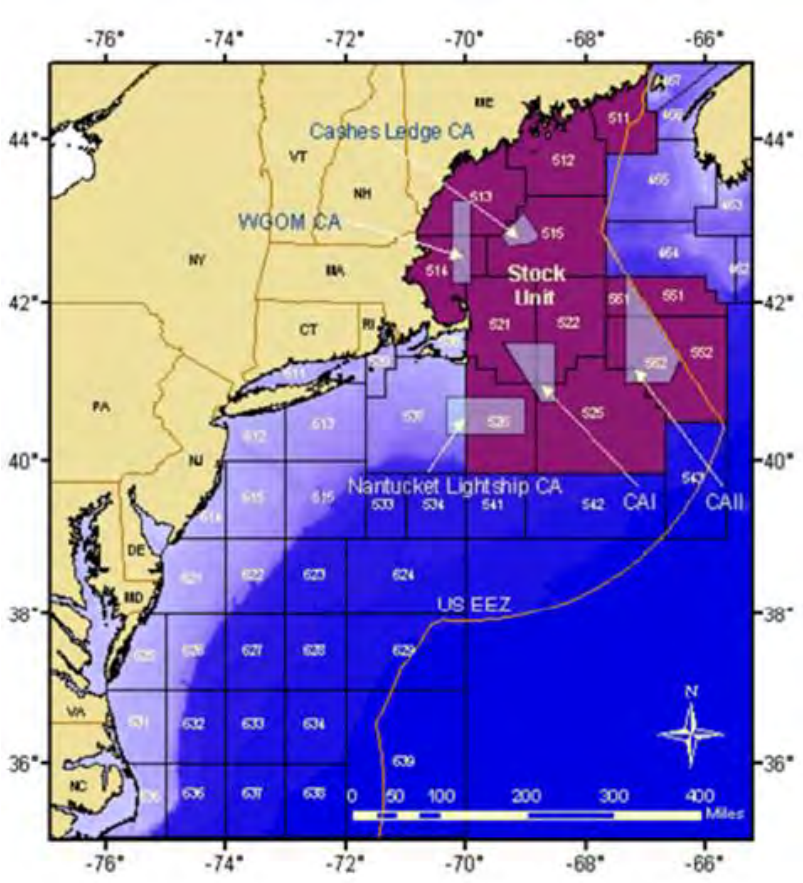

Figure 1. Statistical areas of Gulf of Maine – Georges Bank American plaice as defined by Northwest Atlantic Fisheries Organization (NAFO) are shown in red (O'Brien & Dayton, 2012).

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of the Management Authority and Regulatory Process

Responsibility of Gulf of Maine – Georges Bank American plaice management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of Gulf of Maine – Georges Bank American plaice regulations as part of a complex of 16 species that are managed together as the Northeast Multispecies Fishery. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For Northeast multispecies fisheries management, a sub-set of NEFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the Oversight Committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the Oversight Committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of American plaice. Then the PDT provides reports to the Oversight Committee in response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The NEFMC is also assisted by the members of the Scientific and Statistical

Committee (SSC); SSC members review and participate in stock assessment updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of the entire process.

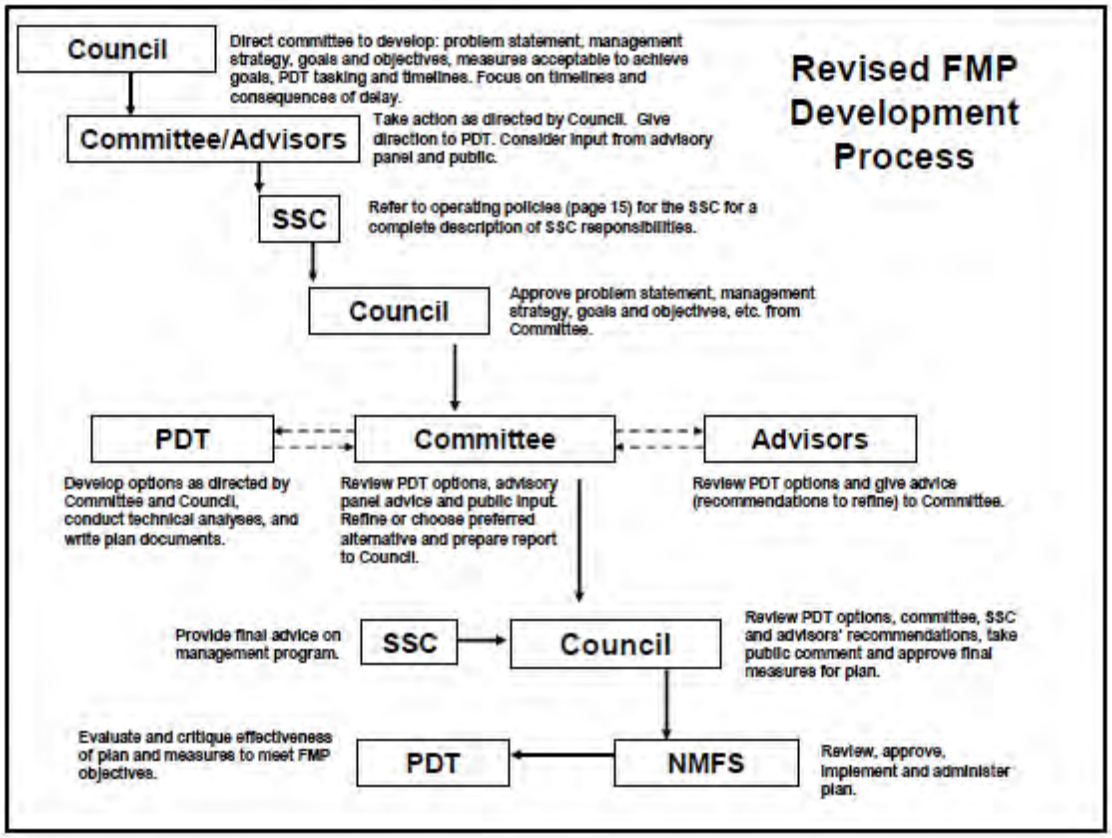

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Northeast Multispecies Fisheries Management Plan

The Northeast Multispecies Fishery Management Plan (FMP) was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks and to promote rebuilding to sustainable biomass levels. Sixteen species are managed under Amendment 16 to the Northeast Multispecies FMP. Thirteen large-mesh species are managed together based on fish size and type of gear used to harvest the fish: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, white hake, and wolffish. Because several large-mesh species are managed as two or more separate stocks, e.g., Gulf of Maine haddock and Georges Bank haddock, there are a total of 20 separate stocks of groundfish managed under the FMP. The other three species (silver hake [or whiting], red hake, and offshore hake) are managed under a separate small-mesh multispecies program pursuant to Amendment 12 of the Northeast Multispecies FMP.

During the 1990s and until April 2009, the groundfish complex was primarily managed under the Days-At-Sea (DAS) system: by seasonal and year-round area closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size, number of nets/hooks, etc.), minimum fish size limits, trip limits (i.e., limiting fishermen to a certain poundage

of fish per trip), limited access (i.e., limiting the number of participants in the fishery) and restrictions on the number of days a vessel is allowed to fish for groundfish each year (i.e., days-at-sea) (NEFMC 2009). In May 2004, Amendment 13 to the FMP implemented formal rebuilding plans for groundfish stocks, including American plaice, based on revised biomass and fishing mortality targets derived by the Working Group on Re-evaluation of Biological Reference Points (BRPs) for New England Groundfish. Amendment 13 also marked the development of the first sector in New England (the Georges Bank Hook sector on Cape Cod). The overall goal of these actions was to reduce fishing mortality to rebuild depleted groundfish stocks to target biomasses.

In May 2010, Amendment 16 authorized the formation of individual fishing organizations, which shifted the management regime from the DAS system to this output-controlled system, referred to as sectors. In addition to general regulations for the fishery, Amendment 16 also implemented species- and stock-specific regulations for vessels in the common pool and in sectors. Beginning in FY 2010, commercial harvesters of groundfish have been managed in two self-selecting categories: common pool and sectors. From the start in 2010, the vast majority of the Northeast groundfish fishery has been enrolled in sectors.

The current regulations setting the catch levels for each of the 20 groundfish stocks, which were implemented by FW 48 to Amendment 16 in 2013, and revised in FW 50 in 2013, implement new requirements under the Magnuson-Stevens Reauthorization Act (MSRA) of 2006. The MSRA requires the NEFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) that enable rebuilding within specified time frames for all managed stocks. This action implements a process for calculating an ACL in addition to the overfishing level (OFL) and acceptable biological catch (ABC) for each stock. Recommendations for these figures are developed by the PDT. The Science and Statistical Committee (SSC) recommends ABC levels, and the NEFMC approves final ACLs, but cannot exceed the SSC's recommended levels. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, sectors, and the common pool. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL. Although the following stocks have ACLs, possession is prohibited: northern and southern windowpane flounder, ocean pout, and wolffish. In addition, Atlantic halibut catch is limited to one fish per trip. Northeast Multispecies permit holders are eligible to receive an allocation for the remaining groundfish stocks.

Common Pool: Members in the common pool are managed by an effort control system that regulates the number of days a harvester may fish. In addition to a limited number of days a harvester may fish, controls include 24-hour DAS counting, trip limits on other groundfish stocks, gear restrictions, minimum mesh size restrictions, gillnet restrictions, hook limits, seasonal and year-round closures, minimum fish size restrictions, and special access programs. Specific effort control measures are described in the final rule for Amendment 16 (NMFS 2010).

Starting in 2012, a trimester hard TAC (total allowable catch) has been used as a primary accountability measure, and the fishery is suspended once 90% of the trimester TAC is reached (NMFS 2014).

Sectors: Sectors are self-selecting and largely self-regulating groups of fishermen who collaboratively manage an allocation of fish. Sectors must draft and submit formation proposals, operations plans, and sector monitoring plans, revised enforcement provisions, and clarification of the interaction of sectors with Special Management Programs, such as U.S./Canada management areas. NMFS prepares an environmental assessment (EA) annually to assess the impacts of the individual and cumulative sector operations as proposed in their operations plans.

In exchange for fishing under an ACL for each allocated species in the management plan, sectors are exempt from most common pool effort control measures, such as limited number of days at sea and trip limits. These are referred to as universal exemptions. A sector's allocation of an ACL for a particular stock is called the Annual Catch Entitlement (ACE), and is a sub-ACL of the overall fishery ACL. At-sea catch monitoring ensures that sector ACEs are not exceeded. For each permit that is eligible to join a sector, the permit's potential sector contribution (PSC) is calculated based on the permit's catch history. The ACE that is allocated to a sector is based on the sum of the PSCs for the permits that join the sector. Sector participants are not allowed to discard legal sized fish, and all fish caught count toward their sector allocations.

Regulations Shared by Common Pool and Sector Vessels: The following regulations exist for Gulf of Maine – Georges Bank American plaice (GARFO 2015):

- All commercial vessels participating in the Northeast Multispecies Fishery are required to use a Vessel Monitoring System (VMS) to report fishing activities, as well as a vessel trip report (VTR).
- Minimum size for American plaice is 14 inches.
- Sector vessels participating in Special Access Programs must only use gear approved under those programs.
- Fish fillets must have at least 2 square inches of skin while possessed on board the vessel at the time of landing.

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

IV. Gulf of Maine – Georges Bank American Plaice Data

Stock Status:

Landings and survey data are used in determining biological reference points (BRPs) for Gulf of Maine – Georges Bank American plaice. The most recent benchmark assessment of American plaice is the Groundfish Assessment Review Meeting (GARM) III analysis, which utilized a virtual population analysis (VPA) including estimates for recreational landings and commercial discards (NEFSC 2008). Prior to GARM III, the Gulf of Maine – Georges Bank American plaice stock assessment was updated as part of GARM II. GARM II included landings and discards through 2004 and abundance indices through 2005, and also employed a VPA model. In 2012, groundfish assessment updates were

made to the GARM III analysis using data through fishing year 2011. In 2015, the Northeast Fisheries Science Center released an operational assessment update to the 2012 benchmark assessment. The operational assessment updated commercial catch data, survey indices of abundance, the VPA assessment model, and reference points through 2014 (NEFSC 2015).

Biological reference points have been updated based on the GARM III assessment and the 2015 assessment update, using stock weight, catch weight, spawning stock biomass (SSB), and maturity based on an average of the last seven assessed fishing years, 2008 – 2014. The most recent BRP estimates are an equilibrium SSB at maximum sustainable yield (SSB_{MSY}) of 13,288 mt, and a fishing mortality at maximum sustainable yield (F_{MSY}) of 0.196 (NEFSC 2015).

Spawning stock biomass (SSB) in 2014 was estimated at 14,543 mt, 109% of the target biomass for this stock (SSB_{MSY}). When the 2015 assessment update was adjusted for a retrospective bias, SSB in 2014 was estimated to be 10,977 mt, or 83% of the target SSB_{MSY} *(see Figure 3).* The 2014 selected fishing mortality was estimated to be 0.08, which is 41% of the overfishing threshold proxy (F_{MSY}). After adjustment for the retrospective bias, F in 2014 was estimated to be 0.116, or 59% of the overfishing threshold. The fishing mortality has been below the target F_{MSY} since 2009 (Figure 4), thus, overfishing is not occurring. As biomass levels are still significantly greater than half $B_{MSY,}$ the stock is not overfished according to NEFSC metrics (NEFSC 2015) and is currently in a rebuilding phase. This stock has a rebuilding plan that was revised in 2014 and now has a target date of 2024, with a control rule that catch limits be set based on 75% F_{MSY}. The stock has recovered markedly since 2004, when it was overfished (NEFMC 2015).

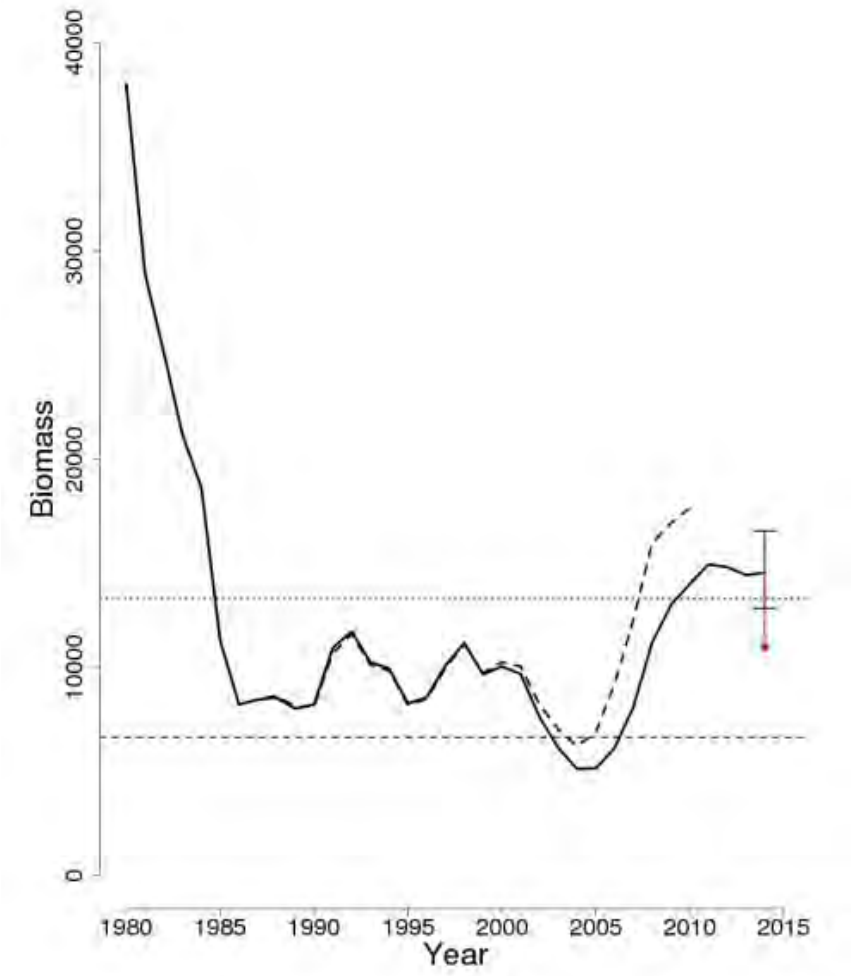

Figure 3. Trends in spawning stock biomass of Gulf of Maine – Georges Bank American plaice shown in solid (2015 update) and dashed line (previous assessment). The SSB overfishing threshold (1/2 SSB_{MSY}) is the horizontal dashed line and the SSB target (SSB_{MSY}) is the horizontal dotted line. Biomass was adjusted for a retrospective pattern to account for variability in the VPA analysis, shown in red (NEFSC 2015).

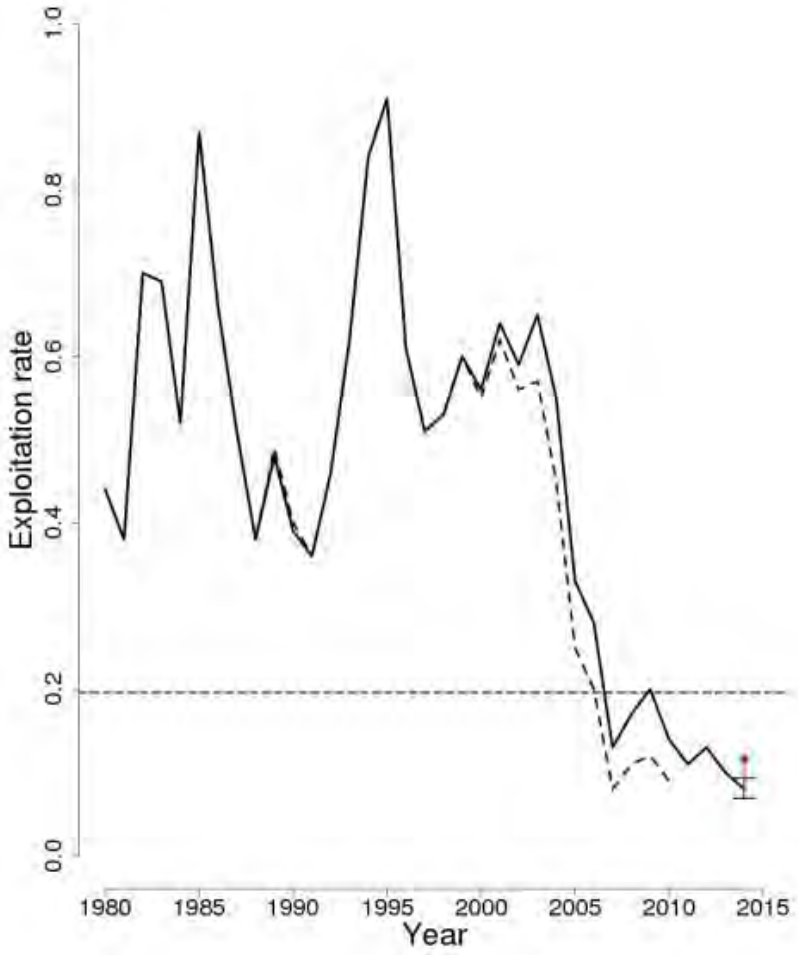

Figure 4.Trends in the fully selected fishing mortality of Gulf of Maine – Georges Bank American plaice shown in solid (2015 update) and dashed line (previous assessment). The corresponding overfishing threshold ($F_{Threshold}$) is the horizontal dashed line. Biomass was adjusted for a retrospective pattern to account for variability in the VPA analysis, shown in red (NEFSC 2015).

Stock History:

The fishery for American plaice developed in the mid-1970s as other flounder stocks became less abundant in the region, and fisheries became more regulated. In 1982, commercial landings of American plaice increased to a record high of nearly 15,000 mt, and then declined drastically to less than 3,000 mt in 1989 as the spawning stock biomass plummeted. Landings increased again in 1992 as a large 1987 year-class entered the fishery, but gradually declined until 2007 (O'Brien & Dayton, 2012). American plaice landings have stabilized between 1,200 mt and 1,800 mt since 2007 as shown in Figure 5 (NEFSC 2015).

It should be noted that the Annual Catch Limit (ACL) for American plaice was nearly cut in half in fishing year (FY) 2013 based on the 2012 GARM III assessment. In the 5 years previous, roughly half of the ACL or TAC for American plaice was being utilized.

Managers determined that while landings at the time allowed for the stock to remain above the target biomass threshold, if fishing pressure were to increase to full utilization following poor recruitment between 2008 and 2010, it could undo plaice's rebuilt status. Despite this major cut in 2013, commercial landings have not exceeded quota entitlements and landings have been relatively stable over the last decade, as shown in Figure 6 (NOAA 2015, NERO 2009).

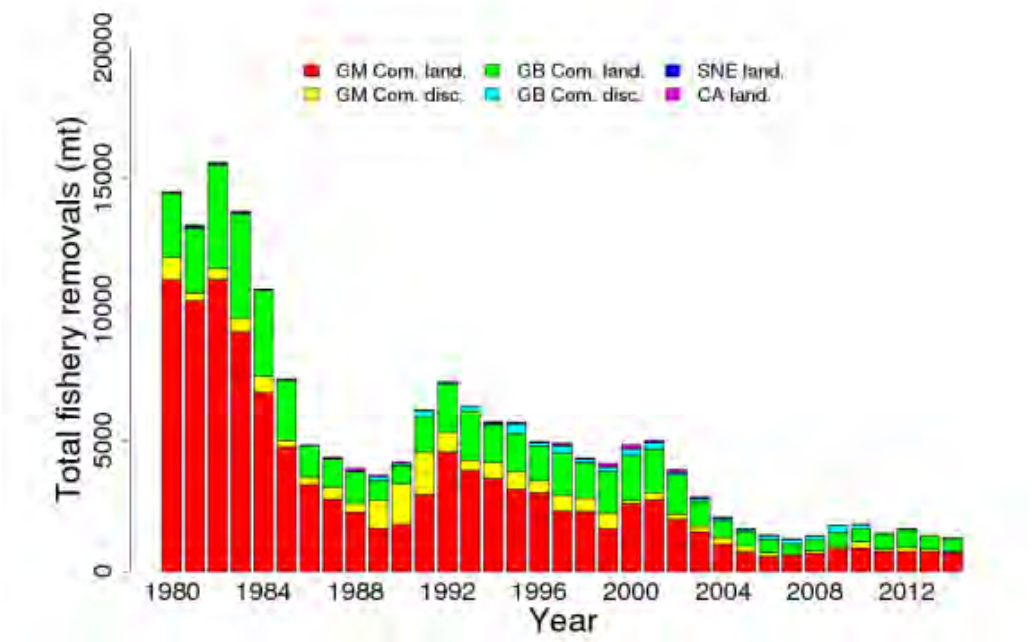

Figure 5. Total catch of Gulf of Maine – Georges Bank American plaice since 1980 by fleet (Gulf of Maine, Georges Bank, Southern New England, and Canadian) and by disposition (landings and discards)(NEFSC 2015).

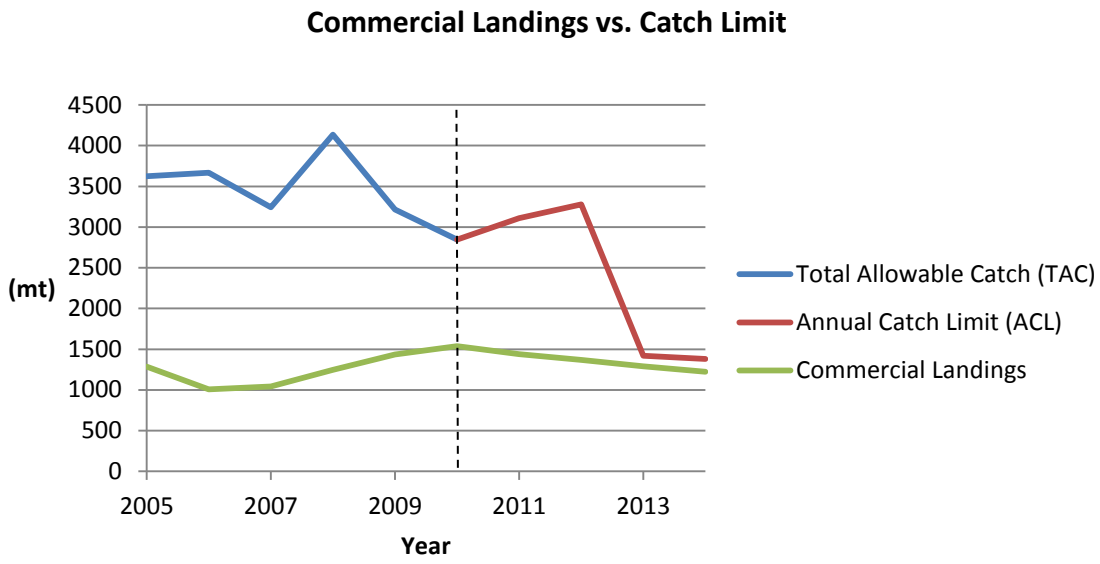

Figure 6. Trend in commercial landings vs. total allowable catch (pre-sectors) or annual catch limits (post-sectors). The dashed line represents when the current sector management system (using ACLs) was implemented in 2010. Prior to 2010, the groundfish fishery was primarily regulated by effort control (i.e. days at sea, trip limits) and there were catch targets, referred to as Total Allowable Catch (TAC), used by the management system in determining regulations (NOAA 2015, NERO 2009).

CRITERION: Sufficient data exist to determine harvest levels.

Harvest Levels:

Sufficient data exist to determine acceptable harvest levels for current and future fishing years. In the 2015 operational update, short term projections of biomass and catch were derived using the VPA model results. The annual fishery selectivity, stock age distribution, and mean weights at age were used to make projections through 2018 *(see Table 1)*. The projections start from the bias-adjusted biomass estimates, although they do not account for the likely retrospective bias in the projected years. Projected catches in fishing years 2016-2018 are based on an assumed fishing mortality at the F_{MSY} proxy. The corresponding SSB projections are conservative, given that the F_{MSY} proxy is higher than the recent fishing mortality rate. Under these scenarios, the SSB is projected to remain well above ½ SSB_{MSY}, projecting that the stock will likely not be overfished in the next four years (NEFSC 2015).

Table 1.

Fishing Year	Projected Catch (mt)	Projected SSB (mt)	Assumed F_{MSY}
2015	1,395	8,947	0.156
2016	1,695	8,645	0.196
2017	1,686	8,324	0.196
2018	1,722	8,710	0.196

As of May 2016, Overfishing Limits (OFLs), Acceptable Biological Catch (ABC), and Annual Catch Limits (ACLs) for FY 2016 – 2018 that were recommended by the Science and Statistical Committee of the NEFMC were approved by NOAA through Framework 55 to the Northeast Multispecies Fishery Management Plan. The current OFLs, ABCs, and ACLs are outlined in Table 2 below (NMFS 2016).

Table 2.

Fishing Year	Overfishing Level (OFL) (metric tons)	Acceptable Biological Catch (ABC) (mt)	Annual Catch Limit (ACL) (mt)
2016	1,695	1,297	1,183
2017	1,748	1,336	1,218
2018	1,840	1,404	1,280

Sources of Uncertainty:

The retrospective biases in spawning stock biomass and fishing mortality are major sources of uncertainty, since the sources of the biases have yet to be identified. Two other sources of uncertainty for this stock noted in the 2015 operational assessment update are the estimates of historical landings at age prior to 1984, and the magnitude of historical discards prior to 1989. Both of these factors affect the scale of the biomass and fishing mortality estimates in these years and thereby slightly influence reference point estimates to date. The 2008 GARM III benchmark assessment pointed out that small mesh fishery discards were not included in catch at age estimates for American plaice, which may have skewed the previous estimates for fishing mortality and stock age distribution. This uncertainty was addressed in the 2012 GARM III assessment, which included biomass estimates from the small mesh otter trawl, gillnet, and scallop fisheries as part of the discard at age analysis. Another potential area of uncertainty is that Georges Bank landings are not as well sampled as Gulf of Maine landings, but the vast majority of catch occurs in the Gulf of Maine and therefore the effect is likely minimal.

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

The monitoring programs in place for the Northeast multispecies fishery provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Monitoring of the common pool is carried out through several different programs. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily vessel trip reports (VTRs), which provide details on type of gear fished, area

fished, species caught and discarded, dealer information, and port of landing information, in addition to other details. The Northeast Fisheries Observer Program (NEFOP) employs at-sea observer coverage and biological sampling for the groundfish fleet. Separate from NEFOP, there are also shore-side port samplers who take biological samples from landed catch to help inform stock assessments and other fisheries research.

The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level of precision (measured as the coefficient of variation [CV]) no greater than 30% for each fishery (73 FR 4736; January 28, 2008). Eight percent of all common pool trips to fish for Gulf of Maine – Georges Bank American plaice need at-sea observers on board as required by NEFOP regulations. The Pre-Trip Notification System (PTNS) ensures fair and adequate coverage of vessels across the multispecies fishery. Vessels enter information into PTNS prior to a trip, and an algorithm randomly selects trips for coverage in order to achieve the targeted observer and at-sea monitor coverage across sectors, areas, and gear types.

Sectors have additional monitoring requirements. Sector operations plans specify how a sector will monitor its catch to assure that sector catch does not exceed the sector allocation. Industry funding of at-sea monitoring (ASM) was recently implemented in March 2016, which was a transition from the federal government covering the costs of ASM. For FY 2016, NOAA adjusted the target coverage level to 14% of sector trips. This includes NEFOP coverage, which has been roughly 4% recently. Thus, sector members will pay for coverage on approximately 10% of trips in FY 2016. Previously, sector required at-sea monitoring coverage was typically between 17% and 22%. While this 14% coverage level is lower than in previous years (prior to industry-funded ASM), additional factors were accounted for in determining the target so as to ensure compliance with the 30% CV requirement, including: removing ASM coverage for a subset of sector trips, using more years of discard data to predict coverage levels, and basing the target on predictions for stocks that are at a higher risk for error in the discard estimate (NMFS 2016). All sector vessels are still required to submit weekly VTRs in accordance with Amendment 16 to the Northeast Multispecies FMP.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

Based on the data collected through monitoring, the Northeast multispecies complex is routinely evaluated and necessary changes to management measures are made through biennial Framework Adjustments.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the Northeast Multispecies FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations. In the common pool, enforcement is focused on compliance with DAS regulations, seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures. Enforcement for sector vessels primarily relies on monitoring harvest levels through sector reporting and VTRs (in addition to some of the measures described above for which sectors are not universally exempt); however individual sectors are also responsible for self-enforcement. Dealer reporting is a requirement of dealers who receive the fish.

It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: ACE overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. American plaice is not identified as a species of concern under OLE's enforcement priorities.

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Gulf of Maine Research Institute
Responsibly Harvested Seafood from the Gulf of Maine Region

Report on
Atlantic Mackerel (US)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *Atlantic mackerel is managed by the National Marine Fisheries Service (NMFS) and Mid-Atlantic Fishery Management Council (MAFMC), under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan, which utilizes the best available science to determine sustainable harvest limits.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *According to the 2005 42nd Stock Assessment Workshop (42nd SAW), Atlantic mackerel is not overfished ($SSB > ½\ SSB_{MSY}$) and overfishing is not occurring ($F<F_{MSY}$). The 2010 Transboundary Resource Assessment Committee (TRAC) stock assessment was uncertain, and listed the status of the Atlantic mackerel stock as unknown.*

☒ Sufficient data exists to determine harvest levels.

- *The 2005 42nd SAW determined biological reference points for the management of the Atlantic mackerel stock. The 2010 TRAC report was unable to conclude biological reference points, but was able to set harvest recommendations based on the outcomes of the assessment. Ultimately, the Council and/or the Regional Administrator sets the harvest levels (Annual Catch Limits) based on this data and information, which incorporate uncertainty.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *In the US, Atlantic mackerel catch is monitored through vessel trip reports (VTRs), observers, and dealer reports. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of mackerel.*

Verified as of July, 2012

I. Definition of Atlantic Mackerel

Atlantic mackerel (*Scomber scombrus*) is harvested in US waters from the coast of Maine, south to North Carolina (see Figure 1). While the stock unit extends into mid-Atlantic waters, this report focuses on the US's management and harvesting of mackerel in the area outlined by Gulf of Maine Responsibly Harvested Standard[1]. All management of mackerel in the US waters fall under federal regulations, as there are no state management regulations of mackerel. The primary gear utilized to target mackerel is mid-water trawl, and a minimal amount of mackerel is harvested using bottom trawls and fish weirs.

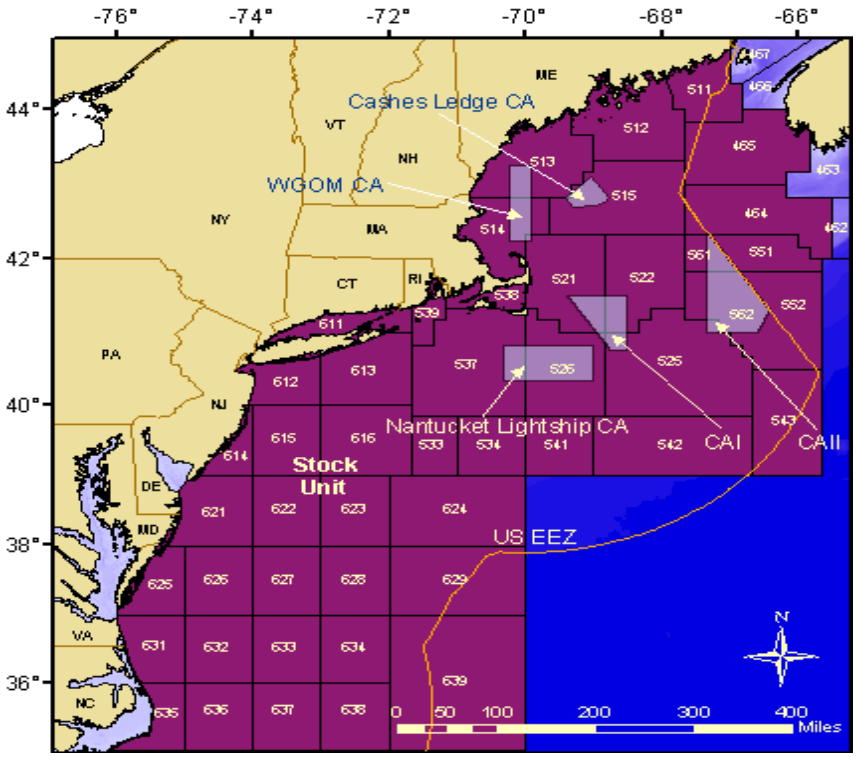

Figure 1. Statistical areas that define the Atlantic mackerel stock. The dashed line represents the United States Exclusive Economic Zone (NEFSC 2006).

II. Description of the Management Authority and Regulatory Process

Responsibility of Atlantic mackerel management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The Mid-Atlantic Fishery Management Council (MAFMC) facilitates the development of Atlantic mackerel regulations and manages the mackerel under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. The MAFMC consists of 21 voting members, including the Regional Administrator for

[1] This excludes mackerel harvested south of statistical areas 521, 522, 561 and mackerel harvested beyond the US's EEZ.

NMFS, state fisheries officials from each of the Mid-Atlantic States, and governor nominated public representatives who are eventually appointed by the Secretary of Commerce.

For Atlantic mackerel management, the MAFMC is advised by a species committee that currently consists of representatives from state and federal management agencies, the fishing industry, and environmental groups. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the species committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. A Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of Atlantic mackerel, provides guidance and terms of reference during the development of mackerel regulations. Then the PDT provides reports to the oversight committee in response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate.

III. Atlantic Mackerel Data

In the US, the Atlantic mackerel stock was last assessed by the 42nd Stock Assessment Workshop (42nd SAW) in 2005, and the Assessment Summary Report was published in 2006 (NEFSC 2006a).

The 2005 stock assessment utilized a model known as an aged structured assessment program (ASAP) to determine the stock status of Atlantic mackerel. This model incorporates age structure, recruitment rates, surveys data, changes in selectivity, and uncertainty in the input data. In addition, the ASAP model applied data from US and Canadian landings, and NEFSC spring surveys to assess the stock. Applying the ASAP model to assess spawning stock biomass and fishing mortality determined that the Atlantic mackerel stock is not overfished and overfishing was not occurring.

As determined in the 42nd SAW, the biological reference point (BRP) used to determine if Atlantic mackerel is overfished is SSB_{MSY} = 644,000 metric tons (mt). In 2004, spawning stock biomass (SSB) was estimated to be 2,300,000 mt, and thus above the SSB_{MSY} threshold (644,000 mt).

The 2005 assessment also determined that the BRP for assessing if overfishing of the Atlantic mackerel stock is occurring is when the fishing mortality (F) exceeds 0.16. In 2004, F=0.05 and thus overfishing of the stock was not occurring (Table 1).

Table 1. Biological Reference Points Used to Determine Overfished and Overfishing Statuses of Atlantic Mackerel

SSB_{MSY} (Overfished threshold)	644,000 mt
2004 SSB	2,300,000 mt
F_{MSY} (Overfishing threshold)	0.16
2004 F	0.05

The following excerpt is from the 42nd SAW Report summarizes trends in Atlantic mackerel landings since 1960, which are depicted in Figure 3:

> Commercial mackerel landings by the United States averaged 2,368 mt from 1960-1983, peaked at 31,261 mt in 1990, and declined to 4,666 mt in 1993. USA landings increased to 16,137 mt in 1996, declined to 5,646 mt in 2000 and steadily increased to 53,724 mt in 2004. Recreational landings in the USA have generally declined during 1979-2004. Landings averaged 2,945 mt during 1979-1988 and declined to a low of 344 mt in 1992. Landings in the US sport fishery peaked at 1,735 mt in 1997, declining slightly thereafter, but remaining relatively steady until declining to 724 mt in 2003 and 467 mt in 2004 (NEFSC 2006a).

Historically, the distant water fleet (DWF), or vessels harvesting under foreign country flags, harvested the majority of the Atlantic mackerel catch in US waters, peaking at 385,000 mt. With the implementation of the Magnuson-Stevens Act and the establishment of the Exclusive Economic Zone (EEZ), DWF landings fell to 400 mt. The original Atlantic Mackerel Fishery Management Plan of 1978 permitted the DWF to harvest mackerel within the EEZ and allowed a gradual increase in landings until the 1990s, when new policies were implemented to eliminate the DWF mackerel fishery within the EEZ.

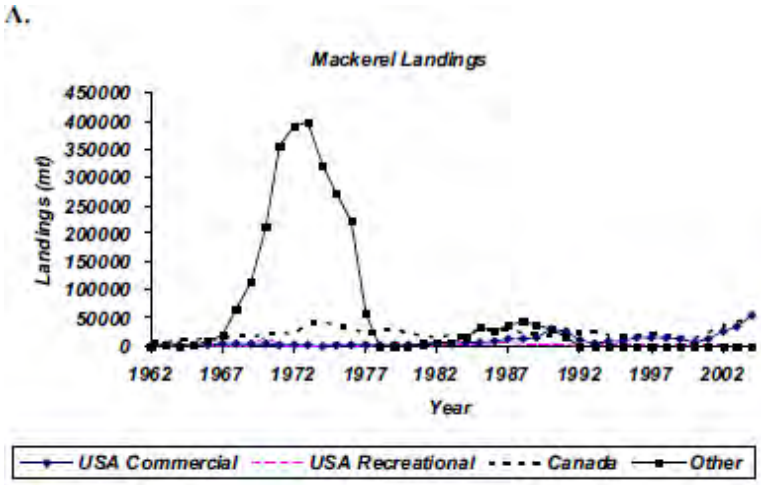

Figure 2. Total Atlantic Mackerel Catch, from 1962 to 2004 (NEFSC 2006a)

Transboundary Resources Assessment Committee Stock Assessment

Because Atlantic mackerel are a migratory species and the stock straddles US and Canadian waters, the first ever joint US/Canada Atlantic mackerel assessment was conducted in 2010 by the Transboundary Resources Assessment Committee (TRAC). Since 1998, the TRAC has "reviewed stock assessments and projections necessary to support management activities for shared resources across the US-Canada boundary in the Gulf of Maine-Georges Bank region" (NEFSC 2012). Prior to the 2010 TRAC assessment, each country assessed the stock individually while peer reviewing each other's assessments.

The TRAC agreed to use NEFSC spring survey data, as well as bottom-trawl and mid-water catch per unit of effort (CPUE) indices in the Atlantic mackerel assessment (TRAC 2010). The assessment utilized a VPA-ADAPT model to reconcile discrepancies between the survey data and CPUE indices.

Utilizing additional data and alternative model that was not included in the 42nd SAW, the 2010 TRAC assessment produced results that vary from that of the 2005 42nd SAW findings. The TRAC assessment suggested that F increased from 0.17 in 2000 to 0.51 in 2008, while SSB = 96,968 mt in 2008 (TRAC 2010). The TRAC assessment recommends using "deterministic per recruit reference points as proxies for F_{MSY} and these were $F_{0.1}$=0.29 and $F_{40\%}$=0.25" (TRAC 2010), but the assessment's estimates for SSB and MSY were considered highly uncertain. Based on the uncertainty around the reference points, the TRAC assessment recommended that the regulatory body implement a short-term, precautionary strategy where catch levels not exceed the average annual landings from 2006-2008, or 80,000 mt (TRAC 2010). Total landings between the US and Canada in 2008 were 50,685 mt, and have remained below 80,000 mt since 2006.

IV. Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan

The Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (FMP) was implemented in 1983 to reduce fishing mortality of heavily fished stocks, promote rebuilding to sustainable biomass levels, and address impacts on stocks by foreign fleets. Prior to the FMP, the mackerel, squid, and butterfish fisheries were managed separately, under individual management plans. The 1983 merger of the plans sought to synthesize regulatory similarities of the three fisheries (MAFMC 1981). Atlantic mackerel is managed in federal waters and there are no state management measures for Atlantic mackerel.

The FMP utilizes seasonal and year-round area closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size, number of nets/hooks, etc.), minimum fish size limits, trip limits (i.e., limiting fishermen to a certain poundage of fish per trip), limited access (i.e., limiting the number of participants in the fishery) and annual catch limits (ACLs) as management measures (CFR 2012). In 2010, Amendment 13 to the FMP was implemented in an effort to address the requirements of the Magnuson-Stevens Reauthorization Act (MSRA) of 2006. The MSRA requires the MAFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) for all managed stocks, including mackerel. This action implements a process for calculating an ACL in addition to the Overfishing Level (OFL) and Acceptable Biological Catch (ABC) for each stock. The MAFMC Science and Statistics Committee recommends the ABC to the MAFMC, and the ABC must be equal to or less than the OFL. The ACL, or US harvest level, is determined by estimating the Canadian harvest for the upcoming year and subtracting that from that from the ABC. The MAFMC approves final ACLs, but the ACL cannot exceed the SCC's recommended levels. The mackerel fishery operates on a calendar year, from January 1st to December 31st. The Atlantic Mackerel, Squid and Butterfish Monitoring Committee (MC) reviews the ACL and determines how the quota will be broken into subcomponents and allocated to the commercial and recreational segments of the fishery. The ACL for mackerel is reviewed by the MC at a minimum of every five years.

Amendment 11 is the most recent modification to the FMP and new management measures were implemented on March 1, 2012. The amendment establishes a tiered limited access program for Atlantic mackerel in an effort to manage the mackerel stock sustainably without impeding utilization of the resource (MAFMC 2011). The three tiered permit system aims to reduce the capacity of the mackerel fishery, while enabling qualified harvesters to continue fishing for mackerel at a level that is comparable to their historic participation in the fishery (NOAA 2012). Table 2 depicts a breakdown of each tier.

Table 2. Atlantic Mackerel Limited Access Permits and Possession Limits (NOAA 2012)			
Permit	**For vessels with…**	**Possession limit when fishery is open**	**Possession limit when 90% of quota is taken**
Tier 1,	The highest level of participation	No possession limit	20,000 lb
Tier 2	A moderate level of historic participation	135,000 lb	20,000 lb
Tier 3	A low level of historic participation	100,000 lb	20,000 lb
Open Access	Any vessel that does not qualify for above, or new participants	20,000 lb	20,000 lb

The Atlantic mackerel fishing year extends from January 1 to December 31, and possession of mackerel is prohibited by all permit holders when 100% of the quota has been harvested.

V. Monitoring

Monitoring of the Atlantic mackerel fishery is carried out through several different programs. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily vessel trip reports (VTRs), which provide details on type of gear fished, area fished, species caught (and discarded), dealer information, and port of landing information, in addition to other details. The Northeast Fisheries Observer Program employs at-sea observer coverage and port sampling for the groundfish fleet. The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level of precision (measured as the coefficient of variation [CV]) no greater than 30% for each (73 FR 4736; January 28, 2008). In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage.

There are also shore-side port samplers who periodically work at fish auctions and exchanges taking biological samples. This program ensures compliance with the MSA in addition to the Endangered Species Act and the Marine Mammal Protection Act. Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed. Weekly dealer reports are collected and analyzed by the NMFS Northeast Regional Office and are assessed against the annual quota on a weekly basis.

VI. Enforcement

In general, enforcement of the Atlantic Mackerel, Squid and Butterfish FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program, which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the EEZ. OLE also partners with the U.S. Coast Guard and various other federal agencies, fishery management councils, and non-governmental organizations. Enforcement for vessels in the mackerel fishery primarily rely on monitoring harvest levels through dealer reporting and VTRs.

VII. References

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Verified as of July, 2012

Gulf of Maine Research Institute

Science. Education. Community.

Verification Report on
Gulf of Maine/Georges Bank Stock of Pollock (*Pollachius virens*)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *Pollock is managed by NMFS and NEFMC, and regulated by the Northeast Multispecies Fishery Management Plan, which utilizes the best available science to inform the management process, and to ultimately set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *According to the most recent assessment data, Atlantic pollock spawning stock biomass is above management target levels. The stock is not overfished and overfishing is not occurring.*

☒ Sufficient data exists to determine harvest levels.

- *The 2010 50th Northeast Regional Stock Assessment Workshop (SAW 50) and the most recent operational assessment in 2017 utilized fisheries-dependent and -independent data to determine stock status and biological reference points (BRPs), which are assessed through the NEFMC process. Ultimately, the NEFMC sets the harvest levels based on this data, which incorporate uncertainty. Atlantic pollock is not considered a data poor species.*
- *This stock is unique in that the assessment considers two different selectivity profiles. While they give different estimates of current biomass, both suggest that the stock is healthy and that fishing mortality is low.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *Pollock catch is monitored through vessel trip reports (VTRs), observers, dealer reports; and for sectors, additional at-sea monitoring. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of Pollock.*

I. Definition of Gulf of Maine/Georges Bank Pollock

Gulf of Maine/Georges Bank pollock (*Pollachius virens*) is harvested from the waters off the coast of Maine, south to New Jersey (see Figure 1). While the pollock stock unit extends into southern New England waters, this report focuses on the management and harvesting of pollock in the area outlined by the Gulf of Maine Responsibly Harvested Standard[1]. The primary gear types utilized to target pollock are otter trawl and gillnet.

Gulf of Maine/Georges Bank redfish, pollock, and haddock collectively received Marine Stewardship Council (MSC) certification specifically for otter trawl gear in July 2016. These three otter trawl fisheries will need to be re-assessed in July 2020 in order to maintain certification. Otter trawl catches comprise more than 70% of pollock, haddock, and redfish landings collectively (MSC 2016).

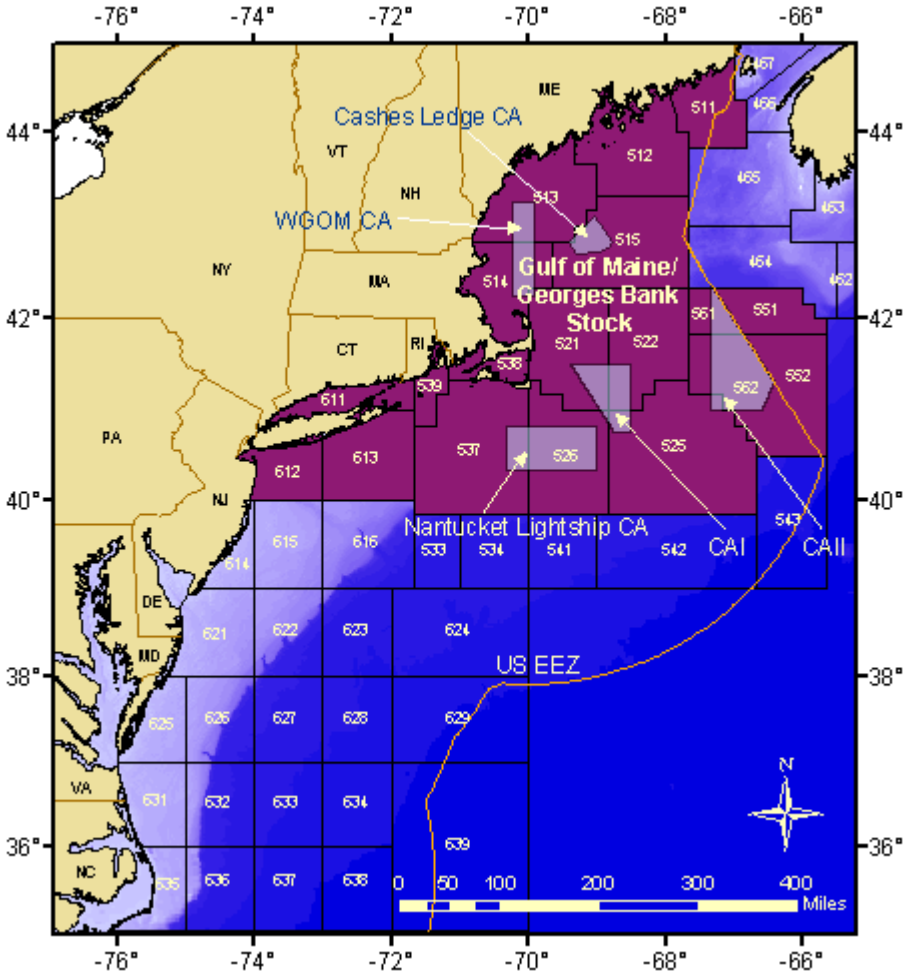

Figure 1. Statistical areas that define the Gulf of Maine/Georges Bank stock of pollock. The orange line represents the United States Exclusive Economic Zone (NEFSC 2006).

[1] This excludes pollock harvested in statistical area 536 and all other areas directly west of statistical area 525.

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of the Management Authority and Regulatory Process

Responsibility of Gulf of Maine/Georges Bank pollock management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of pollock regulations as part of a complex of 16 groundfish species that are managed together as the Northeast Multispecies Fishery. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For Northeast multispecies fisheries management, a sub-set of NEFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the oversight committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the oversight committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of pollock. Then the PDT provides reports to the oversight committee in response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The NEFMC is also assisted by the members of the Scientific and Statistical Committee (SSC); SSC members review and participate in stock assessment

updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of this process.

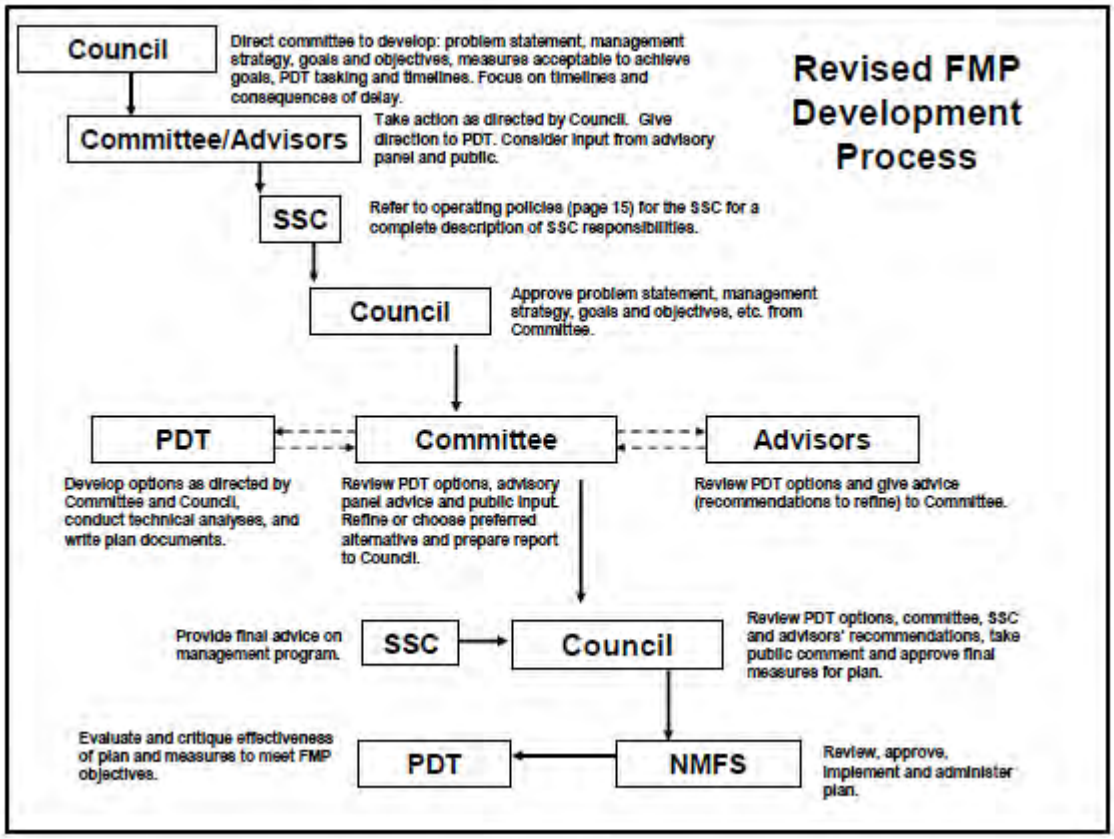

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Northeast Multispecies Fisheries Management Plan

The Northeast Multispecies Fishery Management Plan (FMP) was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks and to promote rebuilding to sustainable biomass levels. Sixteen species of groundfish are managed under Amendment 16 to the Northeast Multispecies FMP. Thirteen large-mesh species are managed together based on fish size and type of gear used to harvest the fish: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, white hake, and wolffish. Because several large-mesh species are managed as two or more separate stocks, e.g., Gulf of Maine haddock and Georges Bank haddock, there are a total of 20 separate stocks of groundfish managed under the FMP. The other three species (silver hake [or whiting], red hake, and offshore hake) are managed under a separate small-mesh multispecies program pursuant to Amendment 12 of the Northeast Multispecies FMP.

During the 1990s and until April 2009, the groundfish complex was primarily managed under the Days-At-Sea (DAS) system: by seasonal and year-round area closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size, number of nets/hooks, etc.), minimum fish size

limits, trip limits (i.e., limiting fishermen to a certain poundage of fish per trip), limited access (i.e., limiting the number of participants in the fishery) and restrictions on the number of days a vessel is allowed to fish for groundfish each year (i.e., days-at-sea) (NEFMC 2009). In May 2004, Amendment 13 to the FMP implemented formal rebuilding plans for groundfish stocks, including pollock, based on revised biomass and fishing mortality targets derived by the Working Group on Re-evaluation of Biological Reference Points for New England Groundfish. Amendment 13 also marked the development of the first sector in New England (the Georges Bank Hook Sector on Cape Cod). The overall goal of these actions was to reduce fishing mortality to rebuild depleted groundfish stocks to target biomasses.

In May 2010, Amendment 16 authorized the formation of individual fishing organizations, which shifted the management regime from the DAS system to an output-controlled system, referred to as sectors. In addition to general regulations for the fishery, Amendment 16 also implemented species- and stock-specific regulations for vessels in the common pool and in sectors. Beginning in FY 2010, commercial harvesters of groundfish have been managed in two self-selecting categories: common pool and sectors. From the start in 2010, the vast majority of the Northeast groundfish fishery has been enrolled in sectors.

The current regulations setting the catch levels for each of the 20 groundfish stocks, which were implemented by FW 48 to Amendment 16 in 2013, and revised in FW 50 in 2013, implemented new requirements under the Magnuson-Stevens Reauthorization Act (MSRA) of 2006. The MSRA requires the NEFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) that enable rebuilding within specified time frames for all managed stocks. This action implements a process for calculating an ACL in addition to the overfishing level (OFL) and acceptable biological catch (ABC) for each stock. Recommendations for these figures are developed by the PDT. The Scientific and Statistical Committee (SSC) recommends ABC levels, and the NEFMC approves final ACLs, but cannot exceed the SSC's recommended levels. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, sectors, and the common pool. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL. Although the following stocks have ACLs, possession is prohibited: northern and southern windowpane flounder, ocean pout, and wolffish. In addition, Atlantic halibut catch is limited to one fish per trip. Northeast Multispecies permit holders are eligible to receive an allocation for the remaining groundfish stocks.

Common Pool

Members in the common pool are managed by an effort control system that regulates the number of days a harvester may fish. In addition to a limited number of days a harvester may fish, controls include 24-hour days-at-sea counting, trip limits on other groundfish stocks, gear restrictions, minimum mesh size restrictions, gillnet restrictions, hook limits, seasonal and year-round closures, minimum fish size restrictions, and special access programs. Specific effort control measures, such as minimum mesh size and trip limits, are described in the final rule for Amendment 16 (NMFS 2010). For FY 2016, the common pool possession for pollock was unlimited (81 FR 26428; 2 May 2016).

Starting in 2012, a trimester hard TAC (total allowable catch) has been used as a primary accountability measure (AM) and the fishery is suspended once 90% of the trimester TAC is reached (79 FR 14957; 17 March 2014).

Sectors

Nineteen sectors have been authorized in the New England region. Sectors are self-selecting and largely self-regulating groups of fishermen who collaboratively manage an allocation of fish. Sectors must draft and submit formation proposals, operations plans, and sector monitoring plans, revised enforcement provisions, and clarification of the interaction of sectors with Special Management Programs, such as U.S./Canada management areas. NMFS prepares an environmental assessment (EA) annually to assess the impacts of the individual and cumulative sector operations as proposed in their operations plans.

In exchange for fishing under an ACL for each allocated species in the management plan, sectors are exempt from most common pool effort control measures, such as limited number of days at sea and trip limits. These are referred to as universal exemptions. A sector's allocation of an ACL for a particular stock is called the Annual Catch Entitlement (ACE) and is a sub-ACL of the overall fishery ACL. At-sea catch monitoring ensures that sector ACEs are not exceeded. For each permit that is eligible to join a sector, the permit's Potential Sector Contribution (PSC) is calculated based on the permit's catch history. The ACE that is allocated to a sector is based on the sum of the PSCs for the permits that join the sector. Sector participants are not allowed to discard legal sized fish, and all fish caught count toward their allocations.

If the ACL is not reached in a given year, sectors can carry over a maximum of 10% of the unused ACL into the following year. This maximum of 10% can be reduced if the carry over, in addition to the ACL of the upcoming year, exceeds the total ABC (NMFS 2016).

Regulations Shared by Common Pool and Sector Vessels

- All commercial vessels participating in the Northeast Multispecies Fishery are required to use a Vessel Monitoring System (VMS) to report fishing activities, as well as vessel trip reports (VTR).
- Minimum size for pollock is 19 inches.
- Sector vessels participating in Special Access Programs must only use gear approved under those programs.
- Fish fillets must have skin on while possessed on board a vessel at the time of landing in order to meet minimum size requirements. (NOAA 2017).

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

CRITERION: Sufficient data exist to determine harvest levels.

IV. Gulf of Maine/Georges Bank Pollock Data

Stock Status

The Gulf of Maine/Georges Bank stock of pollock was assessed by the 50th Northeast Regional Stock Assessment Workshop (SAW 50) in June 2010, and the Assessment Summary Report (NMFS CRD 10-09) was published in July 2010 (NEFSC 2010). Since SAW 50, there have been three operational assessments, in 2014, 2015, and 2017.

SAW 50 utilized a model known as an aged structured assessment program (ASAP) to determine the stock status of pollock, which was different than previous models used to assess pollock. This model incorporated age structure, additional surveys, more comprehensive catch information, changes in selectivity, and uncertainty in the input data. Catch-at age- and Northeast Fisheries Science Center (NEFSC) spring and fall surveys, both including data for 1970-2009, were used in the ASAP model. The biological reference point (BRP) to determine if pollock is overfished was ½ SSB_{MSY} = $B_{THRESHOLD}$ = 45,500 metric tons (mt). In 2009, spawning stock biomass (SSB) was estimated to be 196,000 mt, and thus well above the ½ SSB_{MSY} threshold. In 2009, fishing mortality was estimated to be 0.07, below the fishing mortality threshold of 0.25, and thus overfishing of the pollock stock was not occurring. These numbers indicated that pollock was not overfished and overfishing was not occurring as of 2009 (NEFSC 2010).

The previous stock assessment to SAW 50 was the Groundfish Assessment Review Meeting (GARM) III in 2008, which showed that pollock was considered overfished and overfishing was deemed to be occurring. However, it was subsequently discovered that the GARM III assessment determined stock status based on erroneous methods and assessment uncertainties. Revisions were made to the GARM III assessment, and SAW 50 was scheduled as soon as possible in order to fully address these errors. Under federal law, NMFS is empowered to enact emergency rules, such as raising catch limits. Due to the findings of the SAW 50 pollock stock assessment, NMFS decided to implement an emergency ruling. In order to enact an emergency ruling, the following criteria must be met:

1. The emergency results from recent, unforeseen events or recently discovered circumstances;
2. The emergency presents serious conservation or management problems in the fishery;
3. The emergency can be addressed through emergency regulations for which the immediate benefits outweigh the value of the advance notice, public comment, and deliberative consideration of the impacts on participants to the same extent as would be expected under normal rulemaking process (62 FR 44421, August 21, 1997).

NMFS implemented an emergency rule that revised and substantially increased pollock catch limits in FY 2010, while ensuring the increased catch limits were consistent with sustaining a long-term biomass associated with maximum sustainable yield. The emergency ruling increased acceptable biological catch from 3,293 mt in FY 2009 to 19,800 mt in FY 2010 (75 FR 41997, July 20, 2010).

Operational assessments

The 2014 operational assessment updated BRPs, determining that the overfishing threshold proxy of $F_{40\%} = 0.27$ and the biomass proxy = 76,900 mt. SSB_{MSY} was considerably less than the estimates from SAW 50 due to decreases of weight-at-age during this time period. Fishing mortality in 2013 was estimated to be at 0.10 while the SSB was estimated to be 126,000 mt. (Hendrickson et al 2015).

The 2015 operational assessment used both a base model (dome-shaped survey selectivity) and a flat selectivity sensitivity model (flat-topped survey selectivity) within ASAP. Pollock stock status is sensitive to gear selectivity at age when looking at older ages. The base (dome) model showed a cryptic biomass of older fish that neither the survey nor the landings reflected. The flat selectivity model run with ages 6 – 9+ resulted in a lower SSB and higher F. When both models were adjusted for retrospective bias, the base model SSB was within the 90% confidence interval. The base model was used to recommend management advice while the flat selectivity model was used to demonstrate the sensitivity of the assessment results to survey selectivity assumptions. The BRPs determined from both models are listed in Table 1, showing that pollock is not overfished and overfishing is not occurring (NEFSC 2015).

Table 1. Biological Reference Points for Pollock in the 2015 Operational Assessment

	Base model	Flat sel sensitivity model
SSB_{MSY} (B_{TARGET})	105,226 mt	54,900 mt
2014 SSB	198,847 mt	57,327 mt
½ SSB_{MSY} (Overfished threshold)	52,613 mt	27,450mt
F_{MSY} proxy $F_{40\%}$ (Overfishing threshold)	0.277	0.252
2014 F	0.133	0.051

The 2017 operational assessment also used both the base model (dome-shaped survey selectivity) and a flat selectivity sensitivity model (flat-topped survey selectivity). The base model is used for management advice, and the flat selectivity model is meant to demonstrate how sensitive the assessment results are to different selectivity assumptions. It was determined that pollock is not overfished and overfishing is not occurring – the results of the two models are seen in Table 2 below. Adjustments were made for major retrospective patterns in both models.

Table 2. Biological Reference Points for Pollock in the 2017 Operational Assessment		
	Base model	Flat sel sensitivity model
SSB_{MSY} (B_{TARGET})	105,510 mt	60,738 mt
2016 SSB	183,907 mt	72,889 mt
½ SSB_{MSY} (Overfished threshold)	52,755 mt	30, 369 mt
F_{MSY} proxy $F_{40\%}$ (Overfishing threshold)	0.26	0.249
2016 F	0.036	0.079

Sources of Uncertainty

The SAW 50 assessment included the consideration of pollock as a transboundary resource as a possible source of uncertainty for management decisions and projections. Another source of uncertainty was that the landings data in the assessment were determined by market categories (large, medium, small) that are variable throughout New England and through time. It was recommended that catch at age was a more appropriate measure of landings as opposed to market category (NEFSC 2010).

In both the 2015 and 2017 operational assessments, the largest source of uncertainty was selectivity from the fisheries-independent survey. The base model suggests that there is a large, unidentified biomass of older fish within the fishery that cannot be confirmed. If the flat topped selectivity is assumed, the unidentified biomass estimate is smaller. Recommendations were made to explore the configuration of the ASAP model to address some of these uncertainties in the next benchmark assessment. Additional studies on gear selectivity were recommended as future research needs to further understand the selectivity shape of fisheries-independent surveys (NEFSC 2017). An additional uncertainty is the size of the 2013 year class, but that uncertainty will diminish with further years of data (NEFSC 2017).

Stock History

Prior to the 1980s, Atlantic pollock were caught as bycatch in demersal otter trawl fisheries, with landings of about 4,000 mt yearly. In the 1980s, fishing effort became more directed, peaking at 24,000 mt in 1986 and 1987. Following this peak, landings declined to a low of 4,000 mt in 1996 (NEFSC 2010). Pollock catches increased again, peaking at around 12,000 mt in 2008 and have been mostly on the decline since then. Recreational catches increased from 600 mt in 2009 to around 1,600 mt in 2013 (Hendrickson et al 2015). In 2016, commercial landings were at 2,582 mt and recreational landings dropped down to 352 mt (NEFSC 2017). These trends are reflected in Figure 3.

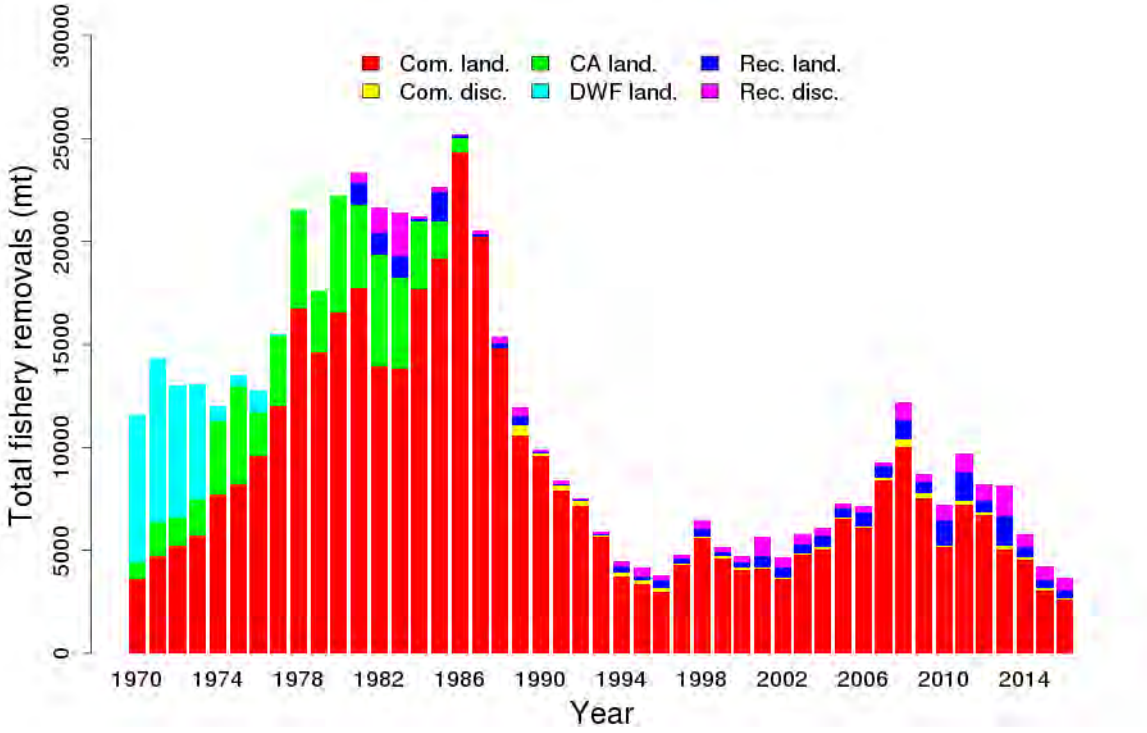

Figure 3. Total landings and discards of pollock (U.S. commercial landings and discards, Canadian commercial landings, distant water fleet landings, and recreational landings and discards) between 1970 and 2016 (NEFSC 2017).

Harvest Levels

Since the emergency ruling in 2010, catch limits have remained at similar levels. The catch limits for FY 2016-2018 can be found in Table 2 below (81 FR 26428; 2 May 2016).

Table 2. Pollock Catch Levels (mt) for FY 2016-2018			
Pollock Regulations	2016	2017	2018
Overfishing Level (OFL)	27,668	32,004	34,745
Acceptable Biological Catch	21,312	21,312	21,312
Groundfish sub-ACL	17,817	17,817	17,817
Sector sub-ACL	17,705	17,705	17,705
Common Pool sub-ACL	112	112	112
State Waters ACL subcomponent	1,279	1,279	1,279
Other ACL sub-component	1,279	1,279	1,279

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

The monitoring programs in place for the Northeast multispecies fishery provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Monitoring of the common pool is carried out through several different programs. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily vessel trip reports (VTRs), which provide details on type of gear fished, area fished, species caught (and discarded), dealer information, and port of landing information, in addition to other details. The New England Fisheries Observer Program (NEFOP) employs at-sea observer coverage and biological sampling for the groundfish fleet. Separate from NEFOP, there are also shore-side port samplers who take biological samples from landed catch to help inform stock assessments and other fisheries research.

The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level of precision (measured as the coefficient of variation [CV]) no greater than 30% for each fishery (73 FR 4736; January 28, 2008). The Pre-Trip Notification System (PTNS) ensures fair and adequate coverage of vessels across the multispecies fishery. Vessels enter information into PTNS prior to a trip, and an algorithm randomly selects trips for coverage in order to achieve the targeted observer and at-sea monitor coverage across sectors, areas, and gear types. In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage.

Sectors have additional monitoring requirements. Sector operations plans specify how a sector will monitor its catch to assure that sector catch does not exceed the sector allocation. Industry funding of at-sea monitoring (ASM) was introduced in March 2016, beginning the transition from the federal government covering the costs of ASM to the industry covering the costs. NOAA reimbursed the industry 85% of its expenses in FY 2016 and 60% in FY 2017 through a grant from the Atlantic States Marine Fisheries Commission (ASMFC). During FY 2018, ASM will be fully funded by NOAA because Congress appropriated additional funding. For FY 2018, total target coverage is 15% for ASM based on an average of ASM data from FY 2014-2016. The Northeast Fishery Observer Program (NEFOP) covers 8% of the target coverage, while the remaining 7% must be covered by industry ASM.

Previously, sector required at-sea monitoring coverage was typically between 17% and 22%. In 2016, additional factors were accounted for in determining the target so as to ensure compliance with the 30% CV requirement, including: removing ASM coverage for a subset of sector trips,

using more years of discard data to predict coverage levels, and basing the target on predictions for stocks that are at a higher risk for error in the discard estimate (NMFS 2016). All sector vessels are still required to submit weekly VTRs in accordance with Amendment 16 to the Northeast Multispecies FMP.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

Based on the data collected through monitoring, the Northeast multispecies complex is routinely evaluated and necessary changes to management measures are made through biennial Framework Adjustments.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the Northeast Multispecies FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations.

In the common pool, enforcement is focused on compliance with DAS, seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures. Enforcement for sector vessels primarily relies on monitoring harvest levels through sector reporting and VTRs (in addition to some of the measures described above for which sectors are not universally exempt); however individual sectors are also responsible for self-enforcement. Dealer reporting is a requirement of dealers who receive the fish.

It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: ACE overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. Atlantic pollock is not identified as a species of concern under OLE's enforcement priorities. Data available on enforcement actions between March 2010 - February 2018 shows that in the Northeast, there were no specific violations involving pollock (NOAA 2018). Of the general

enforcement actions reported that could have pertained to fishermen in the Northeast Multispecies fishery (although not specified in these more general violations), the most predominant problems were related to fishing in closed areas, reporting violations, gear violations, and possession or overage violations. In total, there were less than 25 of these possible NE Multispecies fishery violations between March 2010 – February 2018 (NOAA 2018). Many of the recent cases involved noncompliance with possession limits, particularly for cod.

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Responsibly Harvested Seafood from the Gulf of Maine Region
Report on
Canadian Pollock Stock (4x5) in the Gulf of Maine Region

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.
- *4X5 pollock is managed by the Canadian Department of Fisheries and Oceans (DFO), and the Scotia-Fundy Groundfish Management Plan, in addition to more detailed Conservation Harvesting Plans for each fleet.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.
- *4X5Y pollock: SSB is 27,700t, below the recommend B_{REF} of 30,00t, but quota reduction has ensured that F has remained below the recommend reference point (<0.2) since 2006, resulting in the pollock biomass recovering from a historical low of 7,500t that was witnessed in 2000.*

☒ Sufficient data exists to determine harvest levels.
- *The 2009 stock assessment report for the Western Component of the pollock stock utilized fisheries –dependent and –independent data to determine target levels. The annual TAC is set based on these data.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.
- *The harvest of pollock in Canada is managed through combination of dockside monitoring, at-sea monitoring, and electronic vessel monitoring systems (VMS), logbook requirements, all of which track landings to monitor compliance with applicable TAC and quota levels.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.
- *DFO is responsible for enforcing the Fisheries Act and other regulations and legislation. Enforcement activities are carried out by Fishery Officers across Canada who conduct regular patrols on the land, on the sea, and in the air. In addition, harvest levels of small vessels are regulated and enforced by Community Management Boards.*

I. Definition of Pollock (harvested in Canada)

The Canadian Department of Fisheries and Oceans (DFO) manages the pollock (*Pollachius virens*) stock as two separate population segments based on a 2003 stock evaluation. These populations are the faster growing Western Component and the slower growing Eastern Component[1] (DFO 2009). A significant pollock fishery exists in the Western Component contributing to 87% of the total landings. The range of the Western Component extends from Gulf of Maine to the Canadian portion of Georges Banks. Statistical areas of the Western Component include 4X[2] and 5Yb, and are based on the Northwest Atlantic Fisheries Organization's (NAFO) statistical areas (Fig. 1).

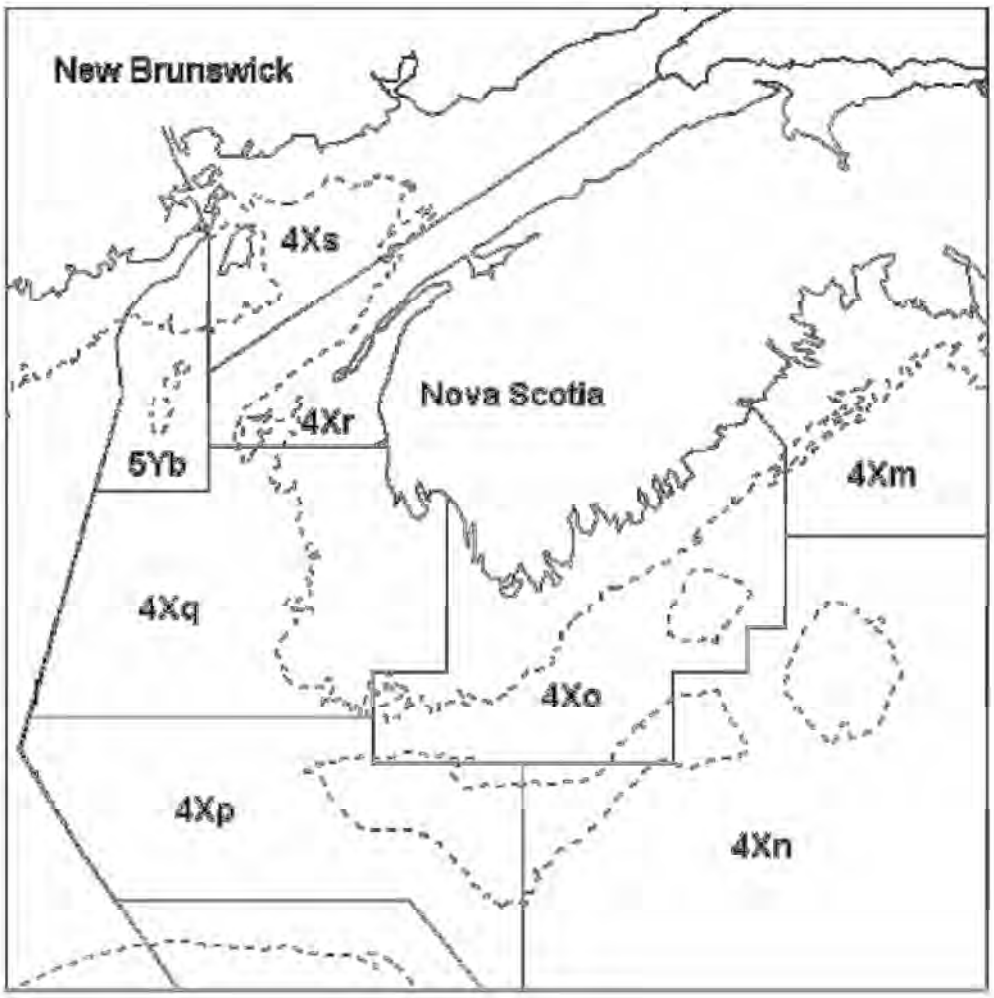

Figure 1. Management units of the Western Component of the pollock fishery (DFO 2009)

[1] The Eastern Component is beyond the Gulf of Maine Responsibly Harvested harvest area.
[2] The harvest strategies determined are for 4Xopqrs+5, but are applied to all of 4X and thus considered conservative (DFO 2009).

II. Description of Management Authority and Regulatory Process

Regulations in Canada are made under the authority of the federal Fisheries Act (1985), which provides the authority and mechanisms to manage fisheries and implement measures. DFO is the main authority for implementing regulations under the Fisheries Act, the Coastal Fisheries Protection Act (1985), and other fisheries-related legislation. In addition to federal laws and regulations, there are also Maritime Provinces Fishery Regulations[3], which govern fishing in the in the Provinces of Nova Scotia, New Brunswick and Prince Edward Island and in adjacent tidal waters. Since 2000, DFO revised the previous Integrated Fisheries Management Planning process, and instituted the current Objective-Based Fisheries Management Planning (OBFM) planning initiative. The current Scotia-Fundy Groundfish Management Plan for planning years 2002 to 2007 includes pollock and implements the OBFM pilot plan. The Scotia-Fundy management area is divided into statistical unit areas for a number of species. These units are defined using the NAFO statistical grid.

The following information is an excerpt from the most recent Groundfish Management Plan for Scotia-Fundy Fisheries in the Maritime Region (April 1, 2002 – March 31, 2007) that describes the advisory and consultative process:

> Scientific advice on stock status is provided by the Regional Advisory Process (RAP) for domestic stocks and by the joint Canada - USA Transboundary Resources Assessment Committee (TRAC) for shared stocks on Georges Bank. Members of the fishing industry participate in the meetings of these committees to provide their knowledge of fishing conditions.
>
> The information provided by RAP, in the form of Stock Status Reports (SSRs), is one of the primary inputs to the consultations on conservation issues among DFO, industry clients and the Fisheries Resource Conservation Council (FRCC). The FRCC is a group composed of industry members and non-government scientists appointed by the Minister to provide him with public recommendations on TACs and other conservation measures. Prior to giving their advice, the FRCC conducts public hearings to obtain industry views (DFO 2002).

Following release of the FRCC recommendations, DFO fishery managers consult with regional management committees to assess the impact of implementing them prior to any decisions by the Minister. Following announcement of the regulatory measures approved by the Minister, further consultations are held with the management committees to develop operational rules.

The views of the fishing industry are provided to DFO through an umbrella Scotia-Fundy Sector Groundfish Advisory Committee. For the inshore fleets, there are the following subsidiary committees:

[3] Department of Justice Canada. Maritime Provinces Fishery Regulations (SOR/93-55). http://laws.justice.gc.ca/en/F-14/SOR-93-55/index.html

- the Fixed Gear Advisory Committee consisting of industry representatives drawn from the community management boards,
- the ITQ Advisory Committee which consists of representatives based on quota holdings by area in specific tonnage groupings, and
- the Generalist Group, represented by a local committee in the Yarmouth area.

Due to the crossover nature of the fixed gear 45–65 feet ITQ fleet, one representative sits on both the ITQ Committee and the Fixed Gear Committee. Consultations also occur on an Atlantic-wide basis with the Groundfish Enterprise Allocation Council (GEAC) for the greater than 65 feet mobile gear fleet and with the Mid-Shore Groundfish Vessel Owners (MIGVO) for the 65-100 feet fixed gear fleet.

Unilateral management of pollock between the US and Canada has been discussed, but transboundary movement of pollock is considered minimal and thus each country manages the resource within its own waters, while biological sampling data is often shared and applied in each country's individual stock assessments.

III. Pollock data

The annual catch of pollock from the Western Component of the stock has averaged 6,000 tons (t) since 2000 and estimated spawning stock biomass (SSB = Age 4+) has risen from 7,500t in 2000 to an estimated 27,700t in 2008. The regulated fishing year for 4X and 5 extends from April 1st to March 31st and the TAC for the 2009/2010 year was set at 5,000t. Because much of the Eastern Component has been closed to cod and haddock fishing, landings from the Western Component have contributed up to 87% of the total landings in previous years (DFO 2009).

Table 1. Biological Reference Points for Canadian Pollock (Western Component)

B_{ref}	30,000t
F_{ref}	0.2
SSB during 2008	27,700t
F during 2008	<0.2

The most recent stock assessment was conducted in 2008 and the results were released in the 2009 Canadian Science Advisory Report. Data used to estimate biomass include DFO research vessel summer survey data from 1984-2008 and catch per unit of effort (CPUE) data collected from the mobile gear sector of the fishery from 1982-2004. CPUE data after 2004 is not used in the population modeling because changes in fishery management have resulted in these years being non-comparable to the rest of the time series (DFO 2009). Indicators of abundance depict a general trend of increasing biomass since 2000, which is supported by US National Marine Fisheries Service's pollock trawl surveys conducted in the Gulf of Maine/Georges Bank region. The DFO assessment utilizes Virtual Population Analysis (VPA) model that was developed for the Western Component and incorporates the previously the mentioned indices of abundance (DFO 2010c).

The 2004 Pollock Framework Meetings produced recommendations for a pollock management strategy that adhered to specific biological reference points (Table 1). Results of a yield per recruit analysis combined with stock-recruitment patterns were used to determine a fishing mortality reference point ($F_{ref} = 0.2$) that would not deplete the stock. The Framework Meetings also produced a reference point for biomass (B_{ref}=30,000t). Biomass levels below 30,000t can result in reduced production and recruitment (Stephenson 2004). These reference points are recommendations and have been used in subsequent stock assessments and management considerations, but have not been adapted to a fishery management plan. Below is an excerpt from the Framework in regards to utilizing F_{ref} and biomass B_{ref}:

> The risk of F exceeding F_{ref} should generally be neutral to risk averse (less than 50%) and the risk of biomass decline (change in B<0 should be neutral to risk averse (less than 50%) when biomass is less than B_{ref} = 30,000t. The further biomass is below 30,000t, the decisions should be more risk averse (Stephenson 2004).

The most recent assessment indicates that the SSB= 27,000t and is slightly below the recommended B_{ref} of 30,000t. This is a decline from a biomass estimate high of 66,000t in 1984, but well above the biomass low estimate of 7,500t in 2000. Recruitment analyzed during the assessment estimated that the 2004 and 2005 year classes were of concern, while the 2002 and 2003 year classes were average, and the 2001 class was the strongest (DFO 2009). Figure 2 depicts Age 4+ biomass and Age 2 recruitment.

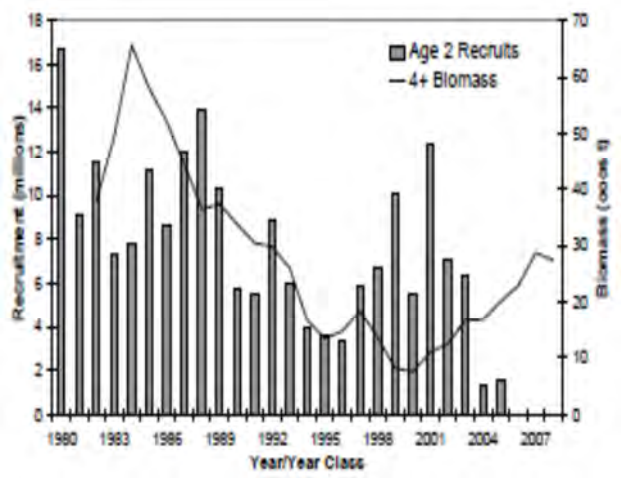

Figure 2. Trends in Age 4+ biomass and Age 2 recruitment for the Western Component of the pollock fishery (DFO 2009)

The biological reference points are considered when the annual pollock TAC is determined by DFO, and the TAC for the 2010/2011 recent year was set at 6,000t (DFO 2011d). Landings peaked at 46,000t in 1987 and have been below 10,000t since 1999. Landings in 2008 were 4,246t, which was below the 2007/2008 TAC of 5,000t. Figure 3 depicts the pollock landings and the annual TACs from 1974-2008.

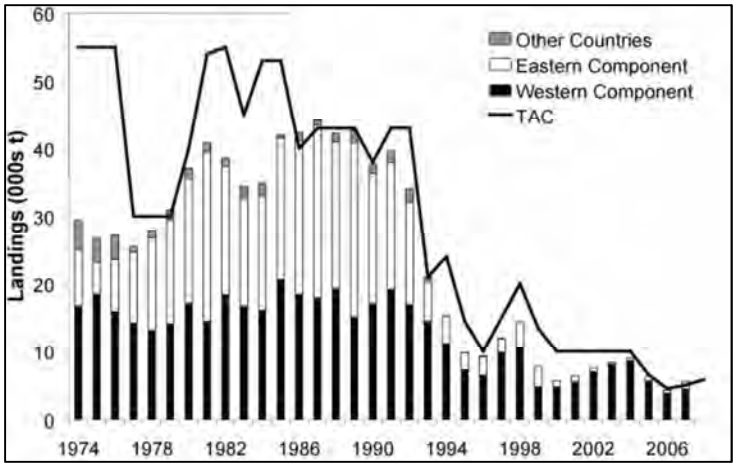

Fig. 3 Landings and TACs for pollock in 4VWX+5, for Eastern and Western Components, including foreign landings (DFO 2009).

Historical fishing mortality for pollock has been as high as 1.0 in the early 1990s, but the reduction of quotas and landings, combined with an increase in biomass has resulted in in reduced fishing mortality. According to the assessment, fishing mortality has been below the recommended F_{ref} of 0.2 the since 2006 (Fig.4).

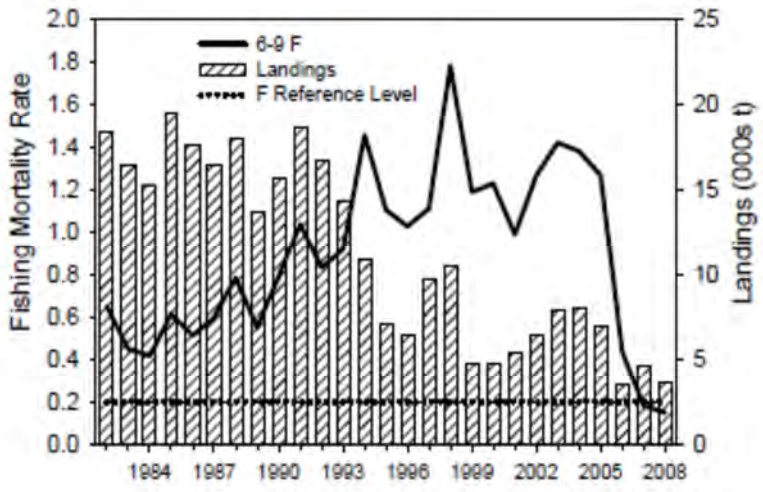

Figure 4. Trends in fishing mortality and landings of pollock for the Western Component (DFO 2009).

IV. Groundfish Management Plan for Scotia-Fundy Fisheries, Maritimes Region

Canadian harvested pollock is managed under the Scotia-Fundy Groundfish Management Plan, which states:

> Management measures are the specific provisions that implement the strategies in the plan. Most of these relate to operationalizing conservation strategies (described in detail in Annex 5). The primary conservation mechanism is restriction of fishing mortality

through the TAC system. Shares of the TAC for each species stock are allocated to fleet sectors or individual fishing enterprises, and landings against these shares must be recorded at ports of landing through a dockside monitoring program (DMP). Ancillary to this DMP is a variety of rules for bycatch management to avoid the discarding of fish at sea (DFO 2002).

The plan calls for DFO to outline policy frameworks in which harvesters and community members can develop specific management measures, thus empowering resource users in the decision making process. Management measures include gear restrictions, bycatch protocols, logbooks, at-sea observer coverage, vessel monitoring systems (VMS), and area and seasonal closures.

Groundfish vessels greater than 45 feet operate under individual transferable quotas (ITQ), also known as enterprise allocations. In recent years, the small vessel groundfish fleet (< 45 feet) in the Maritimes region has shifted towards a community-based management approach, with the implementation of Community Management Boards (CMBs). CMBs are regional boards that are made up of mostly harvesters and industry members and are allocated a share of the pollock quota (DFO 2011d). Each CMB is then responsible for managing the share on behalf of its members, through allocation efforts such as trip limits or individual quotas. In addition, CMBs develop Conservation Harvest Plans (CHPs) that vary by region. CHPs must adopt specific catch and control measures, including violation penalties, for their fleet, while respecting conservation provisions (Peacock and Annand 2008). One CHP example is the *CHP for ITQ Mobile Gear Vessels less than 65 feet in 4VWX + 5*, effective April 1, 2010. This plan details minimum mesh sizes for mobile gear, maximum bycatch levels and associated monitoring requirements, limits on undersized fish, information on catch monitoring (e.g., 100% dockside monitoring, and VMS requirement for all vessels), open seasons for specific fisheries, seasonal closures, spawning and juvenile closures, and other measures (e.g., minimum of 5% at-sea monitoring coverage). While CHPs produce fleet specific regulations, DFO remains responsible for determining and enforcing groundfish quotas and TACs.

Additionally, a quota reconciliation policy is in place for the pollock fishery, resulting in quota overages being deducted from the subsequent fishing year's quota.

V. Monitoring

Several mechanisms exist to monitor the harvest of pollock in Canada. A combination of dockside monitoring, at-sea monitoring, and electronic vessel monitoring systems (VMS) track landings to monitor compliance with applicable TAC and quota levels. Vessels that operate under an ITQ are required to have 100% verification through the dockside monitoring program. Licenses managed under CMPs must meet certain thresholds to achieve 100% dockside monitoring, while there is 25%-50% random monitoring for CMB vessels (DFO 2011d).

DFO's Conservation and Protection branch in the Maritimes region is responsible for the areas fisheries monitoring and compliance-related work. The primary source of landing information utilized in fisheries management decisions in the Maritimes is collected through the dockside monitoring program (DMP), which is funded by the fishing industry. The objective of the DMP

is to provide accurate, timely, and independent third party verification of landings (DFO 2011a). Dockside monitoring companies must be certified in accordance with Canadian Manufacturing and Standards Board. Observers collect and record data, including the weight of species landed, gear type, management area, etc. They also verify the species of all fish landed and offloaded, and ensure this information matches what is recorded in mandatory required logbooks.

The At-Sea Observer Program allows for the collection of detailed, geographically coordinated information on the fishing effort, catches and discards at sea. This program is jointly funded by the industry and DFO, and is also administered by an independent, third party company (Gough 2007). At-sea observer coverage in the groundfish industry is generally less than 100 percent. In addition to gathering scientific and technical data used for fisheries management and stock assessment, observers also monitor compliance with fisheries regulations.

Offshore fleets utilize industry-purchased VMSs to report the locations of fishing vessels to DFO during fishing trips.

VI. Enforcement

DFO is responsible for enforcing the Fisheries Act and other regulations and legislation. Enforcement activities are carried out by Fishery Officers across Canada who conduct regular patrols on the land and sea, as well as aerial surveillance (DFO 2011b). Unannounced at-sea inspections are carried out by both DFO's Conservation and Protection branch and Canadian Coast Guard. The monitoring mechanisms described in Section V are conducted in coordination with the monitoring and enforcement activities conducted by Fishery Officers.

VII. Other

Pollock is currently in the final stages of a Management Strategy Evaluation, with new management measures expected to be released in 2011 during a meeting of Canadian Science, Industry and Management.

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Responsibly Harvested Seafood from the Gulf of Maine Region
Report on
Atlantic Sea Scallops

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *Atlantic Sea Scallops are managed by NMFS and NEFMC, and regulated by the Atlantic Sea Scallop Fishery Management Plan, which utilizes the best available science to set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *The 2006 Stock Assessment Workshop (45th SAW) determined that Atlantic sea scallops were not overfished (SSB > ½ B_{MSY}) and overfishing was not occurring (F<F_{MSY}). This was confirmed in 2010 Stock Assessment Workshop (50th SAW) which utilized improved biological reference points. These new reference points are expected to be approved to the scallop FMP as of June 2011. The most recent assessment determined that Atlantic sea scallops were not overfished (SSB > ½ B_{MSY}) and overfishing was not occurring (F<F_{MSY}) based on data from the 2009 fishing year.*

☒ Sufficient data exists to determine harvest levels.

- *The most recent stock assessment was conducted by the 50th Northeast Regional SAW and was findings were released in July 2010. The assessment utilized fisheries dependent and independent data to determine biological reference points, which are assessed through the Council process. Ultimately, the Council sets the harvest levels based on these data and information, which incorporate uncertainty. As sea scallops were not overfished annual catch limits (ACLs) were not established in 2010, although they will be set when Amendment 15 is implemented in 2011.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *Monitoring and compliance with the regulatory measures in the sea scallop fishery is achieved through at-sea observers, daily vessel trip reports, weekly dealer reports, VMS, and accountability measures.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of sea scallops.*

Verified as of May, 2011

I. Definition of Atlantic Sea Scallops

Atlantic sea scallops (*Placopecten magellanicus)* are distributed in the Northwest Atlantic Ocean from Newfoundland to North Carolina. Sea scallops are divided into three populations: northern Gulf of Maine, Georges Bank, and Mid-Atlantic. This report focuses on the Gulf of Maine population, which occurs primarily in state waters (0-3 nautical miles [nm]), and the Georges Bank population, which primarily occurs in federal waters (3-200 nm). North of Cape Cod, concentrations generally occur in shallow water less than 40 meters (m). The Georges Bank fishery generally occurs at depths between 30 and 200 m. Figure 1 depicts the statistical areas in the Northeast that used to define the stock unit (Hart 2006).

The commercial fishery for sea scallops is conducted from March 1 – February 28, primarily using offshore New Bedford style scallop dredges. There is also a small, primarily inshore fishery for sea scallops in the Gulf of Maine. Digby dredges are sometimes used in near-shore areas in the Gulf of Maine.

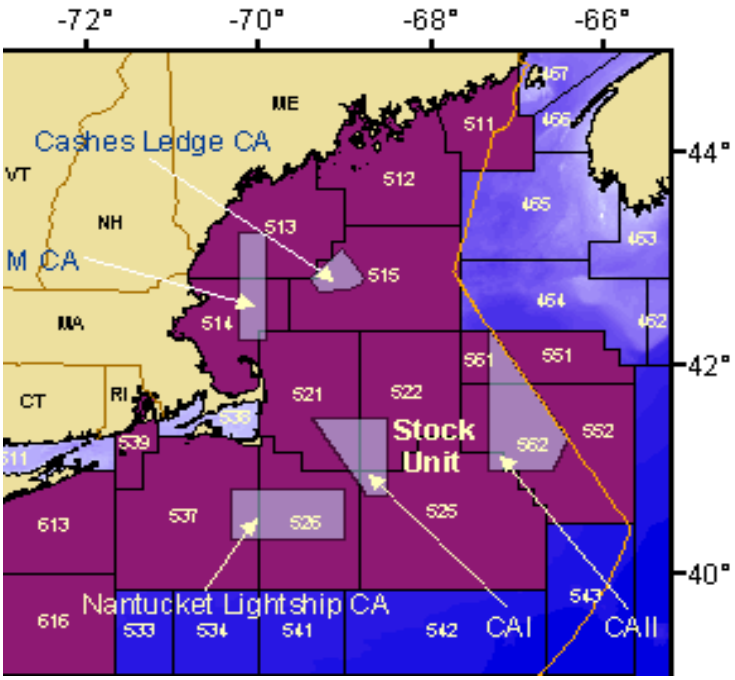

Figure 1. Statistical areas used to define the U.S. Atlantic sea scallop management unit in the Northeast (Hart 2006).

II. Description of the Management Authority and Regulatory Process

Responsibility of Atlantic Sea Scallop management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of Atlantic sea scallop regulations under the Atlantic Sea

Scallop Fishery Management Plan. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For Atlantic Sea Scallop management, the NEFMC is advised by the Scallop Oversight Committee that currently consists of representatives from state and federal management agencies, the fishing industry, and environmental groups, including two representatives from the Mid-Atlantic Fishery Management Council (MAFMC). This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the oversight committee meet these requirements a Scallop Advisory Panel, made up of representatives from the fishing industry, scientists, and conservation organizations and provides input to management measures. The chairs of the oversight committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of sea scallops. Then the PDT provides reports to the oversight committee in response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. Figure 2 provides a visual of this process. There is also a Scallop Survey Advisory Panel (SSAP), which brings together industry, scientists, and government representatives, as well as members of NEFMC and MAFMC to collaborate on gear and protocols for the sea scallop surveys.

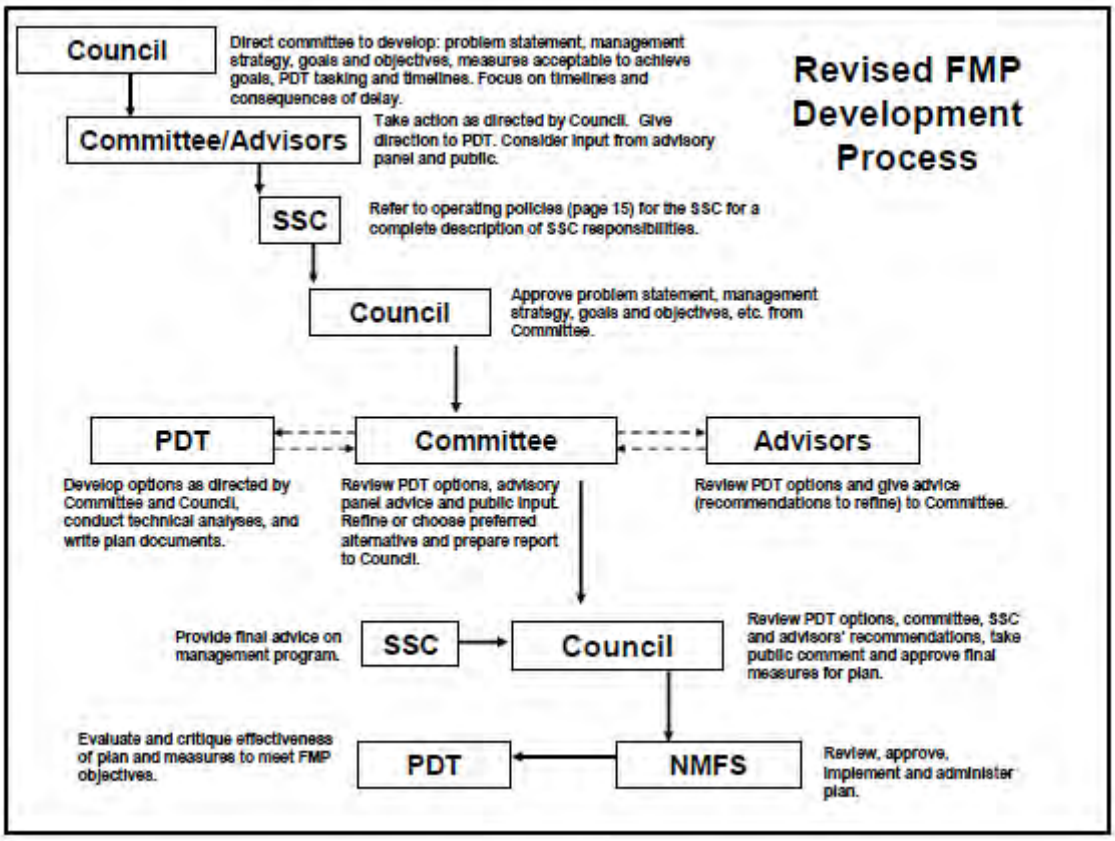

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Management of Atlantic Sea Scallops in state waters

The state of Maine is the only state in the Gulf of Maine region with a prevalent state water scallop fishery. The state scallop fishery is managed under a harvesting season that typically extends from December to March. The state of Maine also utilizes management measures such as gear size restrictions, enforced closed fishing areas, daily possession limits, and minimum scallop size requirements (DMR 2010). The regulations are implemented in accordance with federal scallop regulations.

IV. Atlantic Sea Scallop Data

Stock Status

The most recent stock assessment and peer review for Atlantic sea scallops was conducted in 2010 by the 50th Northeast Regional Stock Assessment Workshop (50th SAW), and the assessment report was published in July 2010 (NEFSC 2010). Data used in the assessment consisted of Northeast Fisheries Science Center (NEFSC) sea scallop dredge and trawl surveys, UMASS School for Marine Science and Technology camera survey, commercial landings, observer data, and shell growth data (NEFSC 2010).

The NEFSC sea scallop survey data used in the assessment to estimate fishing mortality and biomass are from 1982-2009 for Georges Bank and 1975-2009 for the Mid-Atlantic. The assessment determines overfished and overfishing status for the stock as a whole,

even though the fishery was modeled separately for Georges Bank and the Mid-Atlantic Bight stocks. The assessment does not include data from the southern New England fishery, as it only accounts for limited biomass and landings.

Because of limited biomass and landings, the northern Gulf of Maine (NGOM) scallop fishery had not been assessed until the 2009 fishing year. Biomass of NGOM sea scallops was estimated to be 100 metric tons (mt) of meats in 2009 with an exploitation rate (reported landings in weight / estimated biomass) of 0.065, but overfishing and overfished statuses were not evaluated. The 2010 total allowable catch (TAC) for the NGOM was set at 31.8 mt meats (75 FR 36559).

As recommended by the Stock Assessment Review Committee (SARC), the 2010 assessment refined existing biological reference points (BRPs), with new BRPs of F_{MSY} (F_{MSY}=0.38) and 1/2B_{MSY} (1/2B_{MSY}=62,679 mt) as determined by the Stochastic Yield Model (SYM) analysis. The 50th SAW recommended that F_{MSY} should be the fishing mortality target used in determining if overfishing is occurring, as opposed to the reference point F_{MAX} (a proxy for $F_{MSY,}$ where the fishing mortality rate for fully-recruited scallops generates the maximum yield-per-recruit), which was applied in previous stock assessments. The biological threshold ($B_{THRESHOLD}$=1/2B_{MSY}) should be the reference point to determine if the fishery is overfished[1].

Table 1. Biological Reference Points for Atlantic Sea Scallops	
B_{MSY}	125,358 mt
1/2B_{MSY} (overfished threshold)	62,679 mt
F_{MSY} (overfishing threshold)	0.38
B during 2009	129,700 mt
1/2 B in 2009	64,850 mt
F during 2009	0.37

The 2010 assessment determined biomass reference points of $B_{THRESHOLD}$ = 1/2B_{MSY} = 62,679 mt meats and B_{TARGET}=B_{MSY}=125,358 mt meats, while Atlantic sea scallops were not overfished as 1/2B = 64,850 mt meats (Table 1). Fishing mortality during 2009 was 0.37 and below the recommended target fishing mortality rate, thus overfishing was not occurring in (NEFSC 2010). Figure 3 depicts the historical sea scallop biomass and overfished threshold.

The SYM model was incorporated into the assessment in order to account for uncertainty in fishing mortality and recruitment, while parameters were established to ensure consistency with the Catch-At-Size-Analysis (CASA) which is also utilized in the assessment. According the SARC, the additional analysis will better calculate yield from the scallop fishery and aid in preventing overfishing (NESFC 2010). These updated BRPs are currently in the process of being adopted to the FMP by the NEFMC.

[1] Framework 22 proposes that these new BRPs be used in determining future management strategies of FMP and has been submitted to NMFS for final approval.

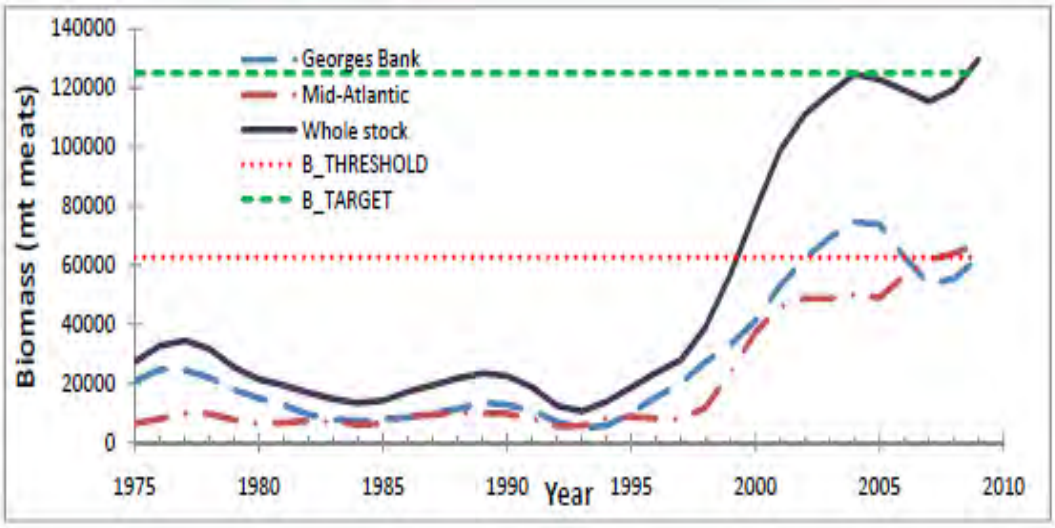

Figure 3. Sea scallop biomass, during 1975-2009

Framework 21 set a hard TAC of 70,000lbs for the limited entry program in NGOM management area. Figure 4 depicts the NGOM management area, which is managed in the Atlantic sea scallop FMP.

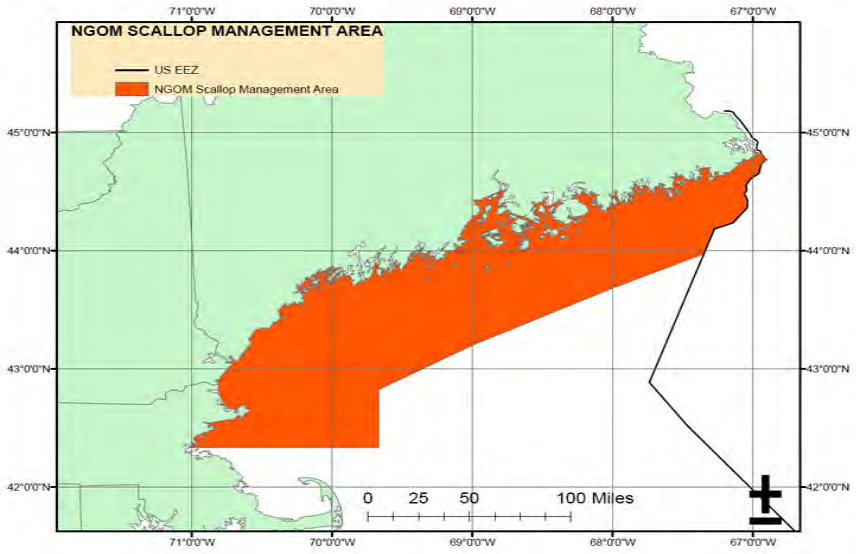

Figure 4. Northern Gulf of Maine scallop management area.

Landings

The following excerpt from the 50th SAW and report describes the trends in landings (Fig. 5) since 1980:

> Annual landings increased from about 8000 mt meats in the mid-1980s to over 17,000 mt meats in 1990-1991, then fell to between 5000 and 8000 mt meats during 1993-1998. Landings increased considerably from 1998-2003 and have remained at high and relatively stable levels since then. US landings during 2003-

2009 exceeded 24,000 mt meats during each year, and were roughly twice the long-term mean.

Discarding occurs due to catch of undersized scallops and some highgrading (in Special Access Areas). Discards averaged about 2300 mt meats during 2002 – 2004 and 800 mt meats since 2005 (NEFSC 2010).

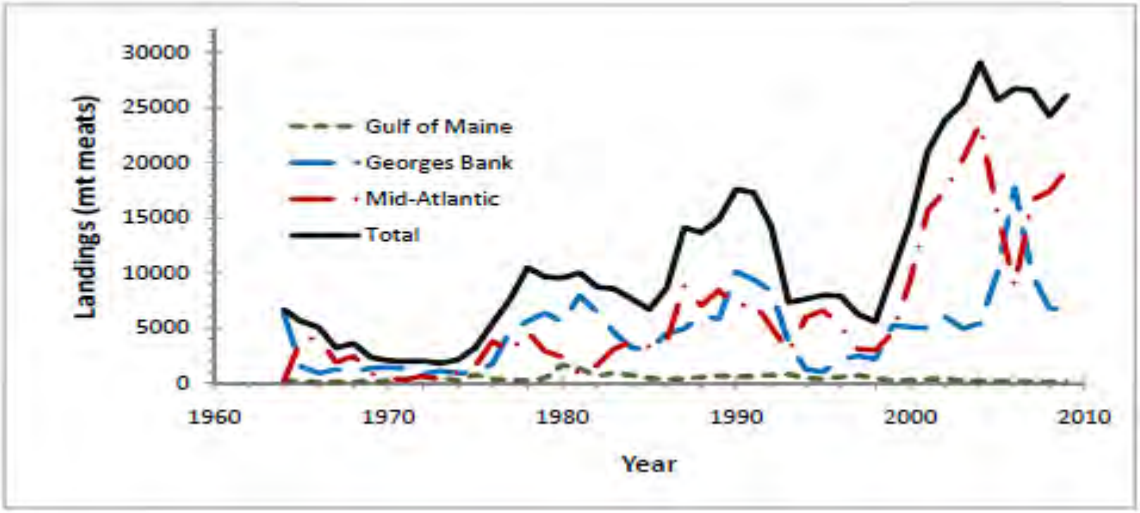

Figure 5. U.S. Sea scallop landings by area, 1975-2009.

V. Atlantic Sea Scallop Fishery Management Plan

The NEFMC established the Atlantic Sea Scallop FMP in 1982. A number of Amendments and Framework Adjustments have been implemented since that time to adjust the original FMP. Some of the significant amendments and framework adjustments are summarized here (NEFMC 2010e):

- Amendment 4, which was implemented in 1994, introduced major changes in management, including a limited access program, a days-at-sea (DAS) reduction plan, new gear regulations, and vessel monitoring system, and an annual framework adjustment process. This Amendment also created a general category scallop permit for vessels that did not qualify for a limited access permit.
- Amendment 7 was implemented in 1999, and changed the overfishing definition, the DAS schedule, and measures to meet new lower mortality targets. In addition, this Amendment established two new scallop closed areas in the Mid-Atlantic and reduced DAS allocations. (Framework adjustments 12, 14, 15, and 16 also adjusted DAS allocations.)
- In 2004, Amendment 10 introduced rotation area management and changed the way that the FMP allocates fishing effort for limited access scallop vessels.
- Framework 16 was also implemented in 2004 to address scallop area management in parts of the groundfish closed areas for Fishing Year 2004

and 2005. This Framework also focuses on allocations of fishing effort and scallop TACs, provisions to fund observers and research, enforcement provisions, monitoring requirements and measures to minimize or control bycatch.

- In 2008, Amendment 11 implemented a limited entry program for the general category fishery. The objective of this action was to control capacity and mortality in the general category scallop fishery. The amendment also approved a hard TAC for the limited entry program in the NGOM management area.
- Amendment 12 was implemented in February 2008, and is an omnibus amendment to all FMPs in the region that focuses on defining a standardized bycatch reporting methodology (SBRM).
- Amendment 13 was implemented in June 2007, and permanently re-activated the industry-funded observer program in the Scallop FMP through a scallop total allowable catch (TAC) and DAS set-aside program that helps vessel owners defray the cost of carrying observers.
- Framework 19 implemented measures for fishing year 2008 and 2009, including the access area schedule, DAS allocations, and general category measures.

The current regulations for the scallop fishery are described in the existing amendments and framework adjustments described above. These regulations will be revised by the final rules for Framework 21 and Amendment 15. The final rule for Framework 21 was implemented on June 28, 2010 (75 FR 36559), and Amendment 15 is expected to be implemented by June 1, 2011. Measures for the 2010 fishing year are described in a Small Entity Compliance Guide for sea scallop permit holders, dated February 24, 2010 (NMFS 2010). The remainder of this section focuses on objectives for Amendment 15 and proposed regulations under Framework 21.

Amendment 15

The primary objective of Amendment 15 is to bring the Scallop FMP into compliance with the Magnuson-Stevens Reauthorization Act (MSRA) by 2011. This Amendment will propose measures to implement annual catch limits (ACLs) and accountability measures (AMs). Other objectives include the following:

- Address excess capacity in the limited access (LA) scallop fishery and provide more flexibility for efficient utilization of the resource.
- Adjust several aspects of the overall program to make the scallop management plan more effective.
- Consider measures to address the essential fish habitat (EFH) closed areas under the Scallop FMP if Phase II of the EFH Omnibus Amendment is delayed (see Table 1 in June 2010 version of the A15 DEIS for additional details on these purposes and needs) (NEFMC 2010b).

The Council initially selected preferred alternatives for some of these objectives in September 2009. For the objective to address excess capacity in the LA scallop

fishery and provide more flexibility for efficient utilization of the resource, the Council identified both and compared both permit stacking and leasing alternatives. Stacking options considered allowing a single limited access vessel to have more than one LA scallop permit, but limiting the "stacking" of two permits per vessel. After considerable feedback from the public and Council members, the measures to allow stacking on permits was voted down by the Council in September 2010, during finalization of Amendment 15. Reasoning for the removal was based on concerns that voluntary stacking could result in excessive consolidation, loss of jobs, and other negative socio-economic impacts on coastal communities (NEFMC 2010c).

For the objective to address EFH closed areas, the preferred alternative would modify the EFH closed areas in the Scallop FMP by removing the four scallop-fishery-specific EFH closed areas that were implemented in Amendment 10 to the Scallop FMP (portion of closed area (CA) II, two areas within CA I, portion of Nantucket Lightship (NL) Closure and area to the north, most of the western GOM closure, eastern portion of Cashes Ledge Closure and area over Jeffreys Bank), and it would instead implement identical areas closed for EFH under Multispecies Amendment 13(NEFMC 2010c).

Framework 21

The final rule for Framework 21 (FW21), which sets the TAC and other management measures for fishing year (FY) 2010, was published on June 28, 2010 (75 FR 36559). The primary objectives of FW21 are:

A. **Set an acceptable biological catch (ABC):** For 2010, the ABC will be set at 29,578 mt, including an estimated 3,363 mt for non-yield fishing mortality (discards and incidental mortality). Therefore, the overall ABC for the fishery, excluding discards and incidental mortality is 26,219 mt.
B. **Set TAC specifications for the 2010 fishing year:** The TAC is set at 21,445 mt, of which 94.5 percent would be allocated to the limited access fishery, 5.0 percent would be allocated to IFQ scallop vessels, and 0.5 percent would be allocated to limited access vessels with IFQ scallop permits that are operating under general category regulations.
    - **Open area DAS allocations** - Full-time vessels are allocated 38 DAS, part-time vessels are allocated 15 DAS, and occasional vessels are allocated 3 DAS.
    - **Open area DAS adjustment if access area yellowtail flounder TAC is attained –** Under the Northeast Multispecies FMP, 10% of the southern New England yellowtail flounder TAC is allocated to scallop vessels fishing in the Nantucket Lightship Access Area (NLAA). For FY 2010, this equates to 103,617 lbs. Once this TAC is attained, the NLAA will be closed to scallopers for the remainder of the fishing year.
    - **Individual access area trips and possession limits for limited access vessels –** Full-time scallop vessels are allocated one trip in the NLAA, two trips in the Elephant Trunk Access Area (ETAA), and one trip in the

Delmarva access area (with a possession limit of 18,000 lbs). Part-time vessels only have two access area trips (with a possession limit of 14,400 lbs), and occasional vessels have one trip (with a possession limit of 6,000 lbs).

- **IFQ allocations, including access area allocations, to vessels with Limited Access General Category (LAGC) IFQ permits –**
  - The FY 2010 TAC for this segment of the fishery has been set at 2,326,700 lbs.
  - The fleet-wide trip allocations for the LAGC IFQ fishery are 1,377 trips in the ETAA and 714 trips in both the NLAA and Delmarva. (The trip limit is 400-lbs per trip.)
  - The FY 2010 TAC for limited access scallop vessels with IFQ permits is 232,670 lbs.
  - The FY 2010 TAC for the northern Gulf of Maine (NGOM) fishery is at 70,000 lbs.
  - The FY 2010 TAC for incidental scallop catch is 50,000 lbs.
- **Research and observer set-asides –** Two percent of each scallop access area quota and two percent of the DAS allocation are set aside for the scallop research set-aside (RSA). One percent of each scallop access area quota and one percent of the DAS allocation are set aside as part of the observer set-aside.

C. **Allow general category (LAGC) vessels with IFQ permits to lease a portion of their quota to other IFQ-permitted vessels:** Partial IFQ leases would be a minimum of 100 lbs., except in circumstances where a vessel owner has previously leased some or all of their IFQ allocation and the remaining allocation is less than 100 lbs. In this case, the remaining IFQ could be transferred in full to another vessel.

D. **Minimize impacts of incidental take of sea turtles:** For FY 2010, the Delmarva access area would be closed from September 1 – October 31. In addition, limited access vessels would be restricted to taking two of the access area trips allocated to those areas from June 15 – August 31, 2010. The trip limit for these access areas would be a maximum of 36,000 lbs.

E. **Improve the observer set-aside program:** The amount of observer compensation LAGC IFQ vessels can possess would be limited to 180-lbs per observed trip in access areas. Therefore, a vessel may land its regular possession limit (400 lbs), plus an additional 180 lbs, for a total of 580 lbs, to offset the cost of an observer. Providers may charge a prorated fee (on an hourly basis) for vessels fishing in access areas if the observer set aside has been fully harvested.

Framework 22

The final rule for Framework 22 is expected to be published and implemented in May of 2011. The primary purpose of the Framework is to prevent overfishing and improve yield-per-recruit. Framework 22 will achieve these objectives and other management issues through:

- Determining fishery specifications for FY2011 and FY2012 including setting of reauthorized MSA required acceptable biological catch that based on modified BRPs. Also, establishing default fishery specifications for the start of FY 2013, in the event subsequent framework action for future fishing years is delayed (Table 2).

Table 2. Scallop Overfishing Limits (OFL) and Acceptable Biological Catch Limits (ACL)			
	2011	**2012**	**2013**
OFL	32,387 mt	34,382 mt	34,081mt
ACL	27,269 mt	28,961 mt	28,700 mt

- Minimizing impacts of incidental take of sea turtles by restricting the number of scallop trips to certain times of year and continuing seasonal closures.
- Assessing the possibility of area rotation adjustments (if necessary) including consideration of a new scallop access area on Georges Bank, if high concentrations of biomass present in 2010 surveys and only if the area is either smaller and/or closed for a shorter period of time (NEFMC 2010b).

VI. Monitoring

Scallop catch is monitored throughout the year. Vessels are required to report landings after each trip, and dealers are required to report landings each week.

In compliance with the reauthorization of MSA, all fisheries are required to implement ACLs and AMs. AMs are management controls implemented for stocks to ensure that the ACL is not exceeded, where possible, and corrected or mitigated if it overage occurs. The annual catch target (ACT) is an amount of annual catch of a stock or stock complex that is the management target of the fishery and accounts for management uncertainty. A stock's ACT should usually be less than its ACL. Since fishing effort will be allocated based on the ACT, the ACT itself will serve as the primary in-season AM due to the buffer between ACT and ACL; lower allocations are given to the fishery in an effort to prevent the ACL from being exceeded. There will be separate ACTs for the two sub-ACLs: one for the limited access fishery and one for the general category fishery. Both are set below the sub-ACL to account for management uncertainty (NEFMC 2010a). The AMs for the limited access, general category, and NGOM fisheries are as follows:

- **Limited access AMs**: The primary AM for the limited access fishery is the use of an ACT. If the sub-ACL for the limited access fleet is exceeded the AM would be an overall DAS reduction in the subsequent year to account for any overages.

- **General Category AMs:** The primary AM for the limited access general category ACL is the use of an ACT. If an individual vessel exceeds their IFQ

or leased IFQ in a given fishing year, their IFQ the following fishing year would be reduced by the same amount.

- **NGOM AMs:** The in-season AM is that the fishery is closed if the hard TAC is predicted to be reached. If this component of the fishery exceeds the overall hard TAC (equal to the NGOM ACL) after all data is final, then the hard TAC the following year could be reduced by that amount the following fishing year, or by mid season the following fishing year if data are not available.

At-sea observers are one method of monitoring compliance with ACLs and other regulatory measures. Limited access vessels are required to notify the observer program prior to all open area and access area trips. LAGC vessels are required to notify the observer program prior to all access area trips. This program is partially subsidized by the observer set-aside program, although it is primarily an industry-funded program.

- All scallop vessels fishing in sea scallops access areas are required to submit daily reports of scallops kept and yellowtail flounder caught on each trip through VMS.
- Vessels issued an IFQ or northern Gulf of Maine (NGOM) scallop permit must report through VMS using the Scallop Pre-Landing Notification Form.

VII. Enforcement

In general, enforcement of the Atlantic Sea Scallop FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations. Enforcement of state regulations in Maine is conducted by the Maine Marine Patrol.

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Gulf of Maine Research Institute
Responsibly Harvested Seafood from the Gulf of Maine Region
Report on
Atlantic Sea Scallops (Inshore Canada)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.
- *The inshore Canadian scallop fishery in the Gulf of Maine is managed by the Canadian Department of Fisheries and Oceans (DFO).*
- *Individual scallop fishery management plans (FMPs), originally established under the Atlantic Fisheries Regulations of 1985, are utilized and each plan is based on fishing areas and fleet characteristics.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.
- *Stock assessments utilize median biomass estimates from historical periods of abundance to establish a baseline when determining recommended harvest levels. Each scallop fishing area (SFA) and scallop production area (SPA) is assessed to determine the current status of biomass and abundance, as well as future projections. This information is then used to determine the Total Allowable Catch that will ensure long-term use of the resource, for each fishing area.*

☒ Sufficient data exists to determine harvest levels.
- *Fishery dependent and independent data are utilized by DFO scientists in the stock assessment process to determine acceptable harvest levels.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.
- *The harvest of scallops in the Bay of Fundy is managed through a combination of dockside monitoring and landings submissions, vessel monitoring systems (VMS), at-sea monitoring, as well as 100% hail in and hail out requirements.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.
- *DFO is responsible for enforcing the Fisheries Act and other regulations and legislation. Enforcement activities are carried out by Fishery Officers across Canada who conduct regular patrols on the land, on the sea, and in the air.*

I. Definition of Atlantic Sea Scallops (Inshore Canada)

Atlantic sea scallops (*Placopecten magellanicus)* are distributed in the Northwest Atlantic Ocean from Newfoundland to North Carolina. The inshore fishery in the Canadian portion of the Gulf of Maine region includes the Bay of Fundy and Scallop Fishing Area 29 west of 65° 30' (Fig. 1). The 43° 40' North Latitude line demarcates the offshore scallop fishery from the inshore fishery in the Bay of Fundy. A larger offshore fishery exists beyond Scallop Fishing Area 29 West, and the offshore fishery has achieved Marine Stewardship Council (MSC) certification in March of 2010 (MSC 2010). This report focuses on the management of the inshore scallop fishery, as the offshore fishery automatically qualifies for the Gulf of Maine Responsibly Harvested verification upon MSC certification.

Vessels in the inshore scallop fleet typically range from 30' – 65', with Digby and New Bedford style dredges being the primary gear types.

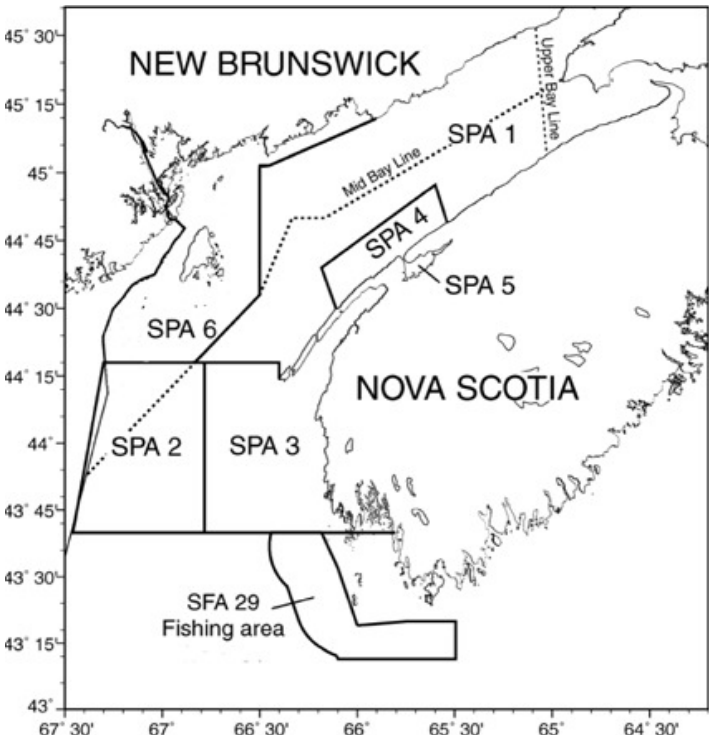

Figure 1. Statistical areas used to define the Scallop Production Areas in the Bay of Fundy (DFO 2010).

II. Description of the Management Authority and Regulatory Process

Responsibility of Atlantic sea scallop management lies within Canada's Department of Fisheries and Oceans (DFO). Regulations are made under the authority of the federal Fisheries Act (1985), which provides the authority and mechanisms to manage fisheries and implement measures. DFO is the main authority for implementing regulations under the Fisheries Act, the Coastal Fisheries Protection Act (1985), and

other fisheries-related legislation. In addition to federal laws and regulations, there are also Maritime Provinces Fishery Regulations[1], which govern fishing in the in the Provinces of Nova Scotia, New Brunswick and Prince Edward Island and in adjacent tidal waters.

III. Atlantic Sea Scallop Data

Scallop Production Areas
In 2002, it was determined that biomass and landings data of scallops in the Bay of Fundy were to be assessed annually in Scallop Production Areas (SPA) 1-6. The most recent available assessment was conducted as part of the Regional Science Advisory Process in November, 2009 (DFO 2010). Biomass data applied in the peer reviewed assessments is collected from DFO and industry surveys, at-sea monitoring, and landings information. Based on the assessment, DFO determines a total allowable catch (TAC) for each SPA.

SPA 1 Inner/Upper Bay of Fundy, Southwest Bay of Fundy
Since 2002, SPA 1 has been managed as two separate areas, SPA 1A and SPA 1B. According to the most recent assessment in 2009, catch rates in SPA1A have declined from 2001 to 2006 (median catch = 14.5 kg/h, meats), before increasing slightly in 2007/2008 (16.73 kg/h, meats). In 2009, total biomass was determined to be 1,299 t (meats) based on population modeling utilizing survey data. This was similar to the median total biomass 1,295 t (1997 to 2008). Despite 2009 total biomass being similar to the median, biomass of commercial size scallops decreased in 2009 from 2008 (DFO 2010).

Commercial catch rates for SPA1B remained stable from 2008 to 2009, except in subarea Scallop Fishing Area (SFA) 28D, where catch rates declined. Biomass data collected from all areas in 2008 indicated declines of commercial scallop size biomass in all areas. Population modeling estimates total biomass to be 1,703t in 2009, which is a decrease from 2008 (1,818t), but is above the median total biomass (1997-2008) of 1,672t (DFO 2010).

SPA 2 Northern/Upper Bay of Fundy
Scallop Production Area 2 is considered poor habitat for scallops and is not assessed annually (DFO 2010).

SPA 3 Brier Island, Lurcher Shoal, and St. Mary's Bay
Commercial catch rates in SPA 3 have been stable since 2007, and landings have declined annually since 2005. DFO surveys conducted in the area have shown a decline in commercial size scallops since 2004, and a decline in total biomass since 2007 in both targeted and non-targeted scallop beds, despite an annual decrease in fishing effort (DFO 2010). DFO has stated that further assessment and research is needed to better understand biomass trends in this area.

[1] Department of Justice Canada. Maritime Provinces Fishery Regulations (SOR/93-55). http://laws.justice.gc.ca/en/F-14/SOR-93-55/index.html

SPA 4 Digby
Commercial catch rates in SPA 4 have remained relatively stable since 2005, and the median 2008/2009 catch rate (18.8 kg/h, meats) was equal to the median catch rate from 1976/1977 to 2007/2008 (DFO 2010). In addition to stable catch rates, survey data indicates that biomass has been stable since 2006, but with low recruitment and commercial size scallops declining in 2009.

The 2009 assessment utilized the delay-difference model (Smith and Lundy 2002) to determine population of SPA 4 scallops, and total biomass was estimated to be 722 t. While this is below the long-term median total biomass of 787 t for the area, it was an increase from the 2008 estimate of 680 t (DFO 2010).

SPA 5 Annapolis Basin
Commercial catch rates from 2009 (16.6 kg/h, meats) in SPA 5 were below 2008 levels and below the 1977-2008 median level of 18.9 kg/h, meats. Landings in 2009 (5.7 t, meats) were below the 2010 TAC of 10 t. The annual survey of SPA 5 was discontinued in 2009 at the request of industry, and survey efforts have been allocated to other areas of the region. Despite this, according to the most recent stock assessment, the average catch of 9 t from 1997 to 2008 has not resulted in an unstable catch per unit of effort (CPUE), and suggests a stable biomass (DFO 2010).

SPA 6 Grand Manan and Southwest New Brunswick
Catch rates and landings for SPA 6 have remained stable since 2002 and have remained well below the TAC since 2001. Due to funding limitations, the number of surveys in SPA 6 were reduced in 2009. Of the data collected, pre-recruits with a shell size of 40-64 mm were found in high densities in select areas, while high concentrations of recruits (65-70 mm) correlated with historical survey data (DFO 2010). Mean catch rates of commercial scallops increased in all areas of SPA 6 in 2009.

Catch data indicates that biomass of commercial sized scallops have remained stable, while survey data indicates an increase in total biomass in 2009. Harvest levels of scallops in SPA 6 appear not to be impacting population biomass levels (DFO 2010).

Scallop Fishing Area 29 West
Scallop Fishing Area 29 West (SFA 29) is the southernmost scallop fishing area in the Bay of Fundy, and SFA 29 is divided into subareas A, B, C, D, and E. SFA 29 is managed and assessed separately from the other areas in the Bay of Fundy. Under the SFA 29 Fishing Plan, a full stock assessment of SFA 29 is conducted every two to three years. During years when a full assessment is not conducted, survey indices from catch data and DFO surveys are used to assess the stock and provide management advice.

In 2010, SFA 29 was not fully assessed, but updated stock information was provided by DFO, with the exception of subarea E. According to the 2010 report, abundance and biomass has not changed significantly since 2006 and remains relatively low in

subareas A and C, while subarea B experienced small increases in biomass and abundance since 2008 (DFO 2011d). Subarea D experienced little change in abundance or biomass. Commercial catch rates have declined in all SFA 29 subareas since 2009, with the exception of the East of Baccaro fleet in subarea A. This increase may be a reflection of a very low 2009 catch.

Scallop Data Uncertainty
The delay-difference model is used in the assessment to determine impacts of the fishery on the scallop population. It should be noted that scallop biomass for recent years tend to be lower than the estimate derived from the previous year's model, resulting in differences between annual biomass estimates. According to the most recent stock assessment report:

> Successive revisions of the estimated biomass in a decreasing direction imply that the model is having difficulty balancing the decrease in survey biomass estimates from one year to the next with removals from the population through fishing and natural mortality (DFO 2010).

As a result, further exploration of data and modeling has been recommended before the next scallop assessment.

IV. Atlantic Sea Scallop Fishery Management Plan

Management plans for the inshore fishery are developed by DFO, and include consultation with the fishing industry (DFO 2004). The inshore scallop fishery in the Bay of Fundy is managed under three separate plans that each seek to "pursue its own conservation and fleet rationalization plans (DFO 2011a)." These plans are the Bay of Fundy Full Bay Scallop Management Plan, Bay of Fundy Upper Bay Scallop Fleet Fishing Plan, the Bay of Fundy Mid Bay Scallop Fleet Fishing Plan, and the Scallop Fishing Area 29 West Scallop Fishing Plan. Application of the each plan is dependent characteristics such as vessel size and fishing area.

Bay of Fundy Scallop Fleet Fishing Plan

The 2010/2011 Full Bay Scallop Plan applies to vessels from 45' to 65', and participants have operated under an Individual Transferable Quota (ITQ) system since 1996. Under the 2007 initiative, *Preserving the Independence of the Inshore Fleet in Canada's Atlantic Fishery,* Full Bay Scallop Fleet licenses were granted transferability rights (DFO 2011a). As a result, licenses are now allowed to be transferred between individuals or corporations, and a singular entity could possess more than one license. As of 2005, the Full Bay Fleet consisted of 100 licenses.

As of 2011, there are 16 licenses regulated under the Upper Bay Scallop Fleet Plan, and these vessels range from 30'to 45' and are managed under a competitive quota regime, as opposed to ITQs utilized in the Full Bay Plan (DFO 2011b). Participants in the Upper Bay Scallop Fleet Plan are typically multi-purpose license holders and target species other than scallops throughout the year.

Similar to the Upper Bay plan, the Mid Bay Scallop Fleet Fishing Plan applies to vessels ranging from 30' to 45' that are managed under a competitive quota. As of 2011, the Mid Bay fleet consisted of 209 licenses, with the majority of vessels fishing out of New Brunswick ports (DFO 2011b).

The SFA 29 West Scallop Fishing Plan uses transferable quotas, seasonal restrictions, subarea TACs and an area TAC to manage the SFA 29 area. The SFA 29 fleet consists of 99 Full Bay licenses and 64 Inshore East of Baccaro scallop licenses, with the Full Bay fleet receiving 65% of the TAC and the Baccaro fleet receiving 35%. Scallop fishing in SFA 29 may be conducted from June 20th to August 31st, unless the area's TAC is met, which would result in a shortened season (DFO 2011e).

Scallop Fleet Fishing Plans and Quotas

Scallop Production Areas 3, 4 and 5 are fished exclusively by the Full Bay Fleet, while quota for SPAs 1 and 6 are divided across the Full, Upper, and Mid Bay Fleets (Table 1). Minimal scallop production occurs in SPA 2 and the area is not managed under a TAC.

Scallop Production Area	Total Quota	Allocation of Quota to Fishing Plan
SPA 1A	300t	Full Bay (100%)
SPA 1B	40 t	Full Bay (50.75%), Mid Bay (35.72%), Upper Bay (13.53%)
SPA 2	N/A	No quota set, marginal fishing area
SPA 3	60t	Full Bay (100%)
SPA 4	120t	Full Bay (100%)
SPA 5	10t	Full Bay 100%)
SPA 6	140t	Mid Bay (85%), Full Bay (15%)
SFA 29	200t	Full Bay (65%), East of Baccaro (35%)

Table 1. Distribution of inshore scallop allocations.

SPA 1

In 2010, the 2009/2010 TAC for SPA 1A was set at 300t. While the 2009 assessment suggested that catch levels below 350t would result in an increase in biomass, concerns that the model may overestimate abundance resulted in a conservative TAC for the sub-area (DFO 2010). Landings for the 2009/2010 season for SPA 1A were below the TAC at 297t (DFO 2011a).

The 2009/2010 TAC for the Full Bay Fleet for SPA 1B was set at 203t and landings were below the TAC at 153.8t. The SPA 1B TAC allocated to the Mid Bay fleet was 144.7t, while landings were 138.7t. Landings for the Upper Bay fleet were also below their TAC of 54.8t at 53.9t (DFO 2011a).

SPA 3

The 2009/2010 TAC for SPA 3 was set at 60t for the Full Bay Fleet, and total landings were below the TAC at 55.8t (DFO 2011a).

SPA 4

In addition to a TAC, management of SPA 4 is regulated under a fishing season that extends from October 1st to April 30th. The 2009/2010 TAC was set at 120t and landings during that year were 114.3t (DFO 2011a).

SPA 5

The Full Bay Fleet has exclusive fishing access to SPA 5, and in the 2009/2010 a TAC of 10t was set. Landings for the same year were below the TAC at 8t (DFO 2011a).

SPA 6

The 2009/2010 TAC for the Full Bay Fleet was 21t with a total of 1.38t landed during the year (DFO Stock Report). The Full Bay Fleet's landings have not met the TAC for the last 6 years, as fishing effort has been redistributed to other areas. The Mid Bay Fleet landed a total of 89.5t against a TAC of 119t in 2009/2010 (DFO 2010).

SFA 29

The 2010 TAC for SFA 29 was set at 200t and total landings for the year were 198t (DFO 2011d). Based on the most recent stock update, the 2011 TAC was set at 200t.

V. Monitoring

Industry is notified when fleets reach 80% of their quota during a fishing year. In the event license holders exceed their ITQ, they have 30 days from the closing of the scallop season to increase their quota through transfers. Otherwise, the amount that was exceeded will be deducted from the quota from following fishing year.

All vessels participating in the inshore scallop fishery must have a DFO approved Vessel Monitoring System (VMS), which is tracked by a Vessel Monitoring Station. In addition to the VMS program, vessels must participate in the Dockside Monitoring Program (DMP) that is overseen by the Conservation & Protection Division under DFO. The primary objective of the DMP is to provide accurate independent third party verification of landings (2010b). The industry funded DMP program for the inshore scallop fishery requires 100% hail in and hail out, 100% weigh out, including submission of landings data on required DMP documents.

VI. Enforcement

DFO is responsible for enforcing the regulations and legislation pertaining to the scallop fishery. Enforcement activities are carried out by Fishery Officers across Canada who conduct regular patrols on the land, on the sea, and in the air (DFO 2010c). The monitoring mechanisms described in Section V are conducted in

coordination with the monitoring and enforcement activities conducted Fishery Officers.

VII. References

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Gulf of Maine Research Institute

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Gulf of Maine Responsibly Harvested
Verification Report on
Georges Bank Haddock (*Melanogrammus aeglefinus*)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *GB haddock is managed by NMFS and NEFMC, and regulated by the Northeast Multispecies Fishery Management Plan, which utilizes the best available science to set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *GB haddock stock size is not below management target levels; the stock is at 278% of its target biomass level. GB haddock is not considered to be overfished and overfishing is not occurring*

☒ Sufficient data exists to determine harvest levels.

- *The Groundfish Assessment Review Meeting III (2012), its 2015 and 2017 updates, and the 2016 Transboundary Resources Assessment Committee report utilized fisheries-dependent and –independent data to determine biological reference points, which are assessed through the Council process. Ultimately, the Council sets the harvest levels (Annual Catch Limits) based on these data and information, which incorporate uncertainty. It is not considered a data poor species.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *GB haddock catch is monitored through vessel trip reports (VTRs), observers, dealer reports, and for sectors, additional at-sea monitoring. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of GB haddock.*

I. Definition of Georges Bank Haddock

Georges Bank haddock (*Melanogrammus aeglefinus*) is harvested from the shallow productive waters of Georges Bank, off the coast of Massachusetts (see Figure 1). The National Marine Fisheries Service (NMFS) manages this stock, although the transboundary management unit of Georges Bank haddock, which corresponds to U.S. statistical areas 551, 552, 561, and 562 (referred to as Eastern Georges Bank haddock) is managed jointly with Canada. On average, Canada has accounted for roughly 90% of the catch of the transboundary unit in recent years, with the U.S. accounting for the remaining catch (TRAC 2016). This report encompasses the entire Georges Bank haddock stock, and takes into account cooperative management in the Eastern Georges Bank transboundary unit. Nearly 90% of the U.S. landings come from trawl gear, with a small amount of landings from hook and line and gillnet gear (NEFSC 2012).

Gulf of Maine/Georges Bank redfish, pollock, and haddock collectively received Marine Stewardship Council (MSC) certification specifically for otter trawl gear in July 2016. These three otter trawl fisheries will need to be re-assessed in July 2020 in order to maintain certification. Otter trawl catches comprise more than 70% of pollock, haddock, and redfish landings collectively (MSC 2016).

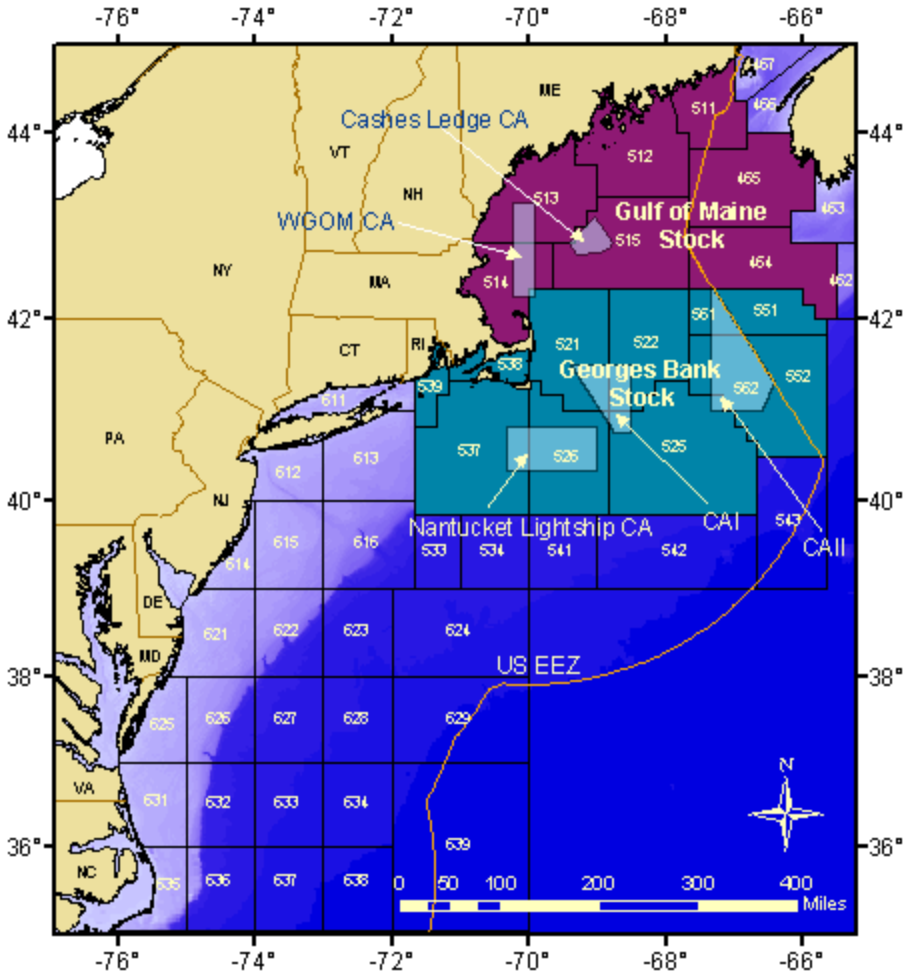

Figure 1. Statistical areas included in the Georges Bank haddock management unit are shown in green (Brodziak et al. 2006).

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of the Management Authority and Regulatory Process

Responsibility of Georges Bank haddock management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of Georges Bank haddock regulations as part of a complex of 16 species that are managed together as the Northeast Multispecies Fishery. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For Northeast multispecies fisheries management, a sub-set of NEFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the Oversight Committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the Oversight Committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of Georges Bank haddock. Then the PDT provides reports to the Oversight Committee in

response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The NEFMC is also assisted by the members of the Scientific and Statistical Committee (SSC), who review and participate in stock assessment updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of the entire process.

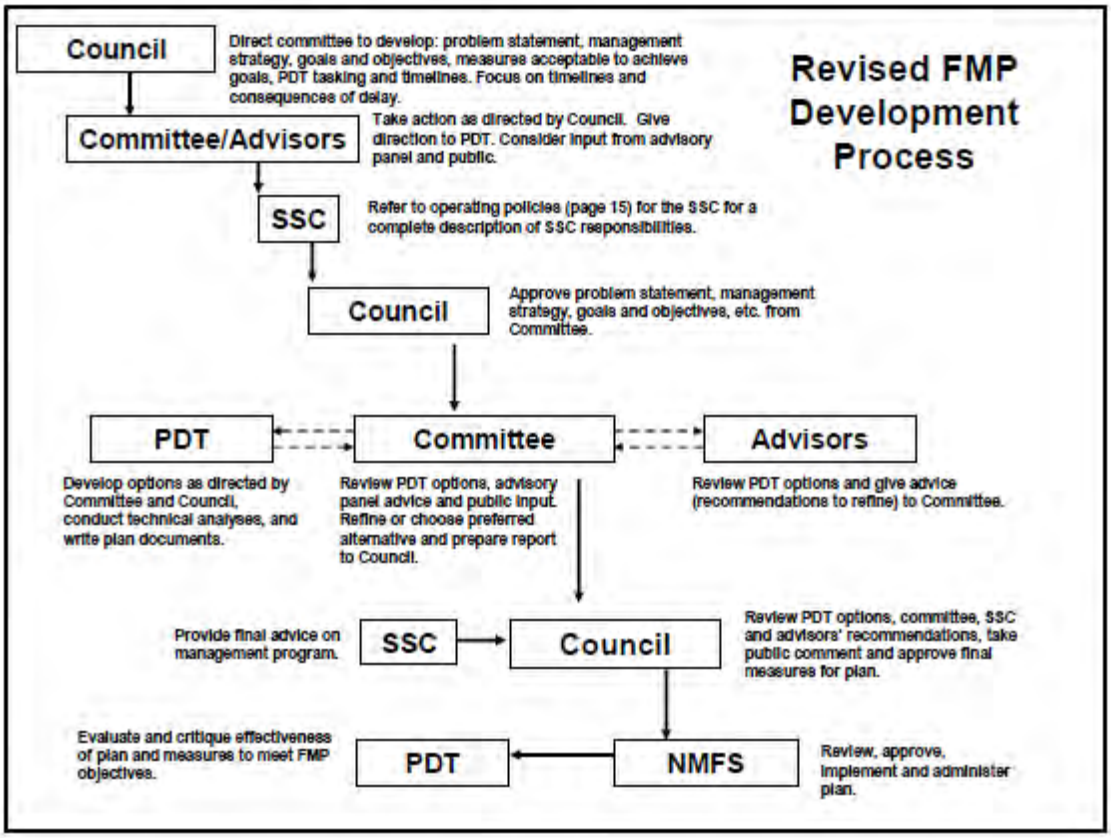

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

The Georges Bank haddock stock is also a transboundary resource, meaning the stock migrates across international boundaries. Therefore, management of a portion of the stock is coordinated with Canada through the Transboundary Resources Assessment Committee (TRAC) process. The Canadian fishery on Georges Bank is managed under an individual quota system. An informal quota sharing understanding between Canada and the U.S. was implemented in 2004 to share the harvest of the transboundary portion of the stock. This understanding includes total allowable catch (TAC) quotas for each country as well as in-season monitoring of the U.S. catch of haddock on Eastern Georges Bank.

III. Northeast Multispecies Fisheries Management Plan

The Northeast Multispecies Fishery Management Plan (FMP) was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks and to promote rebuilding to sustainable biomass levels. Sixteen species are managed under Amendment 16 to the

Northeast Multispecies FMP. Thirteen large-mesh species are managed together based on fish size and type of gear used to harvest the fish: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, white hake, and wolffish. Because several large-mesh species are managed as two or more separate stocks, e.g., Gulf of Maine haddock and Georges Bank haddock, there are a total of 20 separate stocks of groundfish managed under the FMP. The other three species (silver hake [or whiting], red hake, and offshore hake) are managed under a separate small-mesh multispecies program pursuant to Amendment 12 of the Northeast Multispecies FMP.

During the 1990s and until April 2009, the groundfish complex was primarily managed under the Days-At-Sea (DAS) system: by seasonal and year-round area closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size, number of nets/hooks, etc.), minimum fish size limits, trip limits (i.e., limiting fishermen to a certain poundage of fish per trip), limited access (i.e., limiting the number of participants in the fishery) and restrictions on the number of days a vessel is allowed to fish for groundfish each year (i.e., days-at-sea) (NEFMC 2009). In May 2004, Amendment 13 to the FMP implemented formal rebuilding plans for groundfish stocks, including Georges Bank haddock, based on revised biomass and fishing mortality targets derived by the Working Group on Re-evaluation of Biological Reference Points (BRPs) for New England Groundfish. Amendment 13 also marked the development of the first sector in New England (the Georges Bank Hook sector on Cape Cod). The overall goal of these actions was to reduce fishing mortality to rebuild depleted groundfish stocks to target biomasses.

In May 2010, Amendment 16 authorized the formation of individual fishing organizations, which shifted the management regime from the DAS system to this output-controlled system, referred to as sectors. In addition to general regulations for the fishery, Amendment 16 also implements species- and stock-specific regulations for vessels in the common pool and in sectors. Beginning in FY 2010, commercial harvesters of groundfish have been managed in two self-selecting categories: common pool and sectors. From the start in 2010, the vast majority of the Northeast groundfish fishery has been enrolled in sectors, and typically over 90% (sometimes nearly 100%) of the groundfish quotas are allocated to sector participants.

The current regulations setting the catch levels for each of the 20 groundfish stocks, which were implemented by Framework Adjustment (FW) 48 to Amendment 16 in 2013, and revised in FW 50 in 2013, implement new requirements under the Magnuson-Stevens Reauthorization Act (MSRA) of 2006. The MSRA requires the NEFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) that enable rebuilding within specified time frames for all managed stocks. This action implements a process for calculating an ACL in addition to the overfishing level (OFL) and acceptable biological catch (ABC) for each stock. Recommendations for these figures are developed by the PDT. The Science and Statistical Committee (SSC) recommends ABC levels, and the NEFMC approves final ACLs, but cannot exceed the SSC's recommended levels. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, sectors, and the common pool. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL. Although the following stocks have ACLs, possession is prohibited:

northern and southern windowpane flounder, ocean pout, and wolffish. In addition, Atlantic halibut catch is limited to one fish per trip. Northeast Multispecies permit holders are eligible to receive an allocation for the remaining groundfish stocks.

Common Pool

Members in the common pool are managed by an effort control system that regulates the number of days a harvester may fish. In addition to a limited number of days a harvester may fish, controls include 24-hour DAS counting, trip limits on other groundfish stocks, gear restrictions, minimum mesh size restrictions, gillnet restrictions, hook limits, seasonal and year-round closures, minimum fish size restrictions, and special access programs. Specific effort control measures are described in the final rule for Amendment 16 (NMFS 2010).

For example, minimum mesh size for trawl gear used to target haddock is 6.5-inch diamond or square mesh. Under Framework 55, a 100,000-lb trip limit was implemented for Georges Bank haddock for common pool vessels (NMFS 2016).

Starting in 2012, trimester hard TACs (total allowable catch) have been used as a harvest control measure, and the fishery is suspended once 90% of the trimester TAC is reached (NMFS 2014).

Sectors

Nineteen sectors have been authorized in the New England region. Sectors are self-selecting and largely self-regulating groups of fishermen who collaboratively manage an allocation of fish. Sectors must draft and submit formation proposals, operations plans, and sector monitoring plans, revised enforcement provisions, and clarification of the interaction of sectors with Special Management Programs, such as U.S./Canada management areas. NMFS prepares an environmental assessment (EA) annually to assess the impacts of the individual and cumulative sector operations as proposed in their operations plans.

In exchange for fishing under an ACL for each allocated species in the management plan, sectors are exempt from most common pool effort control measures, such as limited number of days at sea and trip limits. These are referred to as universal exemptions. A sector's allocation of an ACL for a particular stock is called the Annual Catch Entitlement (ACE), and is a sub-ACL of the overall fishery ACL. At-sea catch monitoring ensures that sector ACEs are not exceeded. For each permit that is eligible to join a sector, the permit's potential sector contribution (PSC) is calculated based on a slice of the permit's catch history. The ACE that is allocated to a sector is based on the sum of the PSCs for the permits that join the sector. Sector participants are not allowed to discard legal sized fish, and all fish caught count toward their sector allocations.

If the ACL is not reached in a given year, sectors can carry over a maximum of 10% of the unused ACL into the following year. This maximum of 10% can be reduced if the carry over, in addition to the ACL of the upcoming year, exceeds the total ABC (NMFS 2016).

The following universal exemptions from Amendment 16 and measures from Framework 51 directly affect sector vessels' access to Georges Bank haddock (NMFS 2010; 2014):

- Vessels fishing in sectors have access to the Georges Bank Seasonal Closure Area in May.
- Sector vessels are also exempt from the Georges Bank Regulated Mesh Area requirement to use a 6.5 inch-minimum codend mesh size when using either a haddock separator trawl, rope trawl, or Ruhle trawl (a minimum mesh size of 6.0 still applies).

Regulations Shared by Common Pool and Sector Vessels

The following regulations and Special Access Program (SAP) requirements exist for Georges Bank haddock (GARFO 2015):

- All commercial vessels participating in the Northeast Multispecies Fishery are required to use a Vessel Monitoring System (VMS) to report fishing activities, as well as a vessel trip report (VTR).
- Minimum size for haddock is 16 inches (decreased from 18 inches for U.S. fishery in July 2013).
- Common pool and sector vessels are required to use a haddock separator trawl, Ruhle trawl, or rope separator trawl when fishing in the northern windowpane flounder Accountability Measure area.
- Common pool and sector vessels will have access to the Closed Area I Hook Gear Haddock SAP only if fishing with demersal longline gear or tub trawl gear.
- Common pool and sector vessels will have access to the Closed Area II Yellowtail Flounder/Haddock SAP to target Georges Bank haddock from May 1 through January 31.

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

CRITERION: Sufficient data exist to determine harvest levels.
**This criterion refers to setting future harvest levels, not past harvest levels.*

IV. Georges Bank Haddock Data

Stock Status

Landings and fishery-independent data (e.g. survey data) are used in determining biological reference points (BRPs) for Georges Bank haddock. The 2008 Groundfish Assessment Review Meeting (GARM) III analysis utilized a virtual population analysis (VPA) that included estimates for recreational landings and commercial discards (NEFSC 2008). In 2012, groundfish assessment updates were made to the GARM III analysis using more recent data (NEFSC 2012). In 2015, there was an operational update conducted, which included updating commercial catch data, survey indices of abundance,

weights and maturity at age, and the VPA assessment model and reference points through 2014 (NEFSC 2015).

Comparing the time series of VPA estimated spawning stock biomass (SSB) and fishing mortality (F), the stock was at its most depleted in the late 1980s and early 1990s. The rate of fishing dropped sharply in 1995 and consequent gains in SSB were realized. A strong 2003 year class contributed to the ongoing rebuilding of the fishery, and by 2006, the stock was no longer overfished. It is important to note that it is not appropriate to compare the entire time series of SSB and F values (1931-2007) to the reference points derived for the 2008 GARM III assessment because the BRPs derived herein were based on only five years of weights and selectivity: 2003-2007 (NEFSC 2008).

Biological reference points were updated in 2012 based on the GARM III assessment, using stock weight, catch weight, SSB weights, and maturity based on an average of the previous five assessed fishing years, 2008 – 2012. The 2012 BRP estimates were an equilibrium SSB at maximum sustainable yield (SSB_{MSY}) of 124,900 mt, and a fishing mortality $(F)_{MSY}$ of 0.39 (NEFSC 2012). Spawning stock biomass in 2010 was estimated at 167,266 mt, and fishing mortality on ages 5-7, F=0.18 with a CV of 13% (NEFSC 2012).

The operational assessment in 2015, given retrospective adjustments, estimated the 2014 SSB at 150,053 mt, which is 139% of the biomass target. The fishing mortality for 2014 was estimated to be 0.241, which is 62% of the target F_{MSY} (NEFSC 2015).

The most recent operational assessment in 2017, given retrospective adjustments, estimated SSB in 2016 to be 290,324 mt, which is 278% of the biomass target (SSB_{MSY} proxy = 104,312 mt). Fishing mortality on ages 5-7 was estimated to be 0.309, or 88% of the overfishing threshold proxy (F_{MSY} proxy = 0.353) (NEFSC 2017).

Georges Bank haddock is not overfished and overfishing is not occurring; the stock is considered rebuilt. The stock has a broad age structure and broad spatial distribution, although weights at age have been declining since the large 2003 year class.

Sources of Uncertainty

The primary sources of uncertainty for this stock in the 2008 GARM III assessment were the age specific mean lengths and weights. Changes in mean size at age, as well as changes in management regulation, altered the selectivity at age. This, combined with lower weights at age, led to a higher fishing mortality rate and lower values for SSB_{MSY} and MSY (NEFSC 2008). The primary source of uncertainty in the 2012 assessment update was the estimate of the 2010 year class. It's believed that there was more certainty in age specific mean lengths and weights compared to the 2008 GARM III assessment because patterns had stabilized over the period of years used to estimate the reference points and for making projections. (NEFSC 2012). The primary source of uncertainty in the 2015 operational update was the estimate of the 2013 year class. It is acknowledged in the update that very large year classes have typically been considered anomalies, but since (and including) 2003, there have been several very large year classes (2010, 2012, 2013). Given that projection advice and BRPs are strongly dependent on recruitment data, an area of future research could focus on recruitment forecasting.

The primary sources of uncertainty in the 2017 operational update are the retrospective bias and assumptions about weights and selectivity at age. This assessment has developed a major retrospective pattern in recent years. The 2017 assessment was adjusted to account for the significant proportion of SSB represented by the large 2013 year class – numbers at age were adjusted to 53% of unadjusted values. Many of the assumed values in the 2015 update were overestimates when compared to observed weights and estimated selectivity for 2015 and 2016. Catch at age in 2016 is also a source of uncertainty. There were large differences in the catch at ages 5, 6, and 7, which is why a weighted average F was used in this assessment. Thus, there is still a need for more recruitment forecasting, as well as continuing to examine projected values against realized values for weights at age and selectivity.

Transboundary Stock Unit

Annual TACs for the sub-allocation of Eastern Georges Bank haddock are determined through a process involving the New England Fishery Management Council, the Transboundary Management Guidance Committee (TMGC), and the U.S./Canada Transboundary Resources Steering Committee. The recommended FY 2018 TACs were based on the most recent stock assessments and the fishing mortality strategy shared by NMFS and Canada's Department of Fisheries and Oceans (DFO). For the jointly managed haddock stock in Eastern Georges Bank, the TMGC concluded that the most appropriate combined U.S./Canada TAC for FY 2018 was 40,000 mt (NMFS 2018). This resulted in recommended allocations of 39% of the shared TAC to the U.S., and 61% to Canada, or a quota of 15,600 mt for the U.S. and 24,400 mt for Canada (NMFS 2018).

The FY 2018 TAC represents an overall decrease of 10,000 mt from the previous year, based on decreases in biomass seen in surveys and requests for stability in TACs from the industry. According to the Transboundary Resources Assessment Committee (TRAC) 2016 status report, 2015 and 2016 biomass indices were the highest in the time series (TRAC 2016). The TRAC 2017 status report discusses a significant decrease (48%) in the 2017 DFO survey, and a decrease in the 2016 NMFS fall survey (-53% from 2015). However, the NMFS spring survey showed index values increased by 16% from 2016 to 2017. The estimate for the 2016 year class is 111 million age one fish. The 2013 year class is the largest cohort in the time assessment series, estimated at 885 million age one fish, followed by the 2010 year class at 243 million. Fishing mortality (F) was estimated at 0.10 in 2016, which is far below F_{MSY} (0.26) (TRAC 2017).

A retrospective bias was first noted in the 2014 assessment, and retrospective analyses were performed in 2017. The adjusted 2016 recruitment is 57.36 million, or about half the unadjusted estimate. The adjusted 2017 3+ biomass is 154,877 mt, compared to the initial estimate of 274,482 mt (TRAC 2017). Recruitment has typically been higher when the adult biomass is over 40,000 mt. There is a wide range of age groups represented in the age structure, but weights at age have been trending down in the past 20 years. The TRAC 2017 report recommends that Eastern GB haddock be prioritized for a benchmark review, as the VPA model appears to be performing worse over time for assessing this fishery.

As biomass (B) levels are significantly greater than half B_{MSY}, and F is less than F_{MSY}, Georges Bank haddock is not overfished and overfishing is not occurring. This stock is above management target thresholds for SSB_{MSY} and has been rebuilt since 2006.

Stock history

Figure 3 below shows that U.S. Georges Bank commercial catch, shown in metric tons, has not exceeded the Annual Catch Limits since the implementation of the sector-based system).

Figure 3. Trend in ACLs vs. catch (mt) from 2004-2016 (GARFO 2017). The sector management system (using ACLs) was implemented in 2010.

U.S. catch on Eastern GB (which is included in Figure 3 total catch) has been less than 2,000 mt every year between 2006-2016, and less than 500 tons in 2007, 2012, and 2016. Combined U.S./Canadian catch on Eastern GB has exceeded 12,000 mt every year between 2006-2016, except for 2012 and 2013, when the combined catch was 5,600 and 5,100 mt, respectively (TRAC 2017).

On the Canadian side of the transboundary stock, observer data shows that discards were less than 2% of the total catch between 2004 – 2008 (Cox et al. 2010). Figure 4 provides a graphical depiction of total catch by country for Georges Bank haddock from 1960 to 2016. Estimated landings for the recreational sector are zero or assumed to be negligible (NEFSC 2017). In 2016, Canadian haddock discards from the groundfish fishery were negligible, while the Canadian scallop fishery resulted in 8 mt of haddock discards compared to 11,943 mt in Canadian haddock landings from Eastern GB. U.S. fisheries generated 125 mt of haddock discards from the otter trawl and scallop dredge fisheries combined, compared to 341 mt in haddock landings from Eastern GB (TRAC 2017).

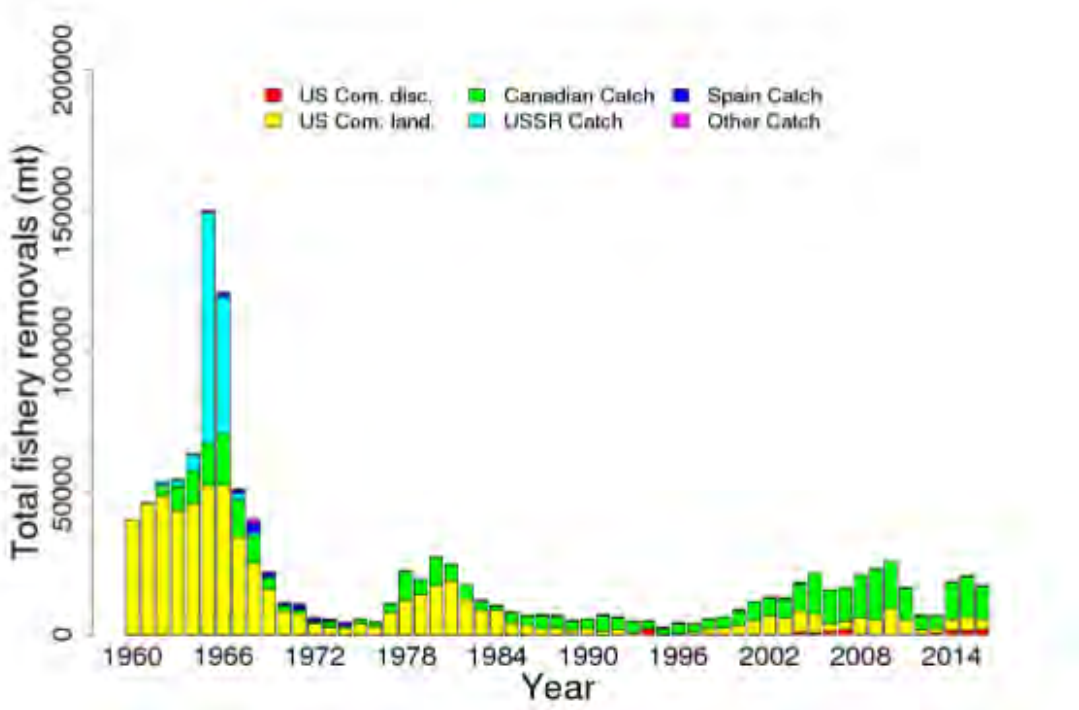

Figure 4. Total fishery removals (mt) of Georges Bank haddock by country, 1960-2016 (NEFSC 2017)

Harvest Levels

Sufficient data exists to determine acceptable harvest levels for current and coming fishing years. The U.S. ACLs for the Georges Bank haddock stock in fishing years (FY) 2018-20 are identified in Framework Adjustment 57, which incorporates findings from the most recent stock assessment (NMFS 2018). Based on recommendations by the Science and Statistical Committee, the NEFMC set an Overfishing Level (OFL) and Acceptable Biological Catch (ABC), which are set to inhibit overfishing. The approved OFL, ABC, and ACLs for FY 2018-20 under Framework Adjustment 57 are outlined in the table below *(Table 1)*[1] (NMFS 2017).

Table 1. Overfishing Limits, Acceptable Biological Catch, and Annual Catch Limits for Fishing Years 2018-2020

Fishing Year	Overfishing Limit (OFL)	Acceptable Biological Catch (ABC)	Total Annual Catch Limit (ACL)	Sector ACL	Common Pool ACL
2018	94,274 mt	48,714 mt	46,312 mt	44,348 mt	311 mt
2019	99,757 mt	48,714 mt	46,312 mt	44,348 mt	311 mt
2020	100,825 mt	73,114 mt	69,509 mt	66,560 mt	467 mt

[1] A Framework Adjustment is an abbreviated rule-making process for actions within the scope of the existing goals and objectives of the respective fishery management plan (Amendment 16 in this case), and with no significant impacts on the human or physical environment.

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

The monitoring programs in place for the Northeast multispecies fishery provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Monitoring of the common pool is carried out through several different programs. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily vessel trip reports (VTRs), which provide details on type of gear fished, area fished, species caught and discarded, dealer information, and port of landing information, in addition to other details. The Northeast Fisheries Observer Program (NEFOP) employs at-sea observer coverage and biological sampling for the groundfish fleet. Separate from NEFOP, there are also shore-side port samplers who take biological samples from landed catch to help inform stock assessments and other fisheries research.

The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level of precision (measured as the coefficient of variation [CV]) no greater than 30% for each fishery (73 FR 4736; January 28, 2008). Eight percent of all common pool trips to fish for Georges Bank haddock need at-sea observers on board as required by NEFOP regulations. The Pre-Trip Notification System (PTNS) ensures fair and adequate coverage of vessels across the multispecies fishery. Vessels enter information into PTNS prior to a trip, and an algorithm randomly selects trips for coverage in order to achieve the targeted observer and at-sea monitor coverage across sectors, areas, and gear types. In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage.

Sectors have additional monitoring requirements. Sector operations plans specify how a sector will monitor its catch to assure that sector catch does not exceed the sector allocation. Industry funding of at-sea monitoring (ASM) was introduced in March 2016, beginning the transition from the federal government covering the costs of ASM to the industry covering the costs. NOAA reimbursed the industry 85% of its expenses in FY 2016 and 60% in FY 2017 through a grant from the Atlantic States Marine Fisheries Commission (ASMFC). During FY 2018, ASM will be fully funded by NOAA because Congress appropriated additional funding. For FY 2018, total target coverage is 15% for ASM based on an average of ASM data from FY 2014-2016. The Northeast Fishery Observer Program (NEFOP) covers 8% of the target coverage, while the remaining 7% must be covered by industry ASM.

Previously, sector required at-sea monitoring coverage was typically between 17% and 22%. In 2016, additional factors were accounted for in determining the target so as to ensure compliance with the 30% CV requirement, including: removing ASM coverage for a subset of sector trips, using more years of discard data to predict coverage levels, and basing the target on predictions for stocks that are at a higher risk for error in the discard estimate (NMFS 2016). All sector vessels are still required to submit weekly VTRs in accordance with Amendment 16 to the Northeast Multispecies FMP.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

Based on the data collected through monitoring, the Northeast multispecies complex is routinely evaluated and necessary changes to management measures are made through biennial Framework Adjustments.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the Northeast Multispecies FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations.

In the common pool, enforcement is focused on compliance with DAS regulations, seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures. Enforcement for sector vessels primarily relies on monitoring harvest levels through sector reporting and VTRs (in addition to some of the measures described above for which sectors are not universally exempt); however individual sectors are also responsible for self-enforcement. Dealer reporting is a requirement of dealers who receive the fish.

It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: ACE overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. Haddock is not identified as a species of concern under OLE's enforcement

priorities. Data available on enforcement actions between March 2010 – February 2018 shows that in the Northeast, there were no specific violations involving haddock (NOAA 2018). Of the general enforcement actions that could have pertained to fishermen in the Northeast Multispecies fishery (although not specified in these more general violations), the most predominant problems were related to fishing in closed areas, reporting violations, gear violations, and possession or overage violations. In total, there were less than 25 of these possible NE Multispecies fishery violations between March 2010 – February 2018 (NOAA 2018). Many of the recent cases involved noncompliance with possession limits, particularly for cod.

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Gulf of Maine Research Institute

Science. Education. Community.

Gulf of Maine Responsibly Harvested
Verification Report on
Gulf of Maine Haddock (*Melanogrammus aeglefinus*)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.
- *GOM haddock is managed by NMFS and NEFMC, and regulated by the Northeast Multispecies Fishery Management Plan, which utilizes the best available science to set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.
- *GOM haddock stock size is not below management target levels; the stock is considered rebuilt. Overfishing is not occurring and the stock is not overfished.*

☒ Sufficient data exists to determine harvest levels.
- *The 59th Stock Assessment Review Committee, as well as the 2015 and 2017 assessments, utilized fisheries-dependent and –independent data to determine biological reference points, which are assessed through the Council process. Ultimately, the Council sets the harvest levels (Annual Catch Limits) based on these data and information, which incorporate uncertainty. It is not considered a data poor species.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.
- *GOM haddock catch is monitored through vessel trip reports (VTRs), observers, dealer reports, and for sectors additional at-sea monitoring . Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.
- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of GOM haddock.*

I. Definition of Gulf of Maine Haddock

Gulf of Maine haddock (*Melanogrammus aeglefinus*) is harvested from the waters off the coast of Massachusetts, New Hampshire, and Maine (see Figure 1). Otter trawl, sink gillnet and benthic longline vessels account for approximately 99% of total landings (NEFSC 2008).

Gulf of Maine/Georges Bank redfish, pollock, and haddock received Marine Stewardship Council (MSC) certification specifically for otter trawl gear in July 2016. That portion of the fishery will need to be re-assessed for its certification in July 2020. Otter trawl catches comprise more than 70% of pollock, haddock, and redfish landings collectively, but the certification does not consider other gear types (MSC 2016).

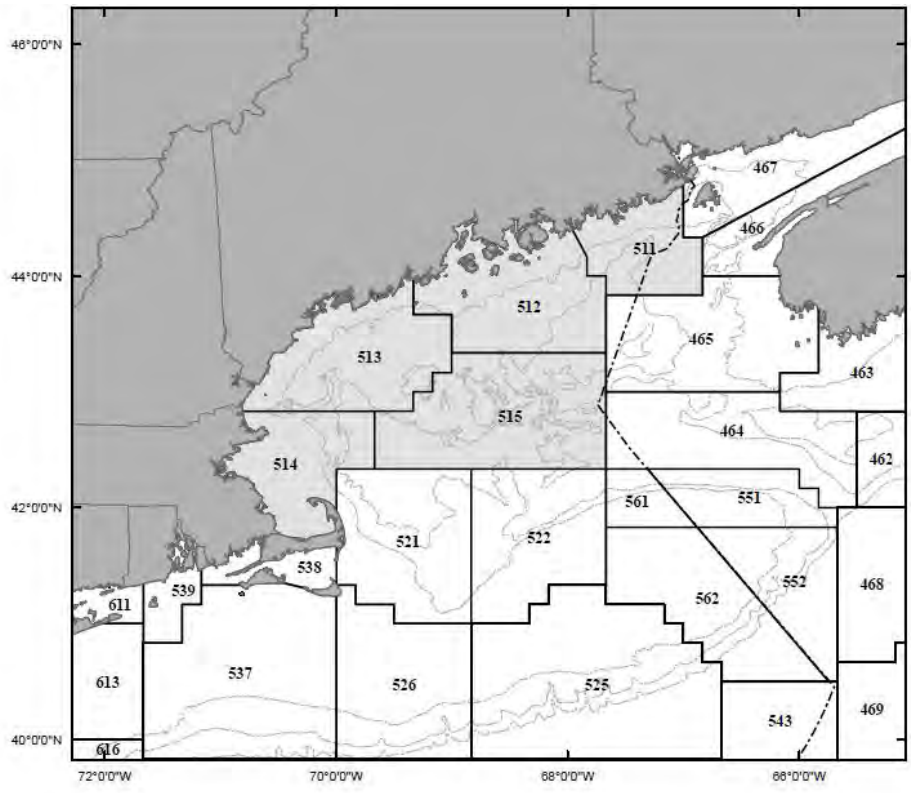

Figure 1. Statistical areas included in the Gulf of Maine haddock management unit, 511-515, are shown in light grey. The dashed line represents the United States Exclusive Economic Zone (NEFSC 2008).

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of the Management Authority and Regulatory Process

Responsibility of Gulf of Maine haddock management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of Gulf of Maine haddock regulations as part of a complex of 16 groundfish species that are managed together as the Northeast Multispecies Fishery. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For Northeast multispecies fisheries management, a sub-set of NEFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the oversight committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the oversight committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of haddock. Then the PDT provides reports to the oversight committee in response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The NEFMC is also assisted by the members of the Scientific and Statistical Committee (SSC); SSC members review and participate in stock assessment updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of this process.

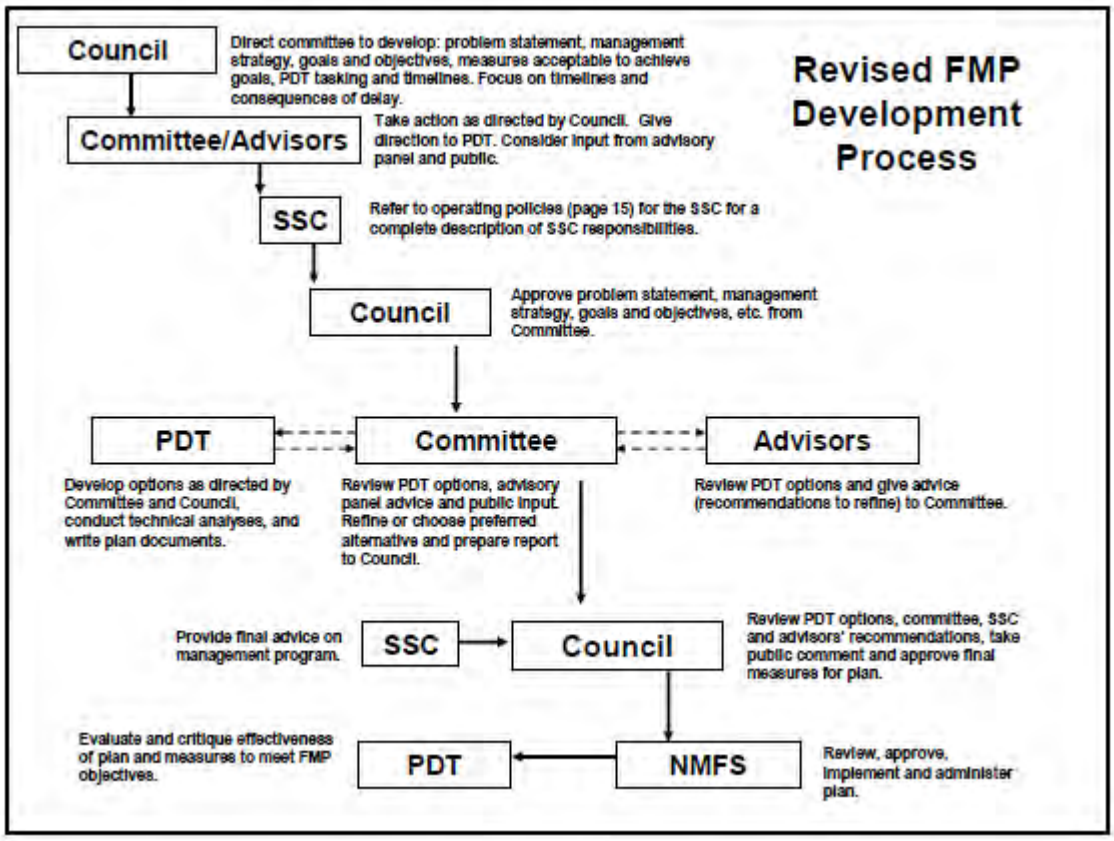

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Northeast Multispecies Fisheries Management Plan

The Northeast Multispecies Fishery Management Plan (FMP) was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks and to promote rebuilding to sustainable biomass levels. Sixteen species of groundfish are managed under Amendment 16 to Northeast Multispecies FMP. Thirteen large-mesh species are managed together based on fish size and type of gear used to harvest the fish: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, white hake, and wolffish. Because several large-mesh species are managed as two or more separate stocks, e.g., Gulf of Maine haddock and Georges Bank haddock, there are a total of 20 separate stocks of groundfish managed under the FMP. The other three species (silver hake [or whiting], red hake, and offshore hake) are managed under a separate small-mesh multispecies program pursuant to Amendment 12 of the Northeast Multispecies FMP.

During the 1990s and until April 2009, the groundfish complex was primarily managed under the Days-At-Sea (DAS) system: by seasonal and year-round area closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size, number of nets/hooks, etc.), minimum fish size limits, trip limits (i.e., limiting fishermen to a certain poundage of fish per trip), limited access (i.e., limiting the number of participants in the fishery) and restrictions on the number of days a vessel is allowed to fish for groundfish each year (i.e., days-at-sea). In May 2004, Amendment 13 to the FMP implemented formal rebuilding plans for groundfish stocks, including Gulf of

Maine haddock, based on revised biomass and fishing mortality targets derived by the Working Group on Re-evaluation of Biological Reference Points for New England Groundfish. Amendment 13 also marked the development of the first sector in New England (the Georges Bank Hook Sector on Cape Cod). The overall goal of these actions was to reduce fishing mortality to rebuild depleted groundfish stocks to target biomasses.

In May 2010, Amendment 16 authorized the formation of individual fishing organizations, which shifted the management regime from the DAS system to an output-controlled system, referred to as sectors. In addition to general regulations for the fishery, Amendment 16 also implemented species- and stock-specific regulations for vessels in the common pool and in sectors. Beginning in FY 2010, commercial harvesters of groundfish have been managed in two self-selecting categories: common pool and sectors. From the start in 2010, the vast majority of the Northeast groundfish fishery has been enrolled in sectors, and typically over 90% (sometimes nearly 100%) of the groundfish quotas are allocated to sector participants.

The current regulations setting the catch levels for each of the 20 groundfish stocks, which were implemented by Framework Adjustment (FW) 48 to Amendment 16 in 2013, and revised in FW 50 in 2013, implemented new requirements under the Magnuson-Stevens Reauthorization Act (MSRA) of 2006. The MSRA requires the NEFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) that enable rebuilding within specified time frames for all managed stocks. This action implements a process for calculating an ACL in addition to the overfishing level (OFL) and acceptable biological catch (ABC) for each stock. Recommendations for these figures are developed by the PDT. The Science and Statistical Committee (SSC) recommends ABC levels, and the NEFMC approves final ACLs, but cannot exceed the SSC's recommended levels. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, sectors, and the common pool. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL. Although the following stocks have ACLs, possession is prohibited: northern and southern windowpane flounder, ocean pout, and wolffish. In addition, Atlantic halibut catch is limited to one fish per trip. Northeast Multispecies permit holders are eligible to receive an allocation for the remaining groundfish stocks.

Common Pool

Members in the common pool are managed by an effort control system that regulates the number of days a harvester may fish. In addition to a limited number of days a harvester may fish, controls include 24-hour days-at-sea counting, trip limits on other groundfish stocks, gear restrictions, minimum mesh size restrictions, gillnet restrictions, hook limits, seasonal and year-round closures, minimum fish size restrictions, and special access programs. Specific effort control measures are described in the final rule for Amendment 16 (NMFS 2010). For example, minimum mesh size for trawl gear used to target haddock is 6.5-inch diamond or square mesh. In FY 2016, the common pool trip limit for GoM haddock was 200 lbs per DAS, up to 600 lbs per trip (NMFS 2016).

Starting in 2012, a trimester hard TAC (total allowable catch) has been used as a harvest control measure, and the fishery is suspended once 90% of the trimester TAC is reached (NMFS 2014).

Sectors

Nineteen sectors have been authorized in the New England region. Sectors are self-selecting and largely self-regulating groups of fishermen who collaboratively manage an allocation of fish. Sectors must draft and submit formation proposals, operations plans, and sector monitoring plans, revised enforcement provisions, and clarification of the interaction of sectors with Special Management Programs, such as U.S./Canada management areas. NMFS prepares an environmental assessment (EA) annually to assess the impacts of the individual and cumulative sector operations as proposed in their operations plans.

In exchange for fishing under an ACL for each allocated species in the management plan, sectors are exempt from most common pool effort control measures, such as limited number of days at sea and trip limits. These are referred to as universal exemptions. A Sector's allocation of an ACL for a particular stock is called the Annual Catch Entitlement (ACE), and is a sub-ACL of the overall fishery ACL. At-sea catch monitoring ensures that sector ACEs are not exceeded. For each permit that is eligible to join a sector, the permit's Potential Sector Contribution (PSC) is calculated based on the permit's catch history. The ACE that is allocated to a sector is based on the sum of the PSCs for the permits that join the sector. Sector participants are not allowed to discard legal sized fish, and all fish caught count toward their allocations.

If the ACL is not reached in a given year, sectors can carry over a maximum of 10% of the unused ACL into the following year. This maximum of 10% can be reduced if the carry over, in addition to the ACL of the upcoming year, exceeds the total ABC (NMFS 2016).

Regulations Shared by Common Pool and Sector Vessels

- All commercial vessels participating in the Northeast Multispecies Fishery are required to use a Vessel Monitoring System (VMS) to report fishing activities, as well as a vessel trip report (VTR).
- Minimum size for Gulf of Maine haddock is 16 inches.
- Sector vessels participating in Special Access Programs must only use gear approved under those programs.
- Fish fillets must have skin on while possessed on board a vessel at the time of landing in order to meet minimum size requirements. (NOAA 2017)

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

CRITERION: Sufficient data exist to determine harvest levels.
**This criterion refers to setting future harvest levels, not past harvest levels.*

IV. Gulf of Maine Haddock Data

Stock Status

Landings and survey data are used in determining the biological reference points (BRPs) for Gulf of Maine (GOM) haddock. In 2008, the Groundfish Assessment Review Meeting (GARM III) utilized a virtual population analysis (VPA) model to assess GOM haddock. The resulting BRP estimates from GARM III were a Spawning Stock Biomass at maximum sustainable yield (SSB_{MSY}) of 5,900 mt, and a fishing mortality $(F)_{MSY}$ of 0.43. The 2007 SSB was estimated to be 5,850 mt and in 2008, F was estimated to be 0.25 (NEFSC 2008).

The GARM III received an assessment update in 2012. This assessment identified that the spawning stock biomass (SSB) was above the revised threshold value of 2,452 mt, determining that the Gulf of Maine haddock stock was not overfished, but approaching an overfished condition with overfishing occurring in 2012 (NEFSC 2012).

In the GOM haddock benchmark assessment in 2014, the Stock Assessment Review Committee (SARC 59) used a different model called an Age Structured Assessment Program (ASAP). The BRPs were determined using an MSY proxy, $F_{40\%,} = .46$, that was calculated using a spawner-per-recruit analysis. This analysis included average SSB weights, catch weights, selectivity, and maturity data from 2009-2013. Fishing mortality (F) was estimated to be at 0.39. SSB was estimated to be at 4,153 mt in 2013, which was 101% of the SSB_{MSY} of 4,108 mt (NEFSC 2014).

Most recently, the SARC 59 assessment received an operational assessment update in 2015 and then again in 2017, the latter of which updated catch data, survey indices, and the ASAP model and reference points through 2016. In the 2017 assessment, SSB was estimated to be 47,821 mt in 2016, which is 706% of the biomass target of the SSB_{MSY} proxy at 6,769 mt. The F was estimated to be 0.137, which is 30% of the overfishing threshold proxy ($F_{40\%}$) of 0.455. No retrospective adjustments were made, as the retrospective pattern was minor. Since biomass (B) levels are above half of the B_{MSY}, Gulf of Maine haddock is not considered overfished and overfishing is not occurring (NEFSC 2017).

Sources of Uncertainty

SARC 59 and the 2015 assessment both identified uncertainty regarding the 2012 and 2013 year classes, which were unusually large and estimated based on a limited number of surveys (NEFSC 2014, 2015). The model has a tendency to overestimate large year classes, and the assessment's review panel recommended that the abundance and growth of the 2012 and 2013 year classes be monitored and that frequent model updates should occur to validate projections and improve the year class estimates. As of the 2017 assessment, the 2012 and 2013 year classes

are now believed to be well estimated, and more recent year classes are not expected to be such anomalies (NEFSC 2017).

The 2015 and 2017 assessments updated discard survival rate estimates, which help to determine the impact of the recreational fishery's catch. Assessments previous to 2015 estimated a post-release mortality rate of 100%. The 2015 assessment updated that to 50%, and the 2017 assessment used season- and size-specific estimates (NEFSC 2015, 2017).

Another large source of uncertainty in the 2017 assessment is commercial catch data. According to a recent report from the Northeast Fisheries Science Center, some fishermen might be misreporting Gulf of Maine haddock as Georges Bank haddock (Palmer 2017). This is believed to only have a significant impact in one or two of the past 10 years, when quota was particularly limited for GOM haddock. The NEFSC's report recommends improvements in catch monitoring and catch accounting (Palmer 2017). The panel for the 2017 assessment recommended more work to assess the accuracy and completeness of commercial and recreational landings and discards, as well as scientific removals. Despite these uncertainties, the population projections for Gulf of Maine haddock are reasonably well determined (NEFSC 2015, 2017).

Stock History

Historical landings information provides a summary of recent trends in the status of Gulf of Maine haddock. Below, figure 3 provides a graphical depiction of Gulf of Maine haddock landings between 1977 and 2016.

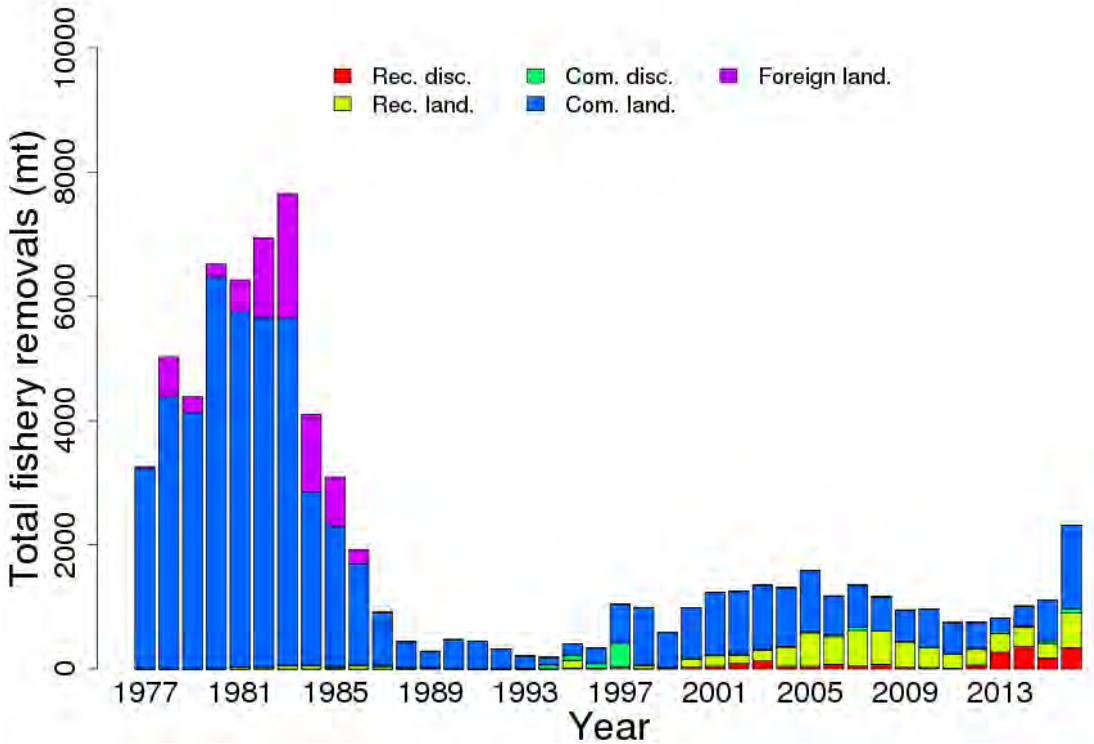

Figure 3. Total catch (mt) of Gulf of Maine haddock, 1977-2016 (NEFSC 2017).

While landings rose above 6000 metric tons (mt) in the early 1980s, a steep decline followed until around 1994. Commercial landings gradually increased after 1994 and remained relatively constant at approximately 1000 mt in the early 2000s. Between 2006-2015, commercial landings remained below 700 mt per year, in part because the Annual Catch Limits were lower (see Figure 4 below). Fishing Year 2016 was the first time GOM haddock landings rose over 1000 mt in a decade. Figure 5 below depicts commercial and recreational landings and discards in the past ten years (NEFSC 2015, 2017). Recreational discards have increased recently, as evidenced in Figure 5 below, which is assumed to be related to increases in the minimum recreational retention sizes for haddock.

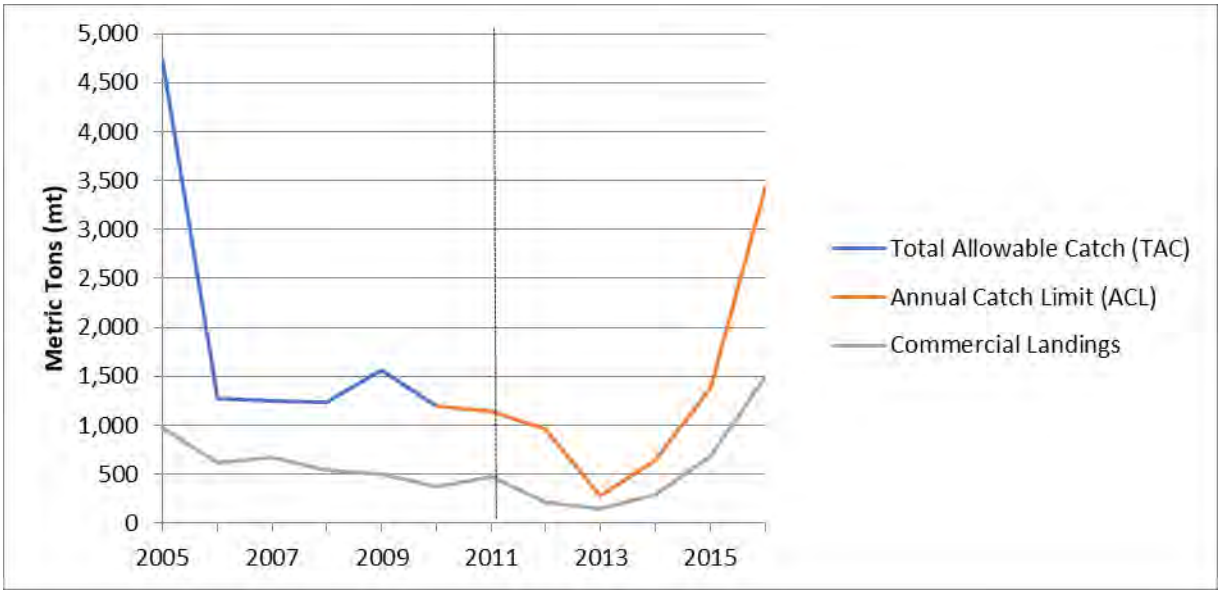

Figure 4. Total Allowable Catch (pre-sector implementation) and total Annual Catch Limits (post-sector implementation) for Gulf of Maine haddock, as well as commercial landings, from 2005-2016 (GARFO 2017).

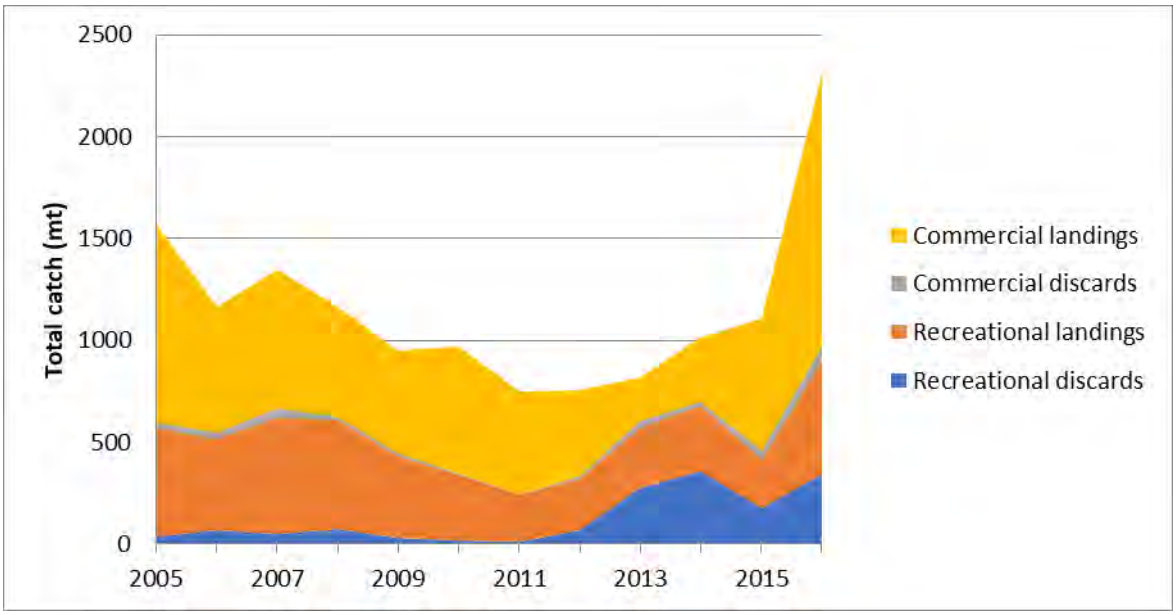

Figure 5. Total catch (mt) of Gulf of Maine haddock 2005-2016. (NEFSC 2017).

Harvest Levels

Sufficient data exist to determine harvest levels. The Annual Catch Limits (ACLs), Overfishing Limits (OFLs), and the Acceptable Biological Catch (ABC) for this stock in fishing years (FY) 2018-2020 are identified in Framework Adjustment 57, shown in Table 1 below (NMFS 2018).[1]

Table 1. Overfishing Limits, Acceptable Biological Catch and Annual Catch Limits for FY 2018-2020

Fishing Year	Overfishing Limit (OFL)	Acceptable Biological Catch (ABC)	Total Annual Catch Limit (ACL)	Sector ACL	Common Pool ACL
2018	16,954 mt	13,131 mt	12,409 mt	8,643 mt	95 mt
2019	16,038 mt	12,490 mt	11,803 mt	8,222 mt	90 mt
2020	13,020 mt	10,186 mt	9,626 mt	6,705 mt	74 mt

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

The monitoring programs in place for the Northeast multispecies fishery provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Monitoring of the common pool is carried out through several different programs. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily vessel trip reports (VTRs), which provide details on type of gear fished, area fished, species caught (and discarded), dealer information, and port of landing information, in addition to other details. The Northeast Fisheries Observer Program (NEFOP) employs at-sea observer coverage and port sampling for the groundfish fleet. Separate from NEFOP, there are also shore-side port samplers who take biological samples from landed catch to help inform stock assessments and other fisheries research.

[1] A Framework Adjustment is an abbreviated rule-making process for actions within the scope of the existing goals and objectives of the respective fishery management plan (Amendment 16 in this case), and with no significant impacts on the human or physical environment.

The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level of precision (measured as the coefficient of variation [CV]) no greater than 30% for each (73 FR 4736; January 28, 2008). Eight percent of all common pool trips to fish for Georges Bank haddock need at-sea observers on board as required by NEFOP regulations. The Pre-Trip Notification System (PTNS) ensures fair and adequate coverage of vessels across the multispecies fishery. Vessels enter information into PTNS prior to a trip, and an algorithm randomly selects trips for coverage in order to achieve the targeted observer and at-sea monitor coverage across sectors, areas, and gear types. In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage.

Sectors have additional monitoring requirements. Sector operations plans specify how a sector will monitor its catch to assure that sector catch does not exceed the sector allocation. Industry funding of at-sea monitoring (ASM) was introduced in March 2016, beginning the transition from the federal government covering the costs of ASM to the industry covering the costs. NOAA reimbursed the industry 85% of its expenses in FY 2016 and 60% in FY 2017 through a grant from the Atlantic States Marine Fisheries Commission (ASMFC). During FY 2018, ASM will be fully funded by NOAA because Congress appropriated additional funding. For FY 2018, total target coverage is 15% for ASM based on an average of ASM data from FY 2014-2016. The Northeast Fishery Observer Program (NEFOP) covers 8% of the target coverage, while the remaining 7% must be covered by industry ASM.

Previously, sector required at-sea monitoring coverage was typically between 17% and 22%. In 2016, additional factors were accounted for in determining the target so as to ensure compliance with the 30% CV requirement, including: removing ASM coverage for a subset of sector trips, using more years of discard data to predict coverage levels, and basing the target on predictions for stocks that are at a higher risk for error in the discard estimate (NMFS 2016). All sector vessels are still required to submit weekly VTRs in accordance with Amendment 16 to the Northeast Multispecies FMP.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

Based on the data collected through monitoring, the Northeast multispecies complex is routinely evaluated and necessary changes to management measures are made through biennial Framework adjustments.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the NE Multispecies FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers

the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations.

In the common pool, enforcement is focused on compliance with DAS, seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures. Enforcement for sector vessels primarily relies on monitoring harvest levels through sector reporting, dockside monitoring, dealer reporting, and VTR (in addition to some of the measures described above for which sectors are not universally exempt); however individual sectors are also responsible for self-enforcement. Dealer reporting is a requirement of dealers who receive the fish.

It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: ACE overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. Haddock is not identified as a species of concern under OLE's enforcement priorities. Data available on enforcement actions between March 2010 – February 2018 shows that in the Northeast, there were no specific violations involving haddock (NOAA 2018). Of the general enforcement actions that could have pertained to fishermen in the Northeast Multispecies fishery (although not specified in these more general violations), the most predominant problems were related to fishing in closed areas, reporting violations, gear violations, and possession or overage violations. In total, there were less than 25 of these possible NE Multispecies fishery violations between March 2010 – February 2018 (NOAA 2018). Many of the recent cases involved noncompliance with possession limits, particularly for cod.

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Gulf of Maine Responsibly Harvested Verification Report
Kelp (multiple species)
(Alaria esculenta; Laminaria digitate; Saccharina angustissima)

Criterion 1: Aquaculture operations are regulated by competent authorities that have established and acceptable environmental monitoring regulations in place.

Kelp aquaculture in Maine is managed by the Maine Department of Marine Resources (DMR) and requires a permit from the United States Army Corps of Engineers (ACOE). DMR and ACOE oversight incorporates environmental monitoring regulations that include, but are not limited to, interference with natural and supporting ecosystem processes, flora and fauna, and water quality.

Criterion 2: Regulatory oversight ensures that aquaculture operations have limited and reversible impacts on the surrounding habitat, species, and ecosystem structure and function.

State and federal rules and regulations limit the impacts kelp aquaculture may have on the surrounding environment through DMR lease and licensing requirements, ACOE permitting, and established monitoring and enforcement.

Criterion 3: Sufficient data exists to demonstrate that aquaculture operations have limited and reversible environmental impacts.

Kelp aquaculture has been studied for decades and there are several hundred peer-reviewed articles. Research shows that kelp aquaculture, especially at the scale currently conducted in the Gulf of Maine, has limited and reversible environmental impacts.

Criterion 4: Aquaculture regulations include appropriate compliance and enforcement standards.

Kelp aquaculture management by DMR includes compliance and enforcement standards. DMR conducts annual inspections of all kelp farms to ensure compliance with existing rules and regulations.

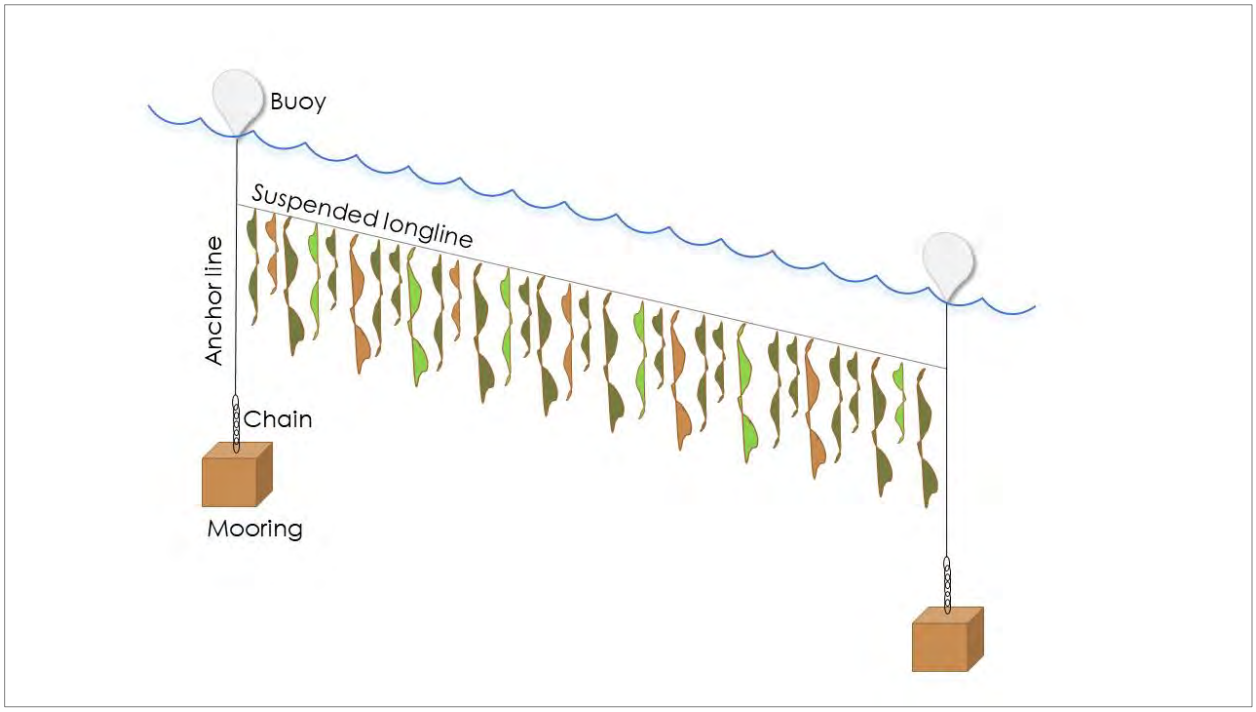
Kelp aquaculture in Maine:

I. Background and typical operations

Marine algae or seaweed has been harvested by humans around the globe for centuries. In the northeast United States, Maine is a leader in seaweed landings. Historically, most seaweed landings have been made through wild harvest. In the past decade, seaweed aquaculture, notably of kelps (order: Laminariales), has increased in the Gulf of Maine. Maine's first seaweed aquaculture operation was established in 2010 in Casco Bay and today there are 94 farms up and down the coast approved for seaweed cultivation (Maine Department of Marine Resources (DMR), 2020). In 2019, the Maine Department of Marine Resources (DMR) reported that 280,612 pounds of marine algae were harvested from aquaculture farms. This is up from 14,582 pounds harvested in 2015. Kelp, specifically sugar kelp (*Saccharina latissisima*), winged kelp (*Alaria esculenta*), and skinny kelp (*Saccharina angustissima)* are the dominant seaweeds that are cultivated in Maine waters (Grebe et al. 2019; Augyte et al. 2018; Augyte et al. 2017).

Typical farm design for kelp aquaculture in Maine consists of an arrangement of seeded horizontal longlines suspended roughly 7' below the surface between two anchor lines (Figure 1) (Grebe et al. 2019; Flavin et al., 2013). The gear required with this design usually includes moorings, buoys, line, chain, and weights. Kelp seed are juvenile marine algae that are cultivated in onshore facilities (nurseries) for use in open ocean farms. Nursey cultivation of kelp seed is reliant on the harvest of sorus tissue (reproductive tissue) from wild kelp (Flavin et al., 2013). In Maine, kelp farms are permitted to be sized up to a maximum of 100 acres. Currently, there are approximately 167 leased and licensed acres approved for seaweed cultivation in the state and an additional 130 acres pending a lease decision (DMR, 2020).

Figure 1. Typical kelp aquaculture gear and display for Maine kelp farms



Regulations for Maine's aquaculture industries have been in place since the early 1970s. DMR leases or licenses all aquaculture operations in the state, including kelp, according to state and federal laws. DMR is also responsible for monitoring aquaculture activities, as well as addressing any compliance issues that arise. Currently, all kelp farm sites are leased or licensed within state waters (within three miles from shore) and, thus, are regulated by the state. At the time of this report, there are no aquaculture sites in federal waters in the Gulf of Maine.

Anyone wishing to establish an aquaculture farm must apply to and be approved by DMR. There are three farm classifications that are available to kelp aquaculturists: standard aquaculture lease, experimental aquaculture lease, and limited-purpose aquaculture license (LPA). Differences between the three options include farm size limitations, duration of lease or license, and renewal terms. A summary of the distinctions between the three classifications is outlined in Table 1.

Table 1. Maine's aquaculture lease and license system (DMR, 2017)

	Standard Lease	**Experimental Lease**	**LPA License**
Size	Up to 100 acres	Up to 4 acres	Up to 400 square feet
Duration	Up to 20 years	Up to 3 years	Up to 1 year
Siting	Commissioner considers other existing aquaculture uses in decision	Commissioner considers other existing aquaculture uses in decision	No more than 3 LPAs allowed in a 1,000-foot radius
Renewal	Renewable and transferable	Renewal only available for scientific research	To renew, applicant must complete educational requirements
DMR site visit	Site visit with dive	Site visit, typically with no dive	No site visit

The process for applying for a standard lease includes a pre-application meeting with DMR, municipal officials, and the harbormaster. Additionally, there must be a public scoping session, public hearing, and defined public comment periods consistent with Maine's Administrative Procedures Act. Experimental lease applicants are not required to hold a pre-application meeting but must convene a public hearing if five or more people request it. Experimental lease holders are also required to submit a yearly report to DMR regarding the results of their scientific or commercial research, as well as plans for the upcoming year. LPA license applicants are not required to hold a pre-application meeting or a public meeting, though the harbormaster (or municipal official in towns without a harbormaster) must confirm that the LPA license site will not unnecessarily conflict with existing uses. Specific lease and license application requirements are detailed in Table 2. Aquaculture installations (for all lease and license sites) must also be permitted by the United States Army Corps of Engineers (ACOE). The ACOE consults with federal agencies to ensure compliance with relevant laws and acts. All kelp aquaculture options consider

environmental impacts, proximity to threatened and endangered species, and require review by and approval from state and federal agencies.

Table 2. DMR lease and license application process (DMR, 2019b; DMR 2017)

	Standard Lease	Experimental Lease	LPA License
Pre-application meeting	✓		
Draft application	✓		
Draft application review	✓		
Scoping session	✓		
Application submission and review	✓	✓	✓
Site visit and report	✓	✓	
Public hearing	✓	30-day comment period; public hearing if there are five or more written requests	No, but harbormaster or municipal official signature required
Draft decision/DMR review	✓	✓	✓
10-day review of proposed decision	✓	✓	No, but town and nearby landowners may comment each year
Final decision	✓	✓	✓
Notice of decision and appeal period	✓	✓	
Concurrent Army Corps of Engineers permit	✓	✓	✓

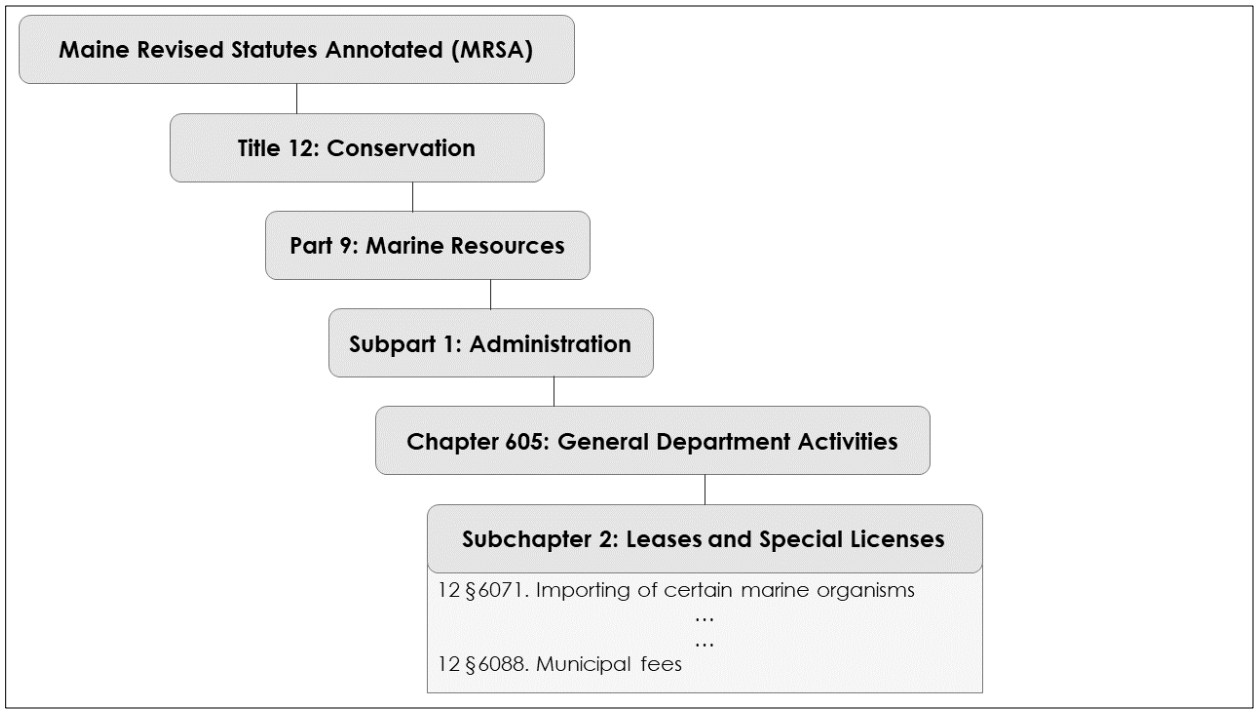
II. Assessment against criteria

Criterion 1: Aquaculture operations are regulated by competent authorities that have established and acceptable environmental monitoring regulations in place.

Maine's aquaculture management system

Aquaculture has been regulated in the State of Maine since the early 1970s. In 1973, Maine's legislature gave the Department of Marine Resources (DMR) the authority to lease state-owned waters for the practice of aquaculture in several state laws: Maine Revised Statutes Annotated, Title 12: Conservation, Chapter 605: General Department Activities, Subchapter 2: Leases and Special Licenses, 12 §6071-12 §6810-B (12 M.R.S.A. §6071-§6088). See Figure 2 for the structure of state regulations around aquaculture. Ten years later, DMR developed the regulations to govern the implementation of these laws. Chapter 2 of DMR's Procedural Rules relate specifically to how the Department will carry out the legislation set forth in 12 M.R.S.A. §6071-§6088. More specifically, Chapter 2 covers the requirements of aquaculture leases and licenses and procedures for all cultured species. Table 3 outlines DMR's decision criteria for aquaculture leases and licenses.

Figure 2. Structure of Maine laws related to aquaculture



12 M.R.S.A. §6071-§6810-B and Chapter 2 of DMR's Procedural Rules encompass the breadth of aquaculture operations in the state, from seaweeds to shellfish to salmon. This report will draw upon only those laws and regulations that relate specifically to the culture of kelp. Further, as this report assesses whether the regulatory body has established and acceptable environmental monitoring regulations in place, only the laws and regulations with environmental considerations will be reviewed.

Table 3. Decision criteria for aquaculture leases and license (DMR, nd; DMR 2019a)

	Standard Lease	Experimental Lease	LPA License
Riparian landowner ingress and egress	✓	✓	✓
Navigation	✓	✓	✓
Fishing and other uses	✓	✓	✓
Other aquaculture uses	✓	✓	✓
Existing support system (ecologically significant flora and fauna; habitat; changes in sedimentation, etc.)	✓	✓	✓
Interference with public facilities (public beaches, parks, conserved lands, etc.)	✓		
Source of cultured species (considerations for biosecurity and sanitation)	✓	✓	✓
Lighting, noise, and visual impacts	✓		

Chapter 2 stipulates the establishment of an environmental baseline for standard and experimental lease sites, as summarized by the lease applicant. The environmental baseline records characteristics such as bottom features, flora and fauna, tide levels, and current speed and direction. For standard and experimental lease applications, DMR will conduct an onsite inspection of the proposed aquaculture site. The site review will cover many of the same environmental conditions described in the environmental baseline: bottom composition, depth and bottom features, flora and fauna, presence of commercial and recreational species, commercial fishing activities, distance to shore, and navigation channels and markers. DMR accesses the proposed lease site via boat and conducts dives or remote video surveillance. The site review and dives and/or video substantiate the environmental baseline conditions described by the applicant. Dives are typically not conducted for experimental leases. DMR site reviews are not required for LPA licenses, though license applicants must include information on bottom characteristics and proximity to eelgrass (*Zostera marina*) beds.

As described in 12 §6072(6)C, DMR is required to notify the following state agencies of all aquaculture lease applications: Department of Environmental Protection (DEP); Department of Agriculture, Conservation, and Forestry (DACF); and Department of Inland Fisheries and Wildlife (IF&W). Chapter 2 adds that DMR may also notify any other state agency as necessary. In the case of kelp aquaculture, the DEP is not notified, as they are only involved if the aquaculture lease application includes discharge.

Growing kelp is non-discharge aquaculture as no external materials are added to or released from the system. In their review, the DACF considers interference with and proximity to public facilities and, therefore, their input is not related to the environmental focus of this assessment. For standard leases and experimental leases, IF&W provides comment on the "existing system support." That is, how the lease site will affect significant wildlife and marine habitat and the related flora and fauna. Typically, this translates to an investigation into the proximity of proposed lease sites to essential habitat for endangered species (such as piping plover and least tern), presence of eelgrass beds, and bald and golden eagle nests, all of which are digitally mapped on the Maine Office of GIS's online database. IF&W will also consider the displacement of marine vegetation, how site design and aquaculture operations will impact current flow, sedimentation impacts, and finfish migration. While IF&W will not review LPA license applications, LPAs cannot be sited in endangered species habitat, pursuant to 12 M.R.S.A. §12803, §12804, and §12806 (related to Maine's endangered species management and research) and IF&W's rules for endangered species (09-137 CMR Chapter 8).

In addition, and as specified in 12 M.R.S.A. §6072(7-A), DMR will consider other aquaculture uses in the area of a proposed site, specifically the intensity and frequency of proximal aquaculture operations for standard and experimental leases. For LPA licenses, there is a limit of no more than three license sites within a 1,000-foot radius.

For all aquaculture leases and licenses, the DMR will review the source of the cultured organism, i.e. the seed source. This consideration is taken to address concerns with the introduction of non-native species and/or disease or pathogens. This is further addressed in 12 M.R.S.A. §6071 (Importing of certain marine organisms). Marine algae seed must be derived from stock originating in Maine waters and come from a DMR approved nursery.

At the federal level, the United States Army Corps of Engineers (ACOE) is involved in the regulation of kelp aquaculture in Maine under section 10 of the River and Harbors Act of 1899. Under this Act, any installations that occur between the high-water mark and 200 miles offshore must be permitted by ACOE. This includes kelp aquaculture infrastructure (moorings, lines, and buoys). Under the National Environmental Policy Act, ACOE consults with other federal agencies when considering issuing a permit for installing aquaculture infrastructure. Specifically, ACOE will review how an aquaculture installation and its operation will conflict with governance authorized under the Endangered Species Act and the Magnuson-Stevens Fishery Conservation and Management Act's Essential Fish Habitat provisions. Further, ACOE may also consult with the National Oceanic and Atmospheric Administration, Environmental Protection Agency, and the United States Fish and Wildlife Service on any aquaculture installation under a number of federal acts, including, but not limited to the Marine Mammal Protection Act and the Fish and Wildlife Coordination Act. Table 4 outlines the federal acts and statutes that ACOE permitting must comply with. Depending on the specifications and siting outlined in the lease or license application, ACOE may incorporate other federal regulations and/or agencies, such as the National Historic Preservation Act, United States Coast Guard, and Federal Aviation Administration. However, consultation with these organizations is outside the scope of the environmental focus of this report.

Kelp aquaculture operations, specifically, are often eligible for Category 2 under ACOE's Maine General Permit, meaning that written approval from ACOE is required before any construction, i.e. gear deployment or

Table 4. Common regulations* considered by ACOE in aquaculture infrastructure permitting

- Magnuson-Stevens Fishery Conservation and Management Act
- Fish and Wildlife Coordination Act
- Endangered Species Act
- Historic Preservation Act
- Coastal Zone Management Act
- Marine Mammal Protection Act
- Migratory Bird Treaty Act
- Bald and Golden Eagle Act

**This is not a complete list; other laws and acts may be considered on a case by case evaluation.*

site buildout. To avoid duplication of work, the ACOE can use the DMR application for leases or licenses for its review. The standard lease, experimental lease, and LPA license applications were jointly developed by DMR and ACOE to ensure they met the requirements of both agencies. Lease and license applicants are encouraged to concurrently submit applications to both DMR and ACOE.

Maine has a long history of regulating aquaculture activities and reviewing rules and regulations to stay current with existing and upcoming activities. DMR's Chapter 2 was recently reviewed and amended in 2019.

Criterion 2: Regulatory oversight ensures that aquaculture operations have limited and reversible impacts on the surrounding habitat, species, and ecosystem structure and function.

Management and its role in responsible harvest

Studies of kelp aquaculture demonstrate numerous environmental benefits, including the uptake of excess nutrients (Pechsiri et al. 2016; Kim et al. 2015; Holdt and Edwards 2014) and habitat provision (Walls et al. 2016). However, there are also some concerns about the impact of aquaculture on the surrounding environs and ecosystem. These include impacts on the benthic environment, such as shading (Walls et al. 2017) and changes in sedimentation (Campbell, 2017), nutrient competition and depletion (Wood et al. 2017), and biosecurity and alien species (Campbell, 2017).

Current aquaculture rules and regulations in Maine address many of these concerns. For benthic impacts, the DMR site visit and subsequent report aim to determine if the lease site will impact ecologically significant flora and fauna and the associated habitat, including rooted or attached marine vegetation. Federal review, coordinated by ACOE, stipulates that aquaculture installations result in no

net loss of eelgrass. DMR reviews the site report and considers the findings in a lease decision. The site visit and report also serve as an established environmental baseline for yearly inspections by DMR staff. LPA license applicants must describe the bottom characteristics of the proposed site and must verify with their signature that the application does not contain any false information. As LPAs are designed for aquaculturists to test areas for future lease sites and are limited in size, benthic impacts are considered to be limited and quickly reversible.

Kelp farms may dampen current flow, which can result in changes to sedimentation (Campbell, 2017; Grant and Bacher, 2001). DMR considers sedimentation and sediment resuspension in the lease determination. Furthermore, the ACOE permit (required for both aquaculture leases and licenses) will not be issued if a proposed kelp aquaculture operation will impede navigation.

Shading is another possible impact of kelp aquaculture (Hasselstrom et al., 2018; Walls et al. 2017). Large kelp farms may shade out native marine plants such as eelgrass. Lease and LPA sites are required to be located away from established eelgrass beds. Maine's IF&W includes this requirement in its review of lease applications. LPA applications must provide maps demarcating the boundaries of eelgrass and other essential habitats in their application and are not permitted to site within those locations. Further, ACOE permitting of any aquaculture installation requires that there is no net loss of eelgrass from resulting farm installation or operation.

Some have raised concerns regarding competition of kelp aquaculture with wild macroalgae populations for nutrients (Wood et al. 2017) or creating nutrient-poor areas (Park et al., 2018; Shim et al., 2014; Zhang et al. 2004). The number, size, location, and type of proximal aquaculture sites are considered in granting lease applications. LPAs have siting limitations in that there may be no more than three LPAs within a 1,000-foot radius.

With any aquaculture activity, there are concerns about the source of seed and the propensity for the introduction of disease and/or non-native species (Campbell 2017). State rules (12 M.R.S.A. §6071 and 12 M.R.S.A. §6085) strictly regulate the introduction of non-native species, as well as the movement of marine organisms from one area of the coast to another to limit the spread of invasive species and/or disease. Kelp seed must be derived from wild species in state waters and come from a DMR approved nursery.

Aquaculture impacts on ecologically significant habitat and flora and fauna are limited by Maine rules and regulations. DMR ensures that kelp lease and license sites are not permitted near eelgrass beds. Review by Maine's IF&W prohibits aquaculture siting in areas with essential habitat for endangered species or areas known to support endangered species, including nesting areas for piping plover and least tern and bald and golden eagle nests. This state regulation is further bolstered by the necessary permit from the ACOE. When permitting aquaculture operations, the ACOE consults with federal agencies such as US Fish and Wildlife Service and strictly adheres to the Endangered Species Act. Maine DMR also considers the presence of recreational and commercial species in the proximity of any proposed lease site.

Criterion 3: Sufficient data exists to demonstrate that aquaculture operations have limited and reversible environmental impacts.

An overview of kelp aquaculture research

Environmental impacts from kelp aquaculture are largely limited and reversible. This is supported by existing peer-reviewed literature. Some of the environmental concerns around kelp aquaculture include changes to the benthic habitat, shading, nutrient competition with wild populations, and changes in sedimentation patterns. Literature reviews, notably Buschmann et al. 2017, Chopin et al. 2004, and Neori et al. 2004 have demonstrated the extent of the current research on kelp aquaculture.

Kelp cultivation infrastructure and gear has a small footprint compared with almost all other aquaculture practices. The farm set up typically consists of longlines secured between two anchor lines with moorings and buoys (Figure 1) (Flavin et al., 2013). In Maine, the farm structure is set up in the fall, prior to the growing season, and removed post-harvest in the spring. Therefore, any stress on the surrounding ecosystem from the placement of moorings or other gear is limited to only a portion of the year. Similarly, any environmental benefits provided by the farm equipment, such as moorings providing habitat for benthic species (Hasselstrom et al., 2018; Walls et al., 2017) or kelp growth attracting other species (Smale et al., 2013; Christie et al., 2009) will be limited to the kelp growing season. However, seasonality of positive or negative effects requires further research (Hasselstrom et al., 2018; Wood et al. 2017). Large kelp farms may impact the surrounding environment by altering benthic communities or changing primary production (Stévant et al., 2017). However, some studies have shown there has been little impact on benthic organisms and community structure or eelgrass beds below kelp operations (Walls et al. 2017).

Kelp aquaculture has been touted as a tool for nutrient extraction in eutrophic waters (Pechsiri et al., 2016; Kim et al. 2015; Rose et al. 2015; Holdt and Edwards, 2014). Growing kelp has been shown to remove excess nitrogen and phosphorus from the surrounding waters (Pechsiri et al. 2016; Kim et al. 2015; Holdt and Edwards 2014). Furthermore, kelp cultivation can also act as a short-term carbon sink (Duarte et al., 2017; Chung et al., 2011; Nellemann et al., 2009) and can reduce the impacts of ocean acidification within a limited distance from the cultivation site (Duarte et al., 2017; Mongin et al. 2016). In Asia, intense and concentrated kelp operations have limited the carrying capacity of some ecosystems by restricting nutrients in the surrounding waters (Park et al., 2018; Shim et al., 2014; Zhang et al., 2004). However, in the coastal Gulf of Maine and other nutrient-rich waters, the bioextractive properties of kelp farming may have a positive environmental impact by removing excess nutrients and helping abate eutrophication in nearshore environments (Grebe et al., 2019; Fei 2004).

Changes to sediment retention and resuspension can be impacted by kelp aquaculture operations, though effects can vary and are site-specific (Hasselstrom et al., 2018). Some research has shown that kelp farms can lessen wave energy and reduce shore side erosion (Mork 1996). Any impacts are dependent upon farm size and specific location (Campbell et al., 2017).

Wild kelp beds are known to be areas of high biodiversity and research shows areas of kelp cultivation may have similar benefits (Hasselstrom et al., 2018). Kelp farm moorings can serve as habitats for

benthic species (Hasselstrom et al., 2018), and the kelp holdfasts have been shown to have high biodiversity (Walls et al., 2016) and to create habitat for other species (Wood et al., 2017).

Currently, kelp aquaculture is reliant on wild kelp sorus tissue for seed cultivation (Grebe et al., 2019; Redmond et al. 2014; Flavin et al. 2013). Attention to wild kelp populations will remain important as wild stocks are a necessary source for growing out kelp seed in the nursery stage and maintaining genetic diversity.

Criterion 4: Aquaculture regulations include appropriate compliance and enforcement standards.

Compliance and enforcement standards for Maine kelp farms

Staff from DMR's Division of Aquaculture, Bureau of Public Health, and Marine Patrol conduct annual inspections for all aquaculture leases and LPAs to verify that the sites comply with the existing rules and regulations around aquaculture. Under the US Food and Drug Administration (FDA), the National Shellfish Model Ordinance requires an annual inspection for shellfish aquaculture. Maine DMR has established the state policy to go beyond the FDA's requirement and to include the inspection of not just shellfish farms, but all farms, including seaweed. Inspections involve a surface assessment to verify site location, gear, cultured species, and farm condition. DMR responds to and follows up with any complaint issued against an aquaculture lease or LPA license site.

Future considerations

Kelp aquaculture in Maine is still a relatively new and growing industry. As kelp aquaculture scales up, state rules and regulations must evolve and adapt to ensure responsible harvest. It will remain important that DMR and other regulatory bodies advance rules and regulations alongside an expanding industry. As such, this assessment report will need to be updated and revaluated as the industry grows and changes. The following factors are noted as potential trigger points for a revaluation of this report:

- **Continued reliance on wild sorus tissue for nursery grow out:** Kelp aquaculture is currently reliant on wild sorus tissue for seed cultivation (Grebe et al., 2019, Redmond et al. 2014, Flavin et al. 2013.) Given the limited regulations around the harvest of wild reproductive kelp seedstock, consideration around how to maintain healthy wild populations alongside a burgeoning kelp aquaculture industry may need to be addressed. Pressure on kelp donor populations, notably those that have very restrictive distributions, such as low intertidal kelp species *Saccharina angustissima* will need to be evaluated to avoid the overharvesting of wild populations.
- **Significant scaling up of industry:** Significant scaling up of the kelp industry in Maine will magnify concerns around kelp aquaculture. As the industry grows, consideration regarding how increased cultivation could amplify impacts may need to be addressed.

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Gulf of Maine Research Institute

Science. Education. Community.

Gulf of Maine Responsibly Harvested Verification Report

Monkfish

(*Lophius americanus*)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *Monkfish is managed jointly by the NEFMC and MAFMC under NMFS and is regulated by the Monkfish Fishery Management Plan. This plan uses the best available science to set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *Monkfish stock size is not below management target levels; there is no indication that overfishing is occurring, and the stock is not considered to be overfished.*

☒ Sufficient data exists to determine harvest levels.

- *The 50th Stock Assessment Workshop in 2010 and the 2013 operational assessment utilized fisheries-dependent and –independent data to determine biological reference points. The 2016 operational assessment updated stock abundance based on biomass survey indices. Ultimately, the Council sets the harvest levels (Total Allowable Landings) based on these data and information, which incorporate uncertainty.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *Monkfish catch is monitored through vessel trip reports (VTRs), observers, and dealer reports. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of monkfish.*

I. Definition of the Monkfish Fishery

Northern stock monkfish (*Lophius americanus*), also known as goosefish, are harvested from the waters off the coast of Massachusetts, New Hampshire, and Maine. While a southern stock extends into the Mid-Atlantic coast, this report focuses on the management and harvesting of monkfish in the area outlined by the Gulf of Maine Responsibly Harvested Standard, which aligns with the northern stock of monkfish (Figure 1).

Monkfish are landed as tails, livers, or whole gutted fish. Historically, monkfish were landed as tails but now whole fish are also a significant portion of the catch (NEFSC 2016). In the southern stock, gillnets are the primary gear type used, however trawl gear has accounted for 75% of monkfish landings in the northern stock area (NEFSC 2016). In the northern stock area, gillnets account for much of the remaining landings, with a small percentage coming from scallop dredges.

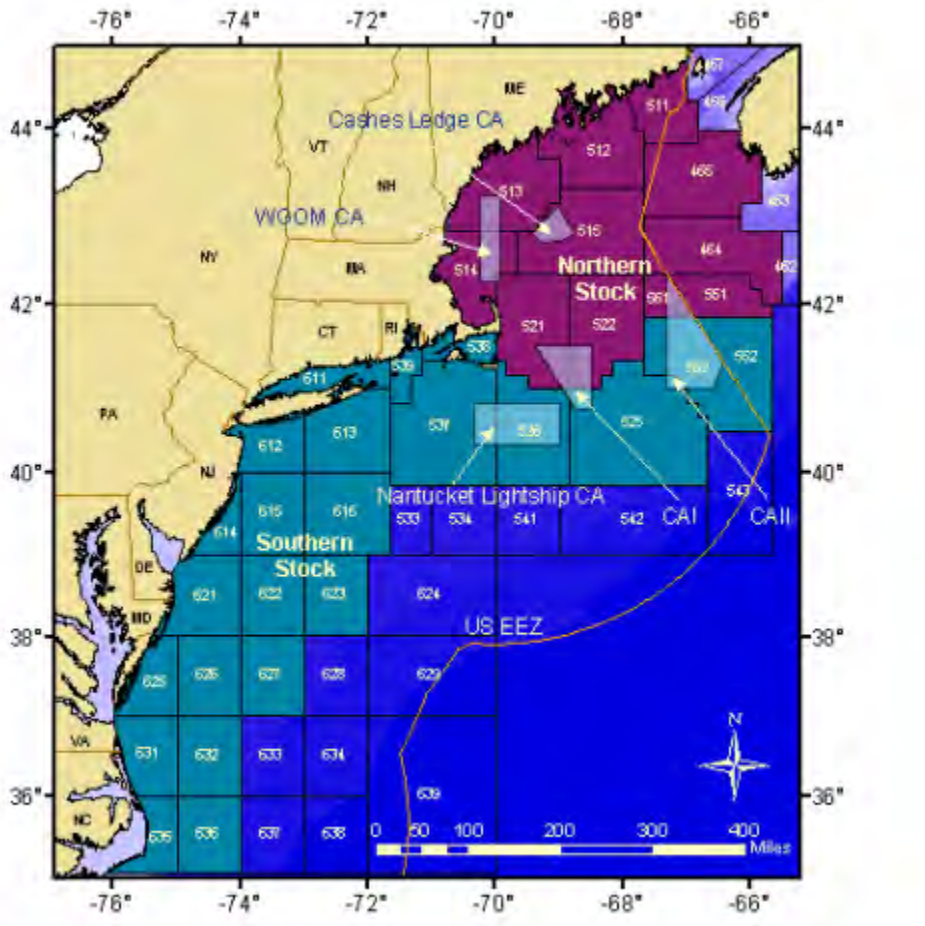

Figure 1. Fishery statistical areas that define the northern and southern stocks of monkfish (NEFSC 2016).

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of Management Authority and Regulatory Process

Responsibility of monkfish management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) and the Mid-Atlantic Fisheries Management Council (MAFMC) jointly facilitate the development of northern and southern monkfish stock regulations as part of the Monkfish Fishery Management Plan (FMP). The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees. The MAFMC consists of 21 voting members from each state's fish and wildlife agencies and 13 citizens involved in marine conservation as well as recreational and commercial fishing.

For the monkfish FMP, a sub-set of NEFMC and MAFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the oversight committee meet these requirements, a Monkfish Advisory Panel, made up of representatives from the fishing industry, scientists, and conservation organizations, provides input to management measures. The chairs of the oversight committee provide detailed guidance (terms of reference) to a Monkfish Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of monkfish. The PDT meets at least annually to review the status of the FMP. The PDT reviews available data on landings and discards, days-at-sea (DAS), measures of fishing effort, stock status, enforcement, and compliance with management measures. Based on this review, the PDT provides reports to the oversight committee in response to the terms of reference.

The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The Councils are also assisted by the members of the Scientific and Statistical Committees (SSC); SSC members review and participate in stock assessment updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of this process.

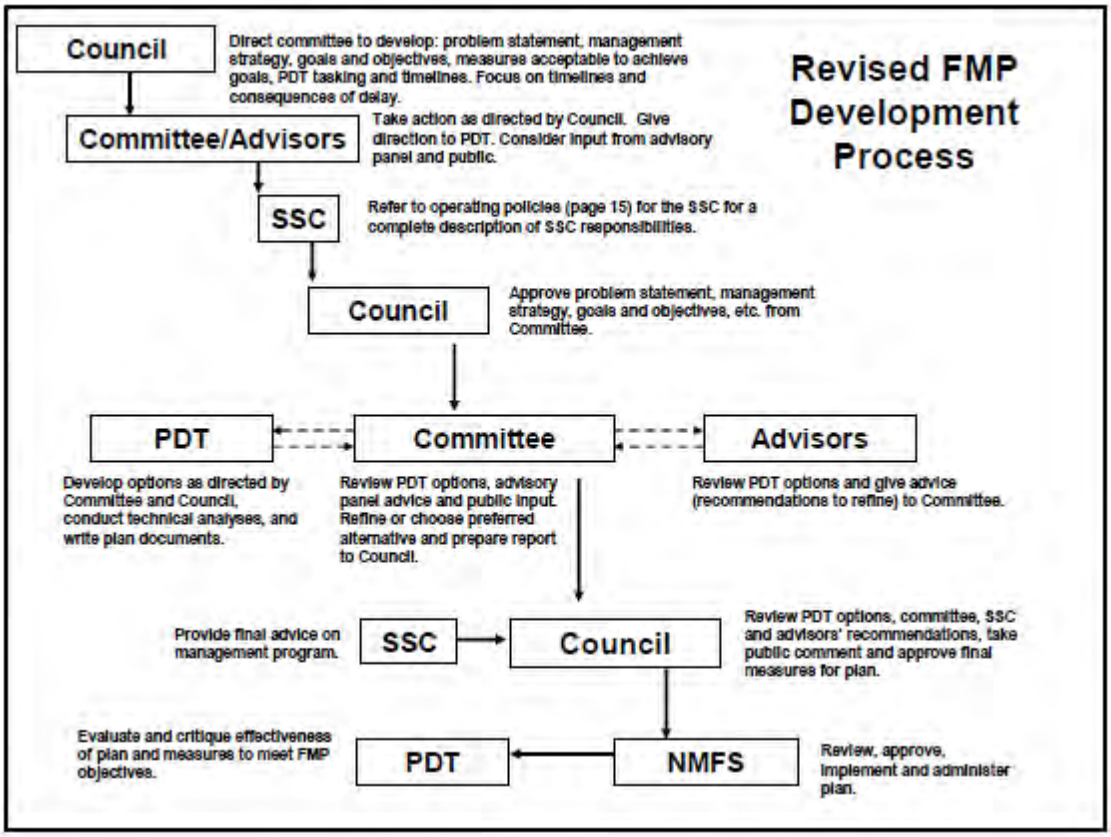

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Monkfish Management Plan

Monkfish are managed under the Monkfish Fishery Management Plan (FMP), which was implemented in 1999. This plan includes a limited access permit program and a Days-at-Sea (DAS) management system. In addition, regulatory measures include limitations on DAS, mesh size restrictions, trip limits, minimum size limits, and annual catch limits (NEFSC 2016).

The monkfish stock is divided into two management areas: the Northern Fishery Management Area (NFMA) and the Southern Fishery Management Area (SFMA). These stocks are defined by differences in temporal patterns of recruitment, perceived differences in growth patterns, and differences in gear usage. A GMRI-led tagging study provided additional evidence that very little movement takes place between the stock areas (Sherwood et al. 2013). Additionally, possession limits and regulatory requirements are

different in each of the areas. The possession limits are different depending on permit, area, gear type, and under which type of DAS permit the monkfish are being landed (GARFO 2017a).

Monkfish are landed in different market categories, including tails, whole gutted fish, and livers. Landed weight often must be converted to live weight because monkfish are commonly landed as just tails. This is done by multiplying landed tail weight by a conversion factor of 2.91. Minimum size for whole monkfish is 17 inches, and 11 inches for tails (GARFO 2017a). Until the 1990s, landings were primarily tails, but whole gutted fish are currently the largest market category (NEFSC 2016). Since 1996, there have consistently been over 2,000 mt of whole gutted monkfish landed in the southern FMA, whereas landings of whole gutted fish in the northern FMA only rose above 2,000 mt between 2000-2003. Landings of tails have been less than 2,000 mt and mostly declining in the SFMA since 2000. Tail landings in the NFMA have fluctuated between 650 – 3,700 mt since 2000. (NEFSC 2016).

In 2011, Amendment 5 to the monkfish FMP established Annual Catch Limits (ACLs) and accountability measures (AMs). The Magnuson-Stevens Reauthorization Act (MSRA) requires the NEFMC to determine ACLs and AMs that enable rebuilding within specified time frames for all managed stocks. This action implements a process for calculating an ACL in addition to the overfishing level (OFL) and acceptable biological catch (ABC) for each stock. Recommendations for these figures are developed by the PDT. The Science and Statistical Committee (SSC) sets ABC levels, and the NEFMC and MAFMC approve final ACLs, but cannot exceed the SSC's set OFL and ABC levels. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, sectors, and the common pool. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL. Amendment 5 also adjusted biological reference points (BRPs), and implemented measures to reduce waste and enhance efficiency. These measures allowed monkfish heads to be landed separately from the body, and also allowed for an additional day to be added to a limited access monkfish DAS vessel in the case of an overage to reduce discards (NMFS 2011).

In 2016, Framework Adjustment 9 approved possession limits for vessels operating under different DAS programs aside from a monkfish DAS. A new measure allowed Northeast Multispecies (groundfish) permit A and monkfish DAS vessels to possess unlimited monkfish tails under category C and D permits in the NFMA (NMFS 2016).

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

CRITERION: Sufficient data exist to determine harvest levels.

IV. Monkfish Data

Stock Status

According to the 50th Stock Assessment Workshop (SAW 50) in 2010 (NEFSC 2010) and an operational assessment in 2013 (NEFSC 2013), monkfish is not overfished and overfishing is not occurring. Biological reference points (BRPs) were estimated using a Statistical Catch at Length (SCALE) model in SAW 50, as well as the 2013 operational assessment. In 2016, there was an operational assessment, for which the Terms of Reference were approved by an Assessment Oversight Panel (AOP). According to the preface of the 2016 operational assessment (NEFSC 2016):

"One purpose of the AOP meeting was to confirm the recommendation made by the NEFSC and the concurrence of the NEFMC's Scientific and Statistical Committee to not update the monkfish assessment using the same modeling approach as used in the last assessment. This recommendation was based on new scientific evidence that the vertebral ageing method for monkfish is not valid. The AOP agreed with the recommendation to not update the previous modeling approach (SCALE) for monkfish during the update assessment. This decision is recognized as a departure from standard procedure but is based on the recognition that the inability to estimate monkfish growth makes any analysis using SCALE unusable for providing catch advice. The AOP recommended that stock status not be evaluated during this data update for monkfish because of the lack of biological reference points to allow status determination."[1]

Thus, the BRPs are currently considered uncertain according to the 2016 operational assessment (NEFSC 2016). Rather than updating the stock status, the focus of the 2016 assessment was on developing analyses to help the Scientific and Statistical Committee (SSC) project acceptable biological catch (ABC) based on proxies used in the place of fishing mortality and spawning stock biomass (SSB), such as exploitation of the stock and survey indices, respectively. Survey data allow a direct understanding of the stock trends and have been used in the past for the management of monkfish. This method appears to work well for monkfish due to consistent data.

Biomass indices for monkfish in the NEFSC fall and spring research trawl surveys were at their lowest in the 1990s. Since the FSV Bigelow survey series began in 2009, however, biomass and abundance indices have been increasing. A strong yearclass and increase appeared in 2015, the latest year for which survey data is available (NEFSC 2016). Additionally, the Atlantic States Marine Fisheries Commission (ASMFC) shrimp survey data is used, and there were more monkfish caught by the shrimp survey prior to 2009 than by the NEFSC spring or fall surveys. Patterns of abundance have been consistent among the NEFSC, ASMFC shrimp, and the Maine/New Hampshire inshore surveys (see figure 3 below). The 2016 Review Panel did not express concern for the biomass trends of the stock, finding no indication that the fishery is overfished or experiencing overfishing (NEFSC 2016).

[1] The full AOP report can be found in Appendix 4 of the 2016 monkfish operational assessment (NEFSC 2016).

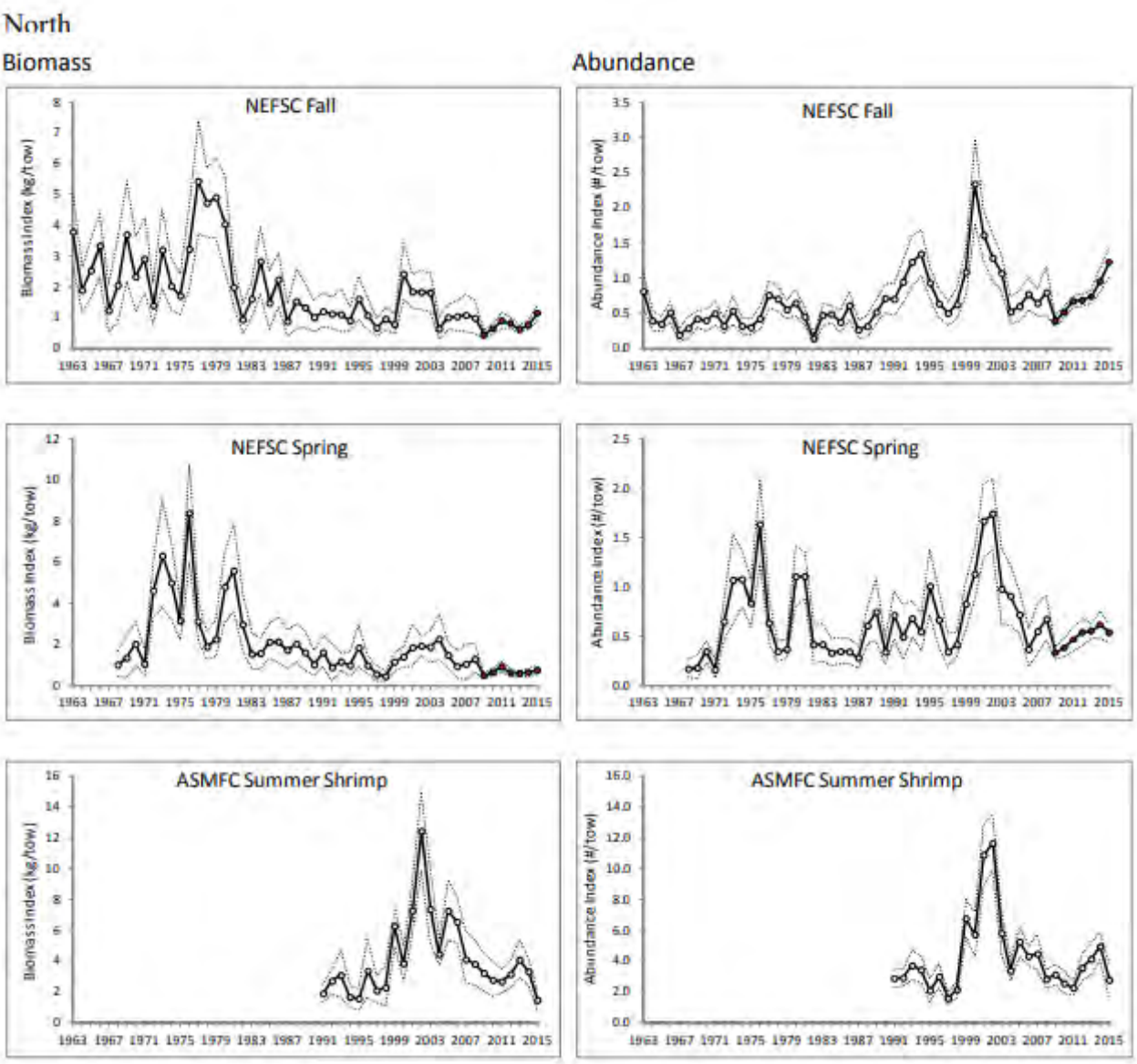

Figure 3. Survey indices for monkfish in the northern management area. Red-filled points are NEFSC surveys conducted on the FSV Bigelow (after 2008), converted to Albatross units.

Sources of Uncertainty

The largest sources of uncertainty in the 2010 and 2013 SAW assessments were as follows:

- Estimations of total catch. Before 1980, fishery removals of monkfish were bycatch and largely unreported.
- The true size and age composition of catch were unknown.
- Estimates of stock size, recruitment, and fishing mortality came from poorly known input data and incomplete information on age and growth, longevity, natural mortality, and sex ratios.
- The NFMA's population model had a strong retrospective pattern

Many of these uncertainties were a roadblock for the development of new BRPs in the 2016 assessment. These uncertainties are taken into account in management decisions to ensure that the stock is healthy and stays below overfished and overfishing levels.

There is a collective effort among management and scientific organizations to improve information and uncertainties surrounding the monkfish fishery and stock. A Research Set-Aside (RSA) program was created for monkfish starting in 2006 to help develop an understanding of the stock structure to inform management decisions and stock assessments. The RSA focuses on priorities set by the Councils, including monkfish life history, stock definition, ecological significance, bycatch and discard, and improvement of gear selectivity (NEFMC 2017).

Stock History

Prior to the late 1970s, monkfish were caught for personal consumption or sold outside of the dealer system, so catch statistics during this time are uncertain. During the 1980s, annual landings ranged between roughly 7,500-10,000 mt. Landings increased between 1992-2004, peaking at 28,500 mt in 1997. Historical landings for both management areas can be seen below in Figure 4 (NEFSC 2016).

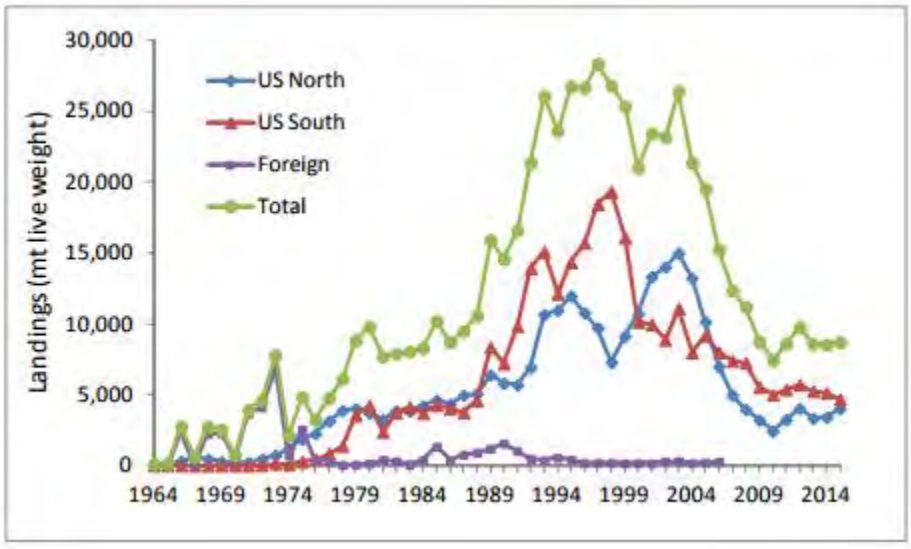

Figure 4. Landings (mt live weight) of monkfish in the NFMA and SFMA from 1964 to 2015 (NEFSC 2016).

Coastwide landings began to decline after 2003, and most recently were reported at 4,138 mt in 2015. During 2008-2015 in the NFMA, landings have remained below the total allowable landings (TAL). This is suspected to be a result of groundfish (Northeast Multispecies) management restrictions. Landings in recent years compared to target TALs in recent years are shown in Figure 5 (NEFSC 2016).

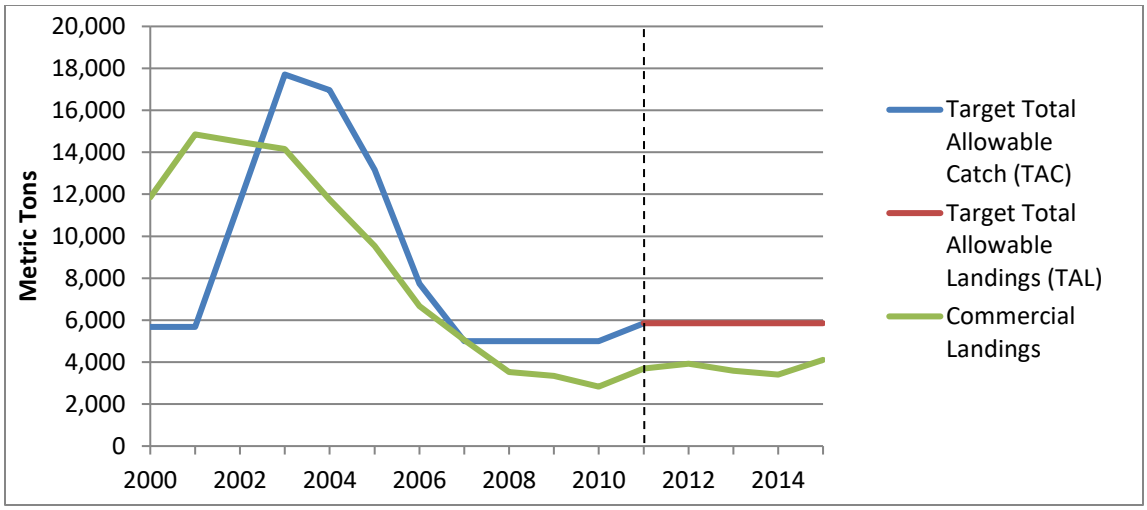

Figure 5. Target Total Allowable Landings (TAL) compared to commercial landings ***in the Northern Fishery Management Area*** *from 2000 to 2015. The dotted line notes the change from target Total Allowable Catch (TAC) to target TAL in 2011.*

Harvest Levels

Harvest levels were most recently determined by Framework Adjustment 10 in 2017, listed in Table 1 below. Framework Adjustment 10 increased the TAL for monkfish in fishing years 2017-2019 to 6,338 mt, compared to the previous TAL of 5,854 mt, which was set by Framework Adjustment 8 in 2014. The ABC and the Annual Catch Target (ACT) remained the same (NMFS 2014; GARFO 2017b).

Table 1. Monkfish Northern Fishery Management Area Harvest Levels for 2017-19	
Acceptable Biological Catch (ABC)	7,592 mt
Annual Catch Target (ACT)	6,567 mt
Total Allowable Landings (TAL)	6,338 mt

Possession limits are also set for monkfish. These limits are different depending on permit, gear, and what type of DAS permit under which they are being landed. The most up to date possession limits can be seen in Table 2 below (GARFO 2017a).

Table 2. Northern Fishery Management Area Possession Limits by DAS Program and Permit Category			
DAS Declaration	Monkfish DAS		Monkfish DAS and Multispecies A DAS
Permit Category	A & C	B & D	C & D
Landing Limit (tail weight per DAS)	1,250 lb (3,638 lb whole weight)	600 lb (1,746 lb whole weight)	Unlimited

Additionally, incidental trip limits are determined for vessels not fishing under a monkfish DAS. These vessels include scallop DAS, Sea Scallop Access Area Program, and Northeast Multispecies DAS. Incidental trip limits are different for non-DAS vessels and non-DAS trips with a skate bait letter of authorization (LOA), depending on the fishing area (NFMA, SFMA, or Regulated Mesh Areas) and gear type. Some additional permits held by non-DAS vessels may also affect incidental landing limits, including Northeast Multispecies small vessel permits, surf clam or quahog permits, and sea scallop permits (GARFO 2017a).

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

The NMFS has the primary responsibility for monitoring and surveillance of the monkfish FMP. The monitoring programs in place provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Vessels are required to submit vessel trip reports (VTRs) for each fishing trip, which provide details on type of gear fished, area fished, species caught (and discarded), dealer information, and port of landing information, in addition to other details. These reports are due to NMFS on a weekly basis. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily VTRs.

The New England Fisheries Observer Program (NEFOP) employs at-sea observer coverage at a level of 8%, as well as port sampling for the monkfish fleet. The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a statistically significant sample (measured as the coefficient of variation [CV]) no greater than 30% for each stock it manages (73 FR 4736; January 28, 2008). In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage. There are also shore-side port samplers who periodically work at fish auctions and exchanges taking biological samples. This program ensures compliance with the MSA in addition to the Endangered ESA and the MMPA.

Monkfish trips are subject to at-sea monitoring (ASM) coverage only in specific cases where a vessel has a Northeast Multispecies permit *and* is fishing such that the vessel's groundfish discards would count against their allocation. This ASM coverage is designed to address discard questions in the Northeast Multispecies fishery. As monkfish vessels operate primarily under days-at-sea with trip limits, there is no requirement for ASM specific to monkfish.

In other fisheries where there can be incidental catch of monkfish (e.g. scallop fisheries), there are also VTR and observer coverage requirements to ensure monitoring of the catch.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the Monkfish FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations. In the common pool, enforcement of the Monkfish FMP is focused on compliance with DAS, seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures. For monkfish landed by a sector vessel, enforcement primarily relies on monitoring harvest levels through sector reporting, dockside monitoring, dealer reporting, and VTRs (in addition to some of the measures described above for which sectors are not universally exempt); however, individual sectors are also responsible for self-enforcement.

It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: Annual Catch Entitlement overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. Monkfish is not identified as a species of concern under OLE's enforcement priorities.

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Gulf of Maine Research Institute

Science. Education. Community.

Verification Report on
Gulf of Maine/Georges Bank Redfish (*Sebastes fasciatus*)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *Redfish is managed by the National Marine Fisheries Service (NMFS) and the New England Fishery Management Council (NEFMC), and regulated by the Northeast Multispecies Fishery Management Plan, which utilizes the best available science to inform the management process, and to ultimately set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *According to the most recent assessment data, redfish spawning stock biomass is at 145% of the SSB_{MSY} proxy. The stock is not overfished and overfishing is not occurring.*

☒ Sufficient data exists to determine harvest levels.

- *The Groundfish Assessment Review Meeting III (2012) and the 2015 and 2017 operational assessments utilized fisheries-dependent and –independent data to determine biological reference points, which are assessed through the Council process. Ultimately, the Council sets the harvest levels based on this data, which incorporate uncertainty. Redfish is not considered a data poor species.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *GOM/GB redfish catch is monitored through vessel trip reports (VTRs), observers, dealer reports, and for sectors, additional at-sea monitoring. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of GOM/GB redfish.*

I. Definition of Gulf of Maine/Georges Bank Redfish

Gulf of Maine/Georges Bank Acadian redfish (*Sebastes fasciatus*), also known as ocean perch, is harvested from the waters off the coast of Massachusetts, New Hampshire, and Maine and is managed as one stock, which is distributed across the Gulf of Maine region *(Figure 1)*. Historically, otter trawls were the primary gear type used in the fishery, however, gillnets have become more popular in recent years. Trawl gear accounts for around 95% of catches, while gillnet catches are around 4% (NEFSC 2012).

Gulf of Maine/Georges Bank redfish, pollock, and haddock collectively received Marine Stewardship Council (MSC) certification specifically for otter trawl gear in July 2016. These three otter trawl fisheries will need to be re-assessed in July 2020 in order to maintain certification. Otter trawl catches comprise more than 70% of pollock, haddock, and redfish landings (MSC 2016).

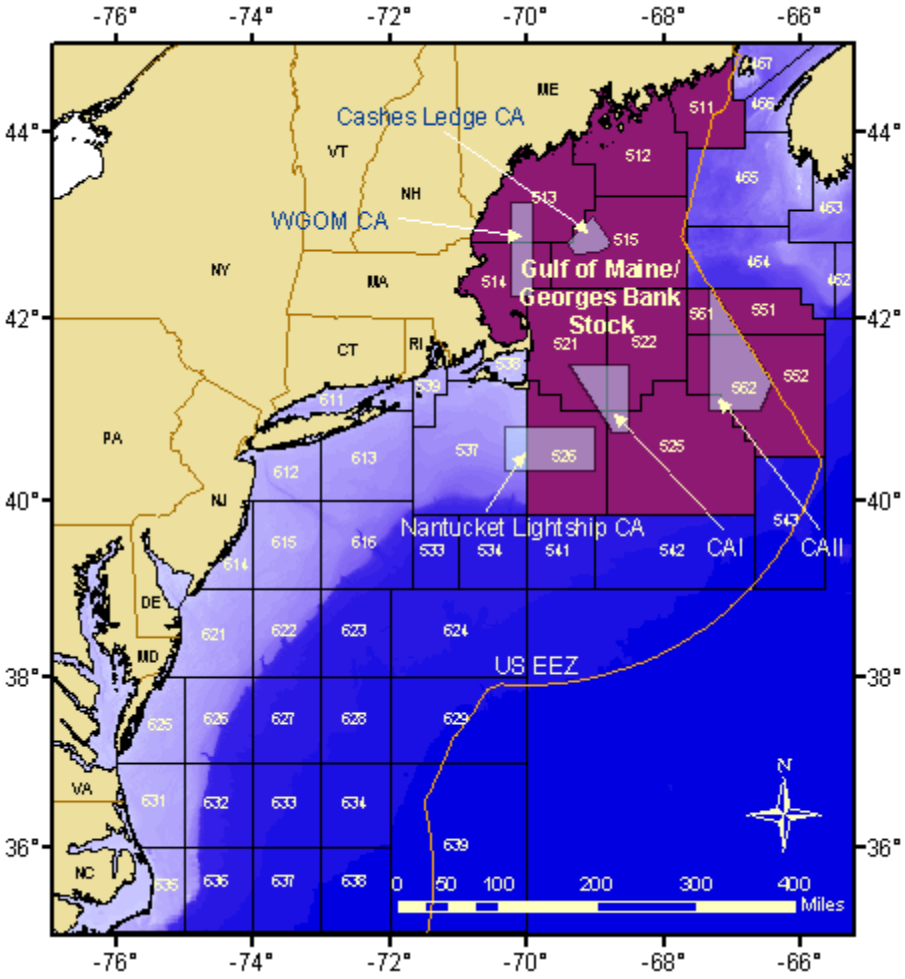

Figure 1. Statistical areas included in the Gulf of Maine/Georges Bank Acadian redfish management unit. The orange line represents the United States Exclusive Economic Zone (NEFSC 2006).

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of the Management Authority and Regulatory Process

Management responsibility of redfish harvested within the United States lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of redfish regulations as part of a complex of 16 groundfish species that are managed together as the Northeast Multispecies Fishery. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For Northeast multispecies fisheries management, a sub-set of NEFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the oversight committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the oversight committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of redfish. Then the PDT provides reports to the oversight committee in response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The NEFMC is also assisted by the members of the Scientific and Statistical Committee (SSC); SSC members review and participate in stock assessment updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of this process.

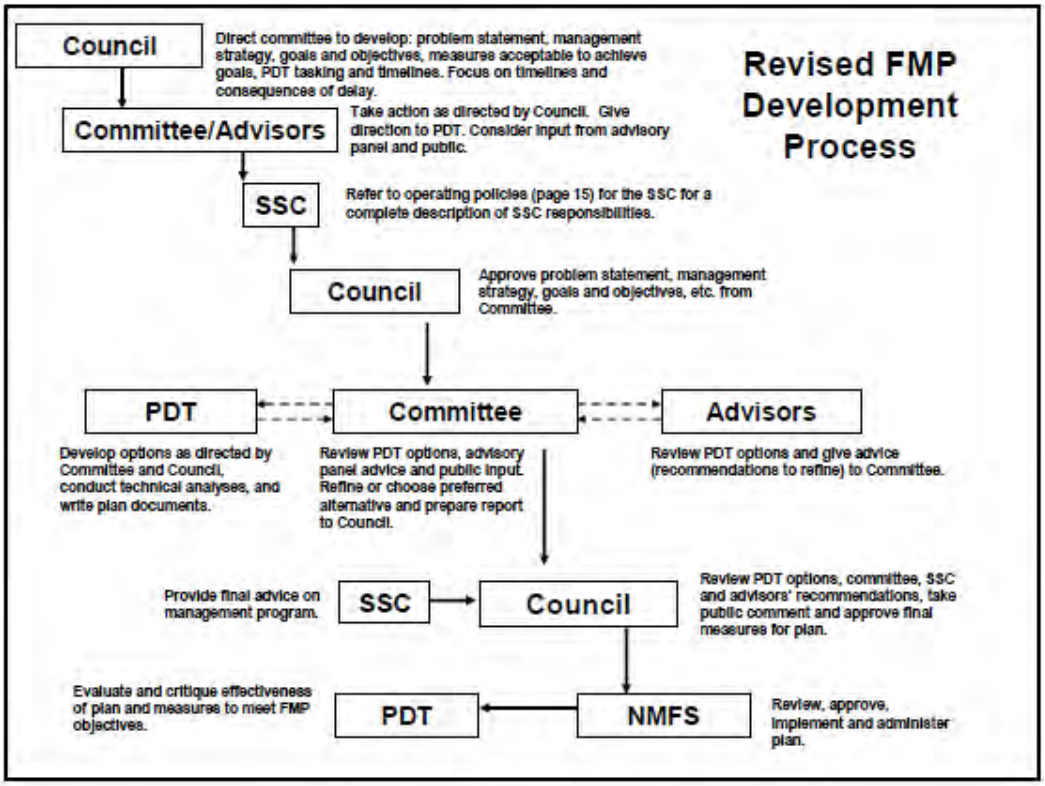

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Northeast Multispecies Fisheries Management Plan

The Northeast Multispecies Fishery Management Plan (FMP) was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks and to promote rebuilding to sustainable biomass levels. Sixteen species of groundfish are managed under Amendment 16 of the Northeast Multispecies FMP. Thirteen large-mesh species are managed together based on fish size and type of gear used to harvest the fish: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, white hake, and wolffish. Because several large-mesh species are managed as two or more separate stocks (e.g., Gulf of Maine haddock and Georges Bank haddock) there are a total of 20 separate stocks of groundfish managed under the FMP. The other three species (silver hake [or whiting], red hake, and offshore hake) are managed under a separate small-mesh multispecies program pursuant to Amendment 12 of the Northeast Multispecies FMP.

During the 1990s and until April 2009, the groundfish complex was primarily managed under the Days-At-Sea (DAS) system: by seasonal and year-round area closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size, number of nets/hooks, etc.), minimum fish size limits, trip limits (i.e., limiting fishermen to a certain poundage of fish per trip), limited access (i.e., limiting the number of participants in the fishery), and restrictions on the number of days a vessel is allowed to fish for groundfish each year (i.e., days-at-sea). In May 2004, Amendment 13 to the FMP implemented formal rebuilding plans for groundfish stocks, including redfish, based on revised biomass and fishing mortality targets derived by the Working Group on Re-evaluation of Biological Reference Points for New England Groundfish. Amendment 13 also

marked the development of the first sector in New England (the Georges Bank Hook sector on Cape Cod). The overall goal of these actions was to reduce fishing mortality to rebuild depleted groundfish stocks to target biomasses.

In May 2010, Amendment 16 authorized the formation of individual fishing organizations, which shifted the management regime from the DAS system to this output-controlled system, referred to as sectors. In addition to general regulations for the fishery, Amendment 16 also implemented species- and stock-specific regulations for vessels in the common pool and in sectors. Beginning in FY 2010, commercial harvesters of groundfish have been managed in two self-selecting categories: common pool and sectors. From the start in 2010, the vast majority of the Northeast groundfish fishery has been enrolled in sectors.

The current regulations setting the catch levels for each of the 20 groundfish stocks, which were implemented by FW 48 to Amendment 16 in 2013, and revised in FW 50 in 2013, implement new requirements under the Magnuson-Stevens Reauthorization Act (MSRA) of 2006. The MSRA requires the NEFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) that enable rebuilding within specified time frames for all managed stocks. This action implemented a process for calculating an ACL in addition to the overfishing level (OFL) and acceptable biological catch (ABC) for each stock. Recommendations for these figures are developed by the PDT. The Scientific and Statistical Committee (SSC) recommends ABC levels, and the NEFMC approves final ACLs, but cannot exceed the SSC's recommended levels. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, sectors, and the common pool. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL. Although the following stocks have ACLs, possession is prohibited: northern and southern windowpane flounder, ocean pout, and wolffish. In addition, Atlantic halibut catch is limited to one fish per trip. Northeast Multispecies permit holders are eligible to receive an allocation for the remaining groundfish stocks.

Common Pool

Members in the common pool are managed by an effort control system that regulates the number of days a harvester may fish. In addition to a limited number of days a harvester may fish, controls include 24-hour days-at-sea counting, trip limits on other groundfish stocks, gear restrictions, minimum mesh size restrictions, gillnet restrictions, hook limits, seasonal and year-round closures, minimum fish size restrictions, and special access programs. Specific effort control measures are described in the final rule for Amendment 16 (NMFS 2010). For example, minimum mesh size for trawl gear is 6.5-inch diamond or square mesh. Framework 55 implemented an unlimited trip limit for redfish in FY 2016 for common pool vessels (81 FR 26428: 2 May 2016).

In 2012 a trimester hard TAC (total allowable catch) was implemented as a primary accountability measure (AM), and the fishery is suspended once 90% of the trimester TAC is reached (NMFS 2014).

Sectors

Nineteen sectors have been authorized in the New England region. Sectors are self-selecting and largely self-regulating groups of fishermen who collaboratively manage an allocation of fish. Sectors must draft and submit formation proposals, operations plans, and sector monitoring plans, revised enforcement provisions, and clarification of the interaction of sectors with Special Management Programs, such as U.S./Canada management areas. NMFS prepares an environmental assessment (EA) annually to assess the impacts of the individual and cumulative sector operations as proposed in their operations plans.

In exchange for fishing under an ACL for each allocated species in the management plan, sectors are exempt from most common pool effort control measures, such as limited number of days at sea and trip limits. These are referred to as universal exemptions. A sector's allocation of an ACL for a particular stock is called the Annual Catch Entitlement (ACE) and is a sub-ACL of the overall fishery ACL. At-sea monitoring and trip reports ensure that sector ACEs are not exceeded. For each permit that is eligible to join a sector, the permit's Potential Sector Contribution (PSC) is calculated based on the permit's catch history. The ACE that is allocated to a sector is based on the sum of the PSCs for the permits that join the sector. Sector participants are not allowed to discard legal sized fish, and all fish caught count toward their allocations. Discarded fish rates are determined based on observed fishing trips from each sector and factor into the determining allocations.

If the ACL is not reached in a given year, sectors can carry over a maximum of 10% of the unused ACL into the following year. This maximum of 10% can be reduced if the carry over, in addition to the ACL of the upcoming year, exceeds the total ABC (NMFS 2016).

Regulations Shared by Common Pool and Sector Vessels

- All commercial vessels participating in the Northeast Multispecies Fishery are required to use a Vessel Monitoring System (VMS) to report fishing activities, as well as a vessel trip report (VTR).
- Minimum size for redfish is 7 inches.
- Sector vessels participating in Special Access Programs must only use gear approved under those programs.
- Fish fillets must have skin on while possessed on board a vessel at the time of landing in order to meet minimum size requirements. (NOAA 2017)

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

CRITERION: Sufficient data exist to determine harvest levels.

IV. Acadian Redfish Data

Stock Status

The most recent benchmark assessment of redfish was conducted during the Groundfish Assessment Review Meeting (GARM III) in 2008 using an aged-structured assessment program

(ASAP) model, and included estimates from catch/survey biomass exploitation ratios, yield- and biomass-per-recruit analysis, catch per unit of effort indices, trends in relative abundance, and discard estimates (NEFSC 2008). The accepted ASAP model configuration included catch, survey, and biological data from 1989 through 2006. The resulting assessment included biological reference points (BRPs) utilizing the base model that was approved by the final GARM III review panel *(Table 1)*. The adjusted 2007 BRPs consisted of spawning stock biomass (SSB) at 50% maximum spawning potential [SSB(50%MSP)] of 271,000 mt (a proxy for B_{MSY}) and fishing mortality rate [F(50%MSP)] of 0.0377 (a proxy to F_{MSY}). The 2007 SSB was estimated to be 172,342 mt and above ½ SSB(50%MSP) = 135,500 mt. Fishing mortality was determined to be 0.0068, which was below F(50%MSP) = 0.0377 (NEFSC 2008). As a result, the GARM III assessment determined that Gulf of Maine/Georges Bank redfish was not overfished and overfishing was not occurring.

GARM III received an assessment update in 2012 that identified that the stock size was increasing and in 2010 was at 314,780 mt, the highest that it had been since 1987. The update recognized an error between the survey indices and survey age composition in GARM III, but upon revising this issue there was shown to be negligible effect on the scale and trend of the data.

In 2015 and again in 2017, there were operational assessment updates for redfish. These assessments have updated commercial fishery data, BRPs, and research survey indices of abundance through 2016 based on the ASAP model used in the 2008 GARM III assessment. Retrospective adjusted spawning stock biomass in 2016 was estimated at 359,970 mt, which is 145% of the updated biomass target of 247,918 mt (SSB_{MSY} proxy of SSB at $F_{50\%}$). F was estimated at 0.011, which is 29% of the overfishing threshold of .038. Based on these BRPs, redfish is not overfished and overfishing is not occurring (NEFSC 2017).

Table 1. 2007 and 2015 Adjusted Biological Reference Points, Spawning Stock Biomass, and Fishing Mortality of Redfish

	2007 Assessment	2015 Assessment	2017 Assessment
SSB(50% MSP) a proxy to B_{MSY}	271,000 mt	281,112 mt	247,918 mt
$SSB_{Adjusted}$	172,342 mt	330,004 mt	359,970 mt
F(50%MSP) a proxy to F_{MSY}	0.0377	0.038	0.038
$F_{Adjusted}$	0.0068	0.012	0.011

Sources of Uncertainty

The largest source of uncertainty in the 2017 operational assessment is a lack of age data. After 1985, landings were low, so measurements of redfish were not recorded. Landings have been increasing in recent years, making age data more important. Additionally, redfish have a dimorphic rate of growth between males and females. Females grow faster than males, which could cause stock projections using weight-at-age to be overestimated, with an unknown impact

on BRPs. To address these uncertainties, the panel suggested age sampling of the current commercial fishery (NEFSC 2017).

Stock History

Historical landings of Acadian redfish depict considerable exploitation starting in the late 1930s with landings peaking in 1942 at 56,000 mt, followed by a decline throughout the 1940s and 1950s (NESFC 2006). Following a brief increase in landings in the 1970s, redfish landings declined again and remained below 600 mt from 1989 until 2007(NEFSC 2008). After 2007, landings steadily increased in the following years, reaching 4,078 mt in 2016. Figure 3 provides a graphical depiction of redfish landings between 1913 and 2016 (NEFSC 2017).

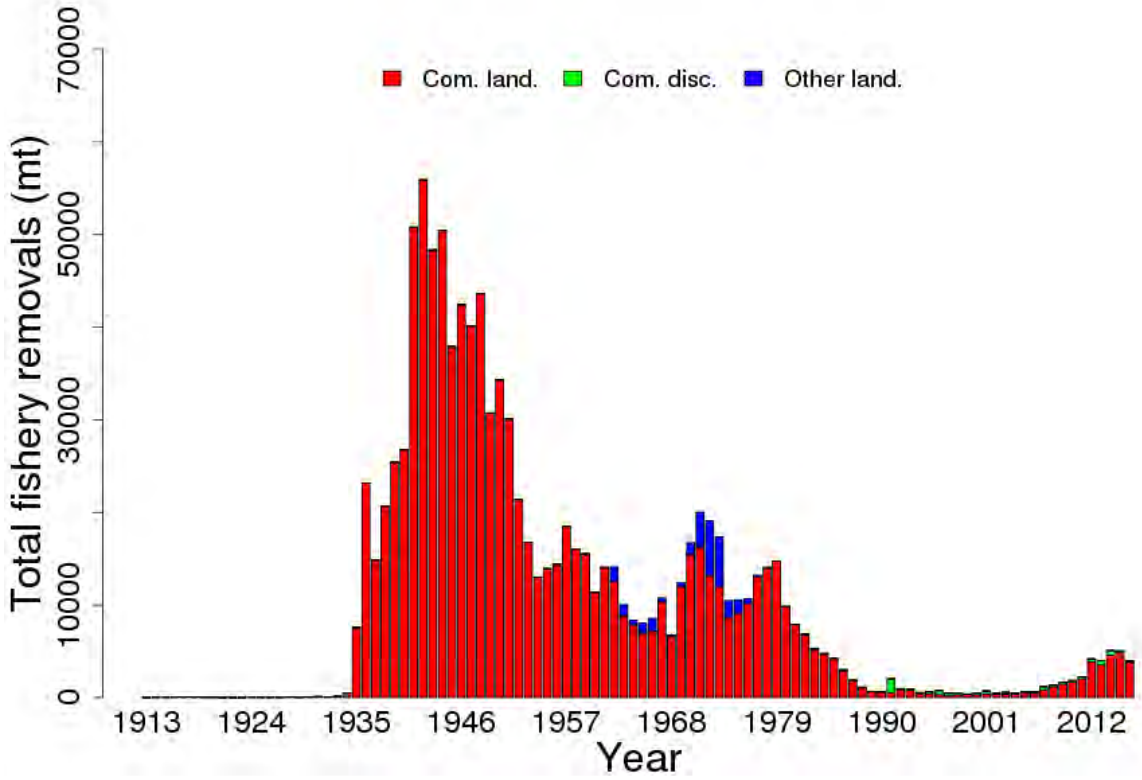

Figure 3. Annual landings (mt) of GoM/GB Acadian redfish between 1913 - 2016 for commercial US landings and discards (NEFSC 2017).

Harvest Levels

Sufficient data exist to determine harvest levels, and the annual catch limits (ACLs) for this stock in fishing years (FY) 2016-2018 were identified in Framework Adjustment 55 (81 FR 26428; 2

May 2016) and are depicted in Table 2.[1] Population projections from the 2017 assessment will be used to revise and determine future catch limits.

Table 2. Fishing Years 2016-2018 Overfishing Limits, Acceptable Biological Catch, and Annual Catch Limits for GoM/GB Redfish

Fishing Year (FY)	Overfishing Limit (OFL)	Acceptable Biological Catch (ABC)	Annual Catch Limit (ACL)
2016	13,723 mt	10,388 mt	9,837 mt
2017	14,665 mt	11,055 mt	10,514 mt
2018	15,260 mt	11,501 mt	10,943 mt

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

The monitoring programs in place for the Northeast multispecies fishery provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Monitoring of the common pool is carried out through several different programs. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily vessel trip reports (VTRs), which provide details on type of gear fished, area fished, species caught (and discarded), dealer information, and port of landing information, in addition to other details. The New England Fisheries Observer Program (NEFOP) employs at-sea observer coverage and biological sampling for the groundfish fleet. Separate from NEFOP, there are also shore-side port samplers who take biological samples from landed catch to help inform stock assessments and other fisheries research.

The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level of precision (measured as the coefficient of variation [CV]) no greater than 30% for each fishery (73 FR 4736; January 28, 2008). The Pre-Trip Notification System (PTNS) ensures fair and adequate coverage of vessels across the multispecies fishery. Vessels enter information into PTNS prior to a trip, and an algorithm randomly selects trips for coverage in order to achieve the targeted observer and at-sea monitor coverage across sectors, areas, and gear types. In addition, vessels

[1] A Framework Adjustment is an abbreviated rule-making process for actions within the scope of the existing goals and objectives of the respective fishery management plan (Amendment 16 in this case), and with no significant impacts on the human or physical environment.

fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage.

Sectors have additional monitoring requirements. Sector operations plans specify how a sector will monitor its catch to assure that sector catch does not exceed the sector allocation. Industry funding of at-sea monitoring (ASM) was introduced in March 2016, beginning the transition from the federal government covering the costs of ASM to the industry covering the costs. NOAA reimbursed the industry 85% of its expenses in FY 2016 and 60% in FY 2017 through a grant from the Atlantic States Marine Fisheries Commission (ASMFC). During FY 2018, ASM will be fully funded by NOAA because Congress appropriated additional funding. For FY 2018, total target coverage is 15% for ASM based on an average of ASM data from FY 2014-2016. The Northeast Fishery Observer Program (NEFOP) covers 8% of the target coverage, while the remaining 7% must be covered by industry ASM.

Previously, sector required at-sea monitoring coverage was typically between 17% and 22%. In 2016, additional factors were accounted for in determining the target so as to ensure compliance with the 30% CV requirement, including: removing ASM coverage for a subset of sector trips, using more years of discard data to predict coverage levels, and basing the target on predictions for stocks that are at a higher risk for error in the discard estimate (NMFS 2016). All sector vessels are still required to submit weekly VTRs in accordance with Amendment 16 to the Northeast Multispecies FMP.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

Based on the data collected through monitoring, the Northeast multispecies complex is routinely evaluated and necessary changes to management measures are made through biennial Framework adjustments.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the Northeast Multispecies FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations.

In the common pool, enforcement is focused on compliance with DAS, seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures. Enforcement for sector vessels primarily relies on monitoring harvest levels through sector reporting and VTRs (in addition to

some of the measures described above for which sectors are not universally exempt); however individual sectors are also responsible for self-enforcement. Dealer reporting is a requirement of dealers who receive the fish.

It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: ACE overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. Gulf of Maine/Georges Bank redfish is not identified as a species of concern under OLE's enforcement priorities. Data available on enforcement actions between March 2010 - February 2018 shows that in the Northeast, there were no specific violations involving redfish (NOAA 2018). Of the general enforcement actions reported that could have pertained to fishermen in the Northeast Multispecies fishery (although not specified in these more general violations), the most predominant problems were related to fishing in closed areas, reporting violations, gear violations, and possession or overage violations. In total, there were less than 25 of these possible NE Multispecies fishery violations between March 2010 – February 2018 (NOAA 2018). Many of the recent cases involved noncompliance with possession limits, particularly for cod.

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Gulf of Maine Research Institute
Science. Education. Community.

Verification Report on:
Gulf of Maine/Georges Bank White Hake (*Urophycis tenuis*)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

- *White hake is managed by NMFS and NEFMC, and regulated by the Northeast Multispecies Fishery Management Plan, which utilizes the best available science to inform the management process, and to ultimately set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

- *Based on the most recent operational assessment, white hake is not overfished and overfishing is not occurring. The stock is at 69% of SSB_{MSY} and is in a rebuilding plan. While fishing mortality has been well below the target levels, the stock has not rebuilt as expected.*

☒ Sufficient data exists to determine harvest levels.

- *The Northeast Regional Stock Assessment Review Committee (SARC 56) (2013) and operational assessments in 2015 and 2017 utilized fisheries-dependent and –independent data to determine stock status and biological reference points for white hake, which are assessed through the NEFMC process. Ultimately, NEFMC sets the harvest levels based on this data, which incorporates uncertainty. White hake is not considered a data poor species.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.

- *White hake catch is monitored through vessel trip reports (VTRs), observers, dealer reports, and, for sectors, additional at-sea monitoring. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing white hake harvest.*

I. Definition of Gulf of Maine/Georges Bank White Hake

White hake (*Urophycis tenuis*) is a demersal gadid fish species distributed from Newfoundland to North Carolina and is most abundant in the Gulf of Maine. Based on genetics studies, there is evidence of mixing among stock units in Canadian waters, but no such research has provided this information in US waters. White hake is managed as a single stock in US waters (Figure 1). While the white hake stock unit extends into southern New England waters, this report focuses on the management and harvesting of white hake in the area outlined by Gulf of Maine Responsibly Harvested Standard[1]. The primary gear type used to catch white hake is the otter trawl (74% of landings), followed by sink gill nets (25% of landings), and line trawl (less than 1% of landings) (NEFSC 2008).

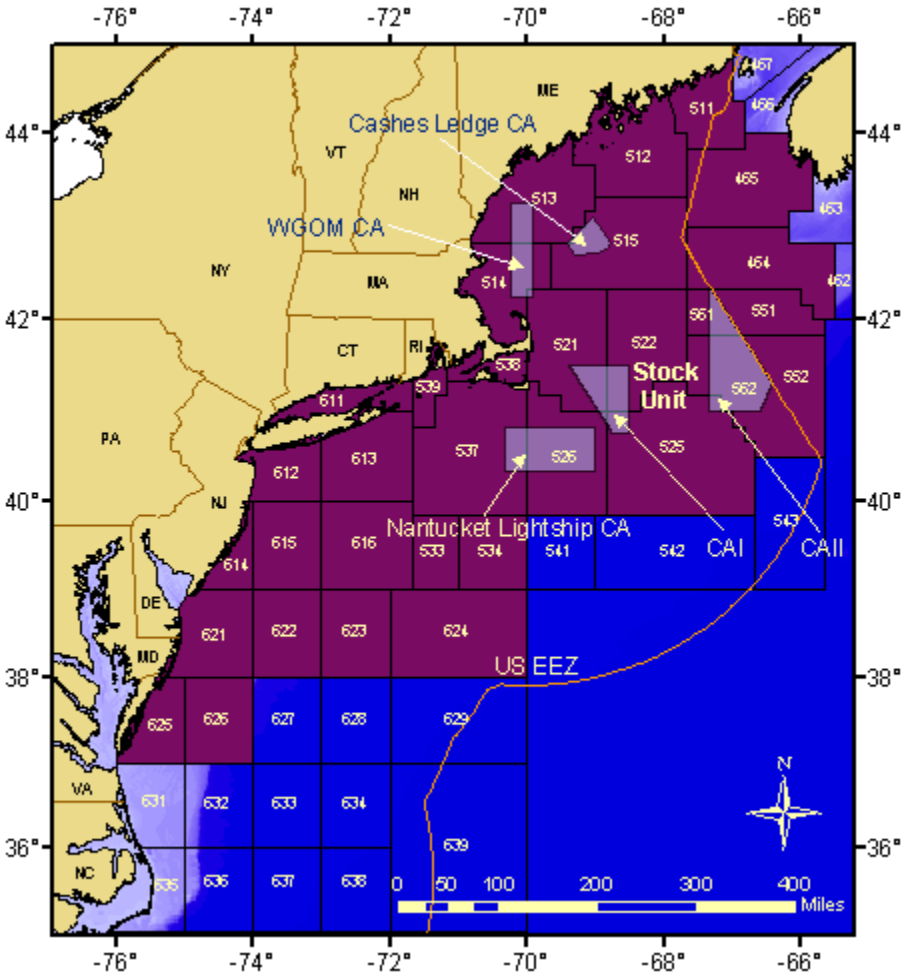

Figure 1. Statistical areas included in the white hake stock unit are shown in pink. Unnumbered areas are closed to groundfishing. The orange line represents the U.S. Exclusive Economic Zone (NEFSC 2008).

[1] This excludes white hake harvested in statistical area 536 and all other areas south or directly west of 525.

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of the Management Authority and Regulatory Process

Responsibility of white hake management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of white hake regulations as part of a complex of 16 species that are managed together as the Northeast Multispecies Fishery. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For Northeast multispecies fisheries management, a sub-set of NEFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the Oversight Committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the Oversight Committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of white hake. Then the PDT provides reports to the Oversight Committee in response to the terms of reference. The PDT

meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The NEFMC is also assisted by the members of the Scientific and Statistical Committee (SSC), who review and participate in stock assessment updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of the entire process.

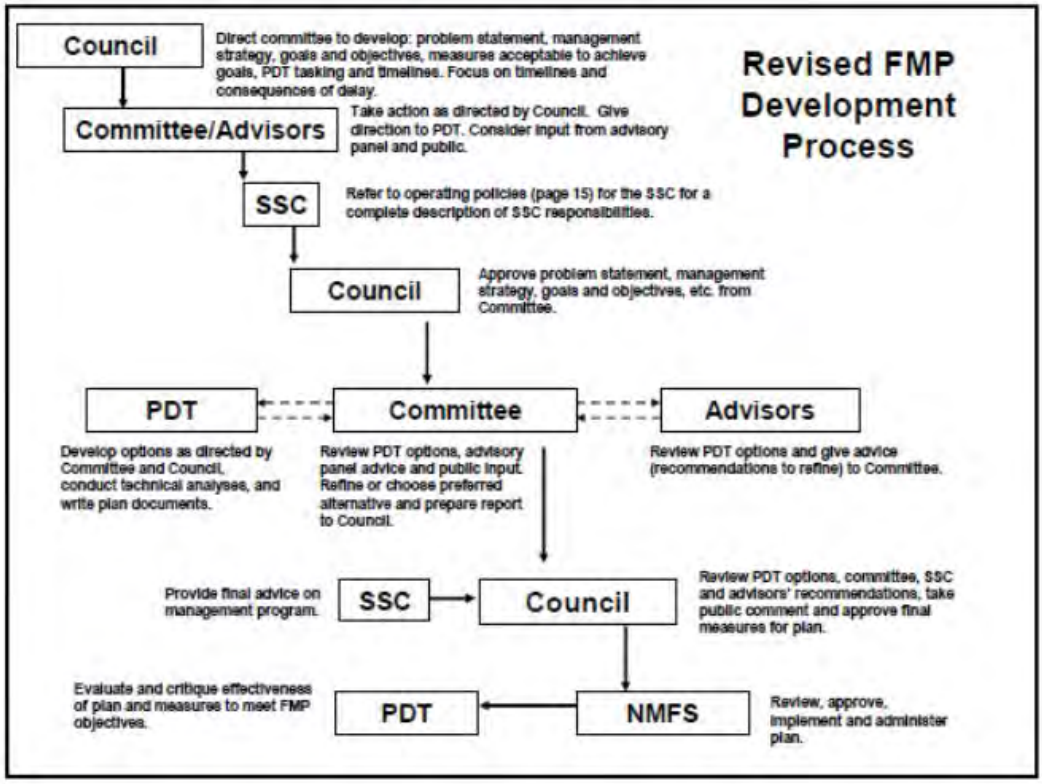

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Northeast Multispecies Fisheries Management Plan

The Northeast Multispecies Fishery Management Plan (FMP) was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks and to promote rebuilding to sustainable biomass levels. Sixteen species are managed under Amendment 16 to the Northeast Multispecies FMP. Thirteen large-mesh species are managed together based on fish size and type of gear used to harvest the fish: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, white hake, and wolffish. Because several large-mesh species are managed as two or more separate stocks (e.g., Gulf of Maine haddock and Georges Bank haddock), there are a total of 20 separate stocks of groundfish managed under the FMP. The other three species (silver hake

[or whiting], red hake, and offshore hake) are managed under a separate small-mesh multispecies program pursuant to Amendment 12 of the Northeast Multispecies FMP.

Groundfish have been managed by seasonal and year-round area closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size, number of nets/hooks, etc.), minimum fish size limits, trip limits (i.e., limiting fishermen to a certain poundage of fish per trip), limited access (i.e., limiting the number of participants in the fishery), and restrictions on the number of days a vessel is allowed to fish for groundfish each year (i.e., days-at-sea) (NEFMC 2009). In May 2004, Amendment 13 to the FMP implemented formal rebuilding plans for groundfish stocks, including Gulf of Maine white hake, based on revised biomass and fishing mortality targets derived by the Working Group on Re-evaluation of Biological Reference Points for New England Groundfish. The overall goal of these actions was to reduce fishing mortality to rebuild depleted groundfish stocks to target biomass levels.

In May 2010, Amendment 16 authorized the formation of individual fishing organizations, which shifted the management regime from the DAS system to an output-controlled system, referred to as sectors. In addition to general regulations for the fishery, Amendment 16 also implemented species- and stock-specific regulations for vessels in the common pool and in sectors. Beginning in 2010, commercial harvesters of Gulf of Maine white hake became managed in two self-selecting categories: Common Pool and Sectors. The vast majority of the Northeast groundfish fishery has been enrolled in sectors since 2010.

The current regulations setting the catch levels for each of the 20 groundfish stocks, which were implemented by Framework Adjustment (FW) 48 to Amendment 16 in 2013, and revised in FW 50 in 2013, implement new requirements under the Magnuson-Stevens Reauthorization Act (MSRA) of 2006. The MSRA requires the NEFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) for all managed stocks. This action implements a process for calculating an ACL in addition to the Overfishing Level (OFL) and Acceptable Biological Catch (ABC) for each stock. Recommendations for these figures are developed by the PDT. The Scientific and Statistical Committee (SSC) recommends ABC levels, and the NEFMC approves final ACLs, but cannot exceed the SSC's recommended levels. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, sectors, and the common pool. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL. Although the following stocks have ACLs, possession is prohibited: windowpane flounder, ocean pout, and wolffish. In addition, halibut catch is limited to one fish per trip. Northeast Multispecies permit holders are eligible to receive an allocation for the remaining groundfish stocks.

Common Pool

Members in the common pool are managed by an effort control system that regulates the number of days a harvester may fish. In addition to a limited number of days a harvester may fish, controls include 24-hour days-at-sea (DAS) counting, trip limits on other groundfish stocks, gear restrictions, minimum mesh size restrictions, gillnet restrictions, hook limits, seasonal and year-round closures, minimum fish size restrictions, and special access programs. Specific effort control measures are described in the final rule for Amendment 16 (NMFS 2013). NOAA's Greater Atlantic Regional Fisheries Office implemented a 1,500-lb trip limit for GOM white hake beginning in FY 2016 for common pool vessels (NMFS 2016).

Starting in 2012, a trimester hard TAC (total allowable catch) has been used as a primary accountability measure, and the fishery is suspended once 90% of the trimester TAC is reached (NMFS 2014).

Sectors

Nineteen sectors have been authorized in the New England region. Sectors are self-selecting and largely self-regulating groups of fishermen who collaboratively manage an allocation of fish. Sectors must draft and submit formation proposals, operations plans, and sector monitoring plans, revised enforcement provisions, and clarification of the interaction of sectors with Special Management Programs, such as U.S./Canada management areas. NMFS prepares an environmental assessment (EA) annually to assess the impacts of the individual and cumulative sector operations as proposed in their operations plans.

In exchange for fishing under an ACL for each allocated species in the management plan, sectors are exempt from most common pool effort control measures, such as limited number of days at sea and trip limits. These are referred to as universal exemptions. A sector's allocation of an ACL for a particular stock is called the Annual Catch Entitlement, or ACE, and is a sub-ACL of the overall fishery ACL. At-sea catch monitoring ensures that sector ACEs are not exceeded. For each permit that is eligible to join a sector, the permit's potential sector contribution (PSC) is calculated based on the permit's catch history. The ACE that is allocated to a sector is based on the sum of the PSCs for the permits that join the sector. Sector participants are not allowed to discard legal sized fish, and all fish caught count toward their sector allocations.

If the ACL is not reached in a given year, sectors can carry over a maximum of 10% of the unused ACL into the following year. This maximum of 10% can be reduced if the carry over, in addition to the ACL of the upcoming year, exceeds the total ABC (NMFS 2016).

Regulations Shared by Common Pool and Sector Vessels

- All commercial vessels participating in the Northeast Multispecies Fishery are required to use a Vessel Monitoring System (VMS) to report fishing activities, as well as a vessel trip report (VTR).
- No minimum size for white hake in FY 2018.
- Sector vessels participating in Special Access Programs must only use gear approved under those programs.

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

CRITERION: Sufficient data exist to determine harvest levels.

IV. White Hake Data

Stock Status

Data: The most recent benchmark assessment for white hake was the 2013 56th Northeast Regional Stock Assessment Review Committee (SARC 56) and Stock Assessment Workshop (SAW 56). This assessment utilized a wide range of data including state and federal surveys and commercial landings per unit effort (LPUE). More specifically, the 2013 assessment model incorporated data from spring and autumn bottom trawl Northeast Fisheries Science Center (NEFSC) surveys, Maine-New Hampshire Inshore Groundfish Trawl Surveys, vessel trip reports, dealer landings records, and on-board fishery observers (NEFSC 2013). The accepted model, the Age Structured Assessment Program model (ASAP), used in the 2013 assessment includes catch, survey, and biological data from 1963 through 2012. The SAW 56 assessment also used certain data analyses that differed from the previous Groundfish Assessment Review Meeting III Statistical Catch at Age (GARM III SCAA) assessment, thus revising biological reference points (BRPs) utilizing the most up to date understanding of the fishery data (NEFSC 2013a,b,c).

The SAW 56 assessment received an operational assessment update in 2015 and again in 2017. These two assessments updated commercial fishery catch data, research survey indices of abundance, the ASAP assessment model, and reference points through 2016. Stock projections through 2020 were also updated in the recent 2017 assessment.

Modeling: Landings and survey data are used in determining the biological reference points (BRPs) for white hake. SARC 56 utilized the accepted statistical catch-at-age model (ASAP) that included actual commercial landings, estimates for recreational landings, commercial discards, research survey abundance indices, and analytical models. This model assumed asymptomatic

selectivity at age for the catch at age 6, which is more consistent with catch data than the domed F pattern used in an earlier assessment. The SARC 56 assessment also made use of revised catch streams, pooled (as opposed to annual) age-length keys (ALKs), and a revised fishing selectivity estimate (NEFSC 2013c).

Stock Status: The BRPs from SAW 56 were a Spawning Stock Biomass at maximum sustainable yield (SSB_{MSY}) of 32,400 mt, a fishing mortality $(F)_{MSY}$ proxy (F40%) of 0.20, a mean recruitment of 5.5 million, and a Maximum Sustainable Yield (MSY) of 5,639 mt (NEFSC 2013a). Stock assessment estimates indicate that stock size has been consistently below the management target of SSB_{MSY} since 1980, although it is nearing the target threshold for SSB_{MSY} *(Figure 3).*

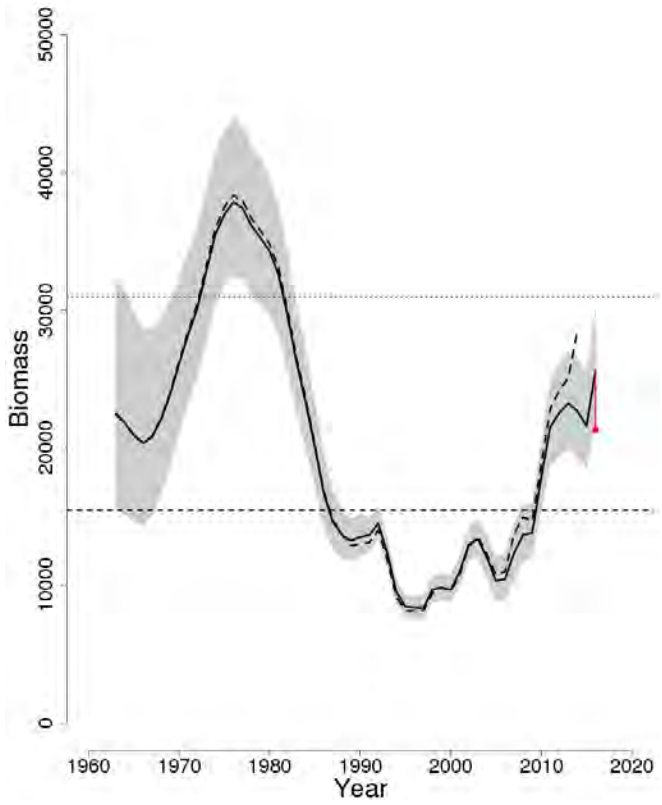

Figure 3. Trend in Spawning Stock Biomass of Gulf of Maine white hake, showing the 2017 operational assessment (solid line) compared to the previous assessment (dashed line), with horizontal lines showing the SSB_{Target} (dotted) and the $SSB_{threshold}$ (dashed). The retrospective adjustment is shown in red, and 90% confidence intervals are shown in gray (NEFSC 2017).

The 2017 operational assessment updated BRP estimates, with a retrospective adjustment. The SSB is estimated at 21,276 mt, which is 69% of the target level (SSB_{MSY} proxy = 30,948 mt). The fishing mortality (F) is estimated at 0.066, which is 36% of the revised F_{MSY} proxy (0.18) *(Figure 4).*

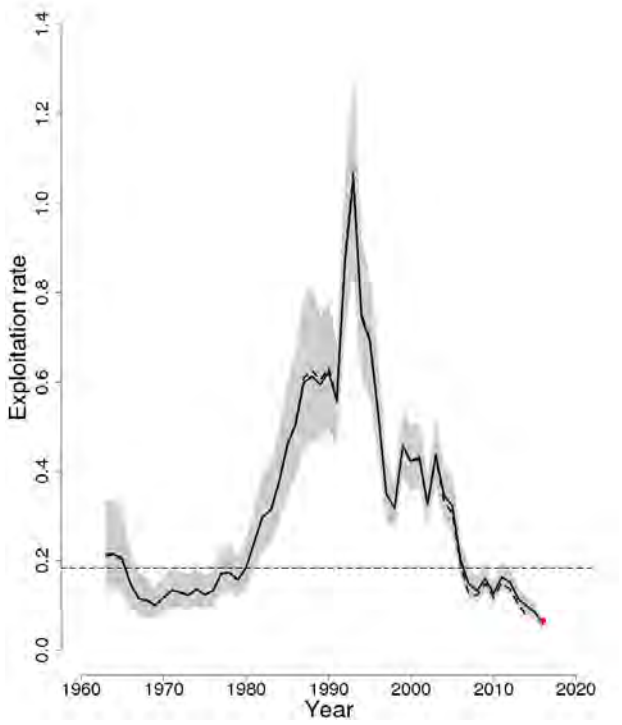

Figure 4. Trend in fishing mortality of Gulf of Maine white hake under the 2017 operational assessment (solid line) and the previous assessment (dashed line). F_{MSY} proxy is represented by the horizontal dashed line and 90% confidence intervals are shown in gray (NEFSC 2017).

As biomass (B) levels are greater than half the B_{MSY}, and F is less than F_{MSY}, white hake is not overfished and overfishing is not occurring in accordance with the NOAA definitions (NEFSC 2017). The stock is in a rebuilding plan – the rebuilding deadline was 2014, but the stock is not yet rebuilt even with a very low fishing mortality. Annual commercial landings have remained below annual catch limits (ACLs) since the transition to the quota-based sector management system in 2010 *(Figure 5)* (NOAA 2018a).

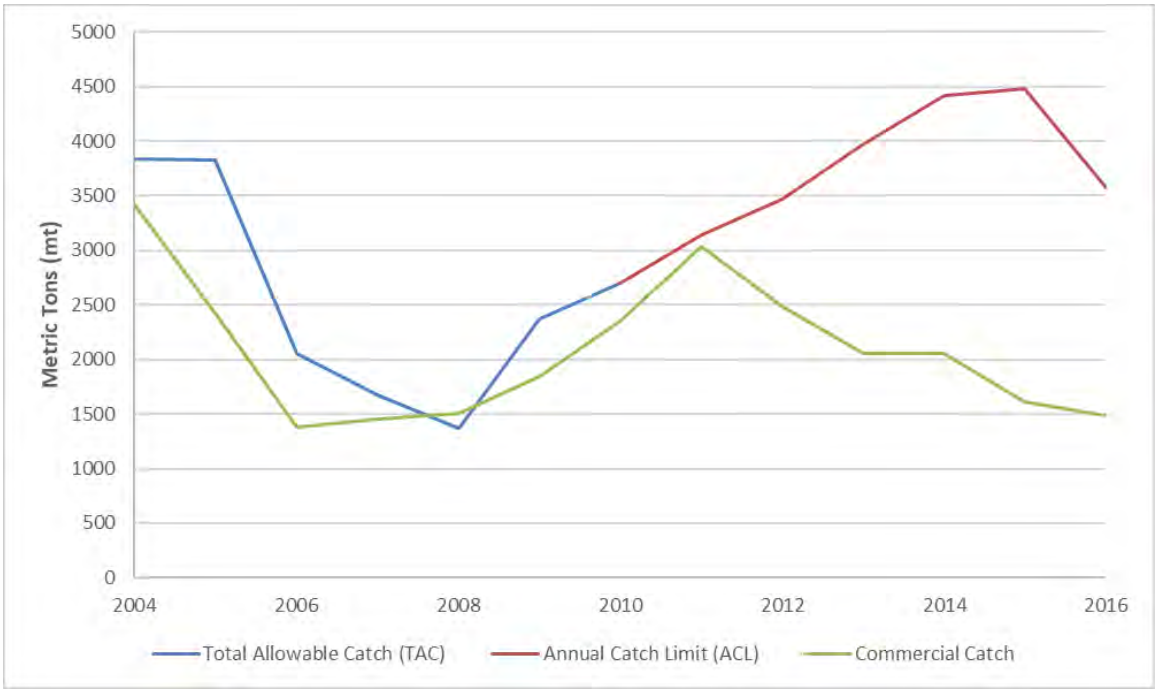

Figure 5. Trend in commercial catch plotted against catch targets and ACLs from 2004-2016 (NOAA 2018a). The dashed line represents when the current sector management system (using Annual Catch Limits) was implemented in 2010. Prior to 2010, the groundfish fishery was primarily regulated by effort control (i.e. days at sea, trip limits) and there were catch targets, referred to as Total Allowable Catch, used by the management system in determining regulations.

Sources of Uncertainty

A source of uncertainty noted in all the recent assessments (SAW 56; 2015 update; 2017 update) is that catch-at-age information is not precisely characterized due to possible misidentification of species in commercial and at-sea sampling data, particularly in early years that include sparse discard data, or in years of low commercial landings. Since the catch is aged with survey age/length keys (ALK), augmentation is required, primarily for ages 5+. In addition, a pooled ALK from 1963-1981 was used to fill in gaps in age composition, which can blur recruitment estimates. (NEFSC 2013a). The presence of a significant retrospective pattern, a feature that has appeared in the operational updates for many Northeast species in the last few years, is a significant source of uncertainty.

The 2015 and 2017 assessments also recognized that white hake may move in and out of the defined stock area. Additionally, it was noted that in June 2014, a market category was added for "extra-large" fish that were previously categorized as "large" fish. This may bias the age composition of the landings. For example, in 2014, 2,000 of the 5,000 large fish caught were actually considered extra-large fish after the length distinction was determined (NEFSC 2015).

In the 2017 assessment, the 2014 catches at age were re-estimated for landings, discards, and both surveys. The annual spring and fall ALKs were completed and used to estimate the catches at age.

The panel recommended augmenting the survey keys by examining the age structures collected by the observer program and the Atlantic States Marine Fisheries Commission shrimp survey. The panel also recommended that otoliths currently being collected from the market category for heads should also be aged.

Stock History

Historic landings of white hake reached as high as 22,000 mt, reported in 1898. Since the modern fishery was established in 1964, U.S. landings have varied from a low of 1,147 mt in 1967 to over 9,500 mt in 1992, and have fluctuated between 2000 mt and 3000 mt in recent years *(Figure 6)*. Discards have been gradually decreasing since 1999, reaching an all-time low of 20.5 mt in FY 2015 (NOAA 2018a). The decrease in fishing effort and discards is representative of management changes within the white hake fishery to support stock sustainability. Recruitment has been shown to be stable as long as catches do not significantly fluctuate, which helps to ensure the future of the stock (NEFMC 2013a).

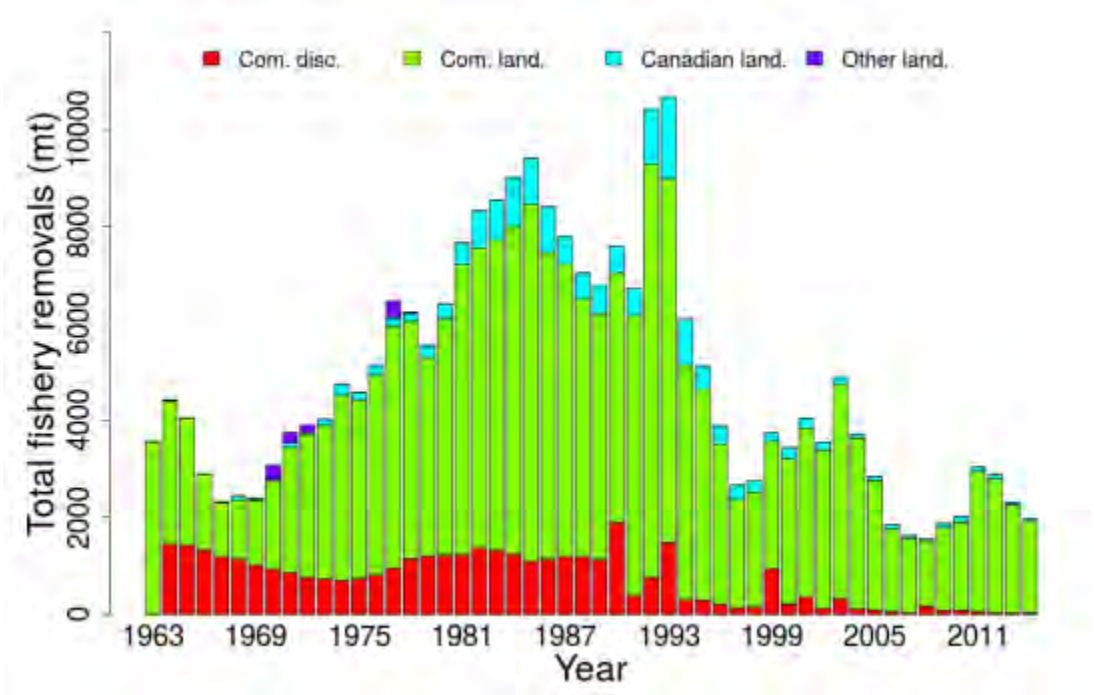

Figure 6. Trend in landings and discards of Gulf of Maine white hake (NEFSC 2015)

Harvest Levels

Sufficient data exist to determine acceptable harvest levels for current and coming fishing years. The annual catch limits (ACLs) for this stock in fishing years (FY) 2016-18 were identified in Framework Adjustment 55, which incorporated findings from the 2015 assessment (NMFS 2014)[2]. Based on recommendations by the Scientific and Statistical Committee (SSC), the NEFMC set Overfishing Levels (OFL) and Acceptable Biological Catch (ABC), which are set to inhibit overfishing. The approved OFLs, ABCs, and ACLs for FYs 2016-2018 under Framework Adjustment 55 are outlined in the table below *(Table 1)* (NMFS 2016).

Table 1. White Hake Overfishing Limits, Acceptable Biological Catch and Annual Catch Limits for FY 2016-2018

Fishing Year	Overfishing Limit (OFL)	Acceptable Biological Catch (ABC)	Total Annual Catch Limit (ACL)	Sector ACL	Common Pool ACL
2016	4,985 mt	3,816 mt	3,572 mt	3,434 mt	25 mt
2017	4,816 mt	3,624 mt	3,448 mt	3,315 mt	24 mt
2018	4,733 mt	3,560 mt	3,387 mt	3,257 mt	24 mt

Projections: In the 2017 assessment, projections for FY 2018-2020 were updated based on a cumulative distribution function of ASAP recruitment estimates from 1995-2014. SSB in the most recent projections is lower than the estimate from the previous assessments in 2013 and 2015, and is estimated to be 24,720 mt in 2018, 23,936 mt in 2019, and 22,963 mt in 2020. These population projections are not well determined, and the new estimates show that the biomass projection from the 2015 assessment was outside the estimated confidence bounds of the 2017 assessment, due to a retrospective pattern (NEFSC 2017).

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

[2] A Framework Adjustment is an abbreviated rule-making process for actions within the scope of the existing goals and objectives of the respective fishery management plan (Amendment 16 in this case), and with no significant impacts on the human or physical environment.

The monitoring programs in place for the Northeast multispecies fishery provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Monitoring of the common pool is carried out through several different programs. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily vessel trip reports (VTRs), which provide details on type of gear fished, area fished, species caught and discarded, dealer information, and port of landing information, in addition to other details. The Northeast Fisheries Observer Program (NEFOP) employs at-sea observer coverage and biological sampling for the groundfish fleet. Separate from NEFOP, there are also shore-side port samplers who take biological samples from landed catch to help inform stock assessments and other fisheries research.

The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level of precision (measured as the coefficient of variation [CV]) no greater than 30% for each fishery (73 FR 4736; January 28, 2008). The Pre-Trip Notification System (PTNS) ensures fair and adequate coverage of vessels across the multispecies fishery. Vessels enter information into PTNS prior to a trip, and an algorithm randomly selects trips for coverage in order to achieve the targeted observer and at-sea monitor coverage across sectors, areas, and gear types. In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage.

Sector vessels have additional monitoring requirements. Sector operations plans specify how a sector will monitor its catch to assure that sector catch does not exceed the sector allocation. Industry funding of at-sea monitoring (ASM) was introduced in March 2016, beginning the transition from the federal government covering the costs of ASM to the industry covering the costs. NOAA reimbursed the industry 85% of its expenses in FY 2016 and 60% in FY 2017 through a grant from the Atlantic States Marine Fisheries Commission (ASMFC). During FY 2018, ASM will be fully funded by NOAA because Congress appropriated additional funding. For FY 2018, total target coverage is 15% for ASM based on an average of ASM data from FY 2014-2016. The Northeast Fishery Observer Program (NEFOP) covers 8% of the target coverage, while the remaining 7% must be covered by industry ASM.

Previously, sector required at-sea monitoring coverage was typically between 17% and 22%. In 2016, additional factors were accounted for in determining the target so as to ensure compliance with the 30% CV requirement, including: removing ASM coverage for a subset of sector trips, using more years of discard data to predict coverage levels, and basing the target on predictions

for stocks that are at a higher risk for error in the discard estimate (NMFS 2016). All sector vessels are still required to submit weekly VTRs in accordance with Amendment 16 to the Northeast Multispecies FMP.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

Based on the data collected through monitoring, the Northeast multispecies complex is routinely evaluated and necessary changes to management measures are made through biennial Framework Adjustments.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the Northeast Multispecies FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations.

In the common pool, enforcement is focused on compliance with days-at-sea (DAS), seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures. Enforcement for sector vessels primarily relies on monitoring harvest levels through sector reporting and VTRs (in addition to some of the measures described above for which sectors are not universally exempt); however individual sectors are also responsible for self-enforcement. Dealer reporting is a requirement of dealers who receive the fish.

It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: ACE overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. White

hake is not identified as a species of concern under OLE's enforcement priorities. Data available on enforcement actions between March 2010 – February 2018 shows that in the Northeast, there were no specific violations involving white hake (NOAA 2018b). Of the general enforcement actions reported that could have pertained to fishermen in the Northeast Multispecies fishery (although not specified in these more general violations), the most predominant problems were related to fishing in closed areas, reporting violations, gear violations, and possession or overage violations. In total, there were less than 25 of these possible NE Multispecies fishery violations between March 2010 – February 2018 (NOAA 2018b). Many of the recent cases involved noncompliance with possession limits, particularly for cod.

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Responsibly Harvested Seafood from the Gulf of Maine Region

Report on
Whiting (Silver hake), US Northern and Southern Stocks

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.
- *Whiting is managed by NMFS and NEFMC, and regulated by under Amendment 12 of the Northeast Multispecies Fishery Management Plan, which utilizes the best available science to set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.
- *According to the biological reference points and analysis of the 2010 51st Northeast Regional Stock Assessment Workshop (SAW 51), the northern and southern stocks are not overfished ($B > ½ B_{MSY}$). In addition, the assessment also determined that overfishing is not occurring in either stock ($F<F_{MSY}$), based on data from the 2009 fishing year.*

☒ Sufficient data exists to determine harvest levels.
- *SAW 51 established up-to-date biological reference points based on the available data. Ultimately, the Council and/or the Regional Administrator set the harvest levels (Annual Catch Limits or ACLs), based recommendations of the Science and Statistic Committee and Plan Development Team. ACLs are being finalized and will be in place for the 2012 fishing year.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.
- *Whiting possession limits and harvests are monitored through observers, dealer reports, dockside monitoring and other electronic reporting requirements. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.
- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of whiting.*

Verified September 2011

I. Definition of Whiting

Silver hake (*Merluccius bilinearis*), also known commonly as whiting, is harvested from waters throughout New England and range from Newfoundland to South Carolina. Whiting prey on other fish, squid, and crustaceans, and play an important role in the food web as prey for important commercial species such as red and white hake, cod, haddock, and pollock (Lock and Packer 2004). Two separate stocks of whiting have been identified based on size variations, resulting in the northern and southern stocks being managed separately to account for these biological variances (Fig. 1). While there is a degree of mixing between the two stocks on Georges Bank, the extent of mixing is unknown (NFSC 2011). The total distribution of the northern stock is included in the Gulf of Maine Responsibly Harvested program's harvest area, while the northern most range of the Southern Stock, Area 562, is also included harvest area. As a result, this report will include information pertaining to both stocks.

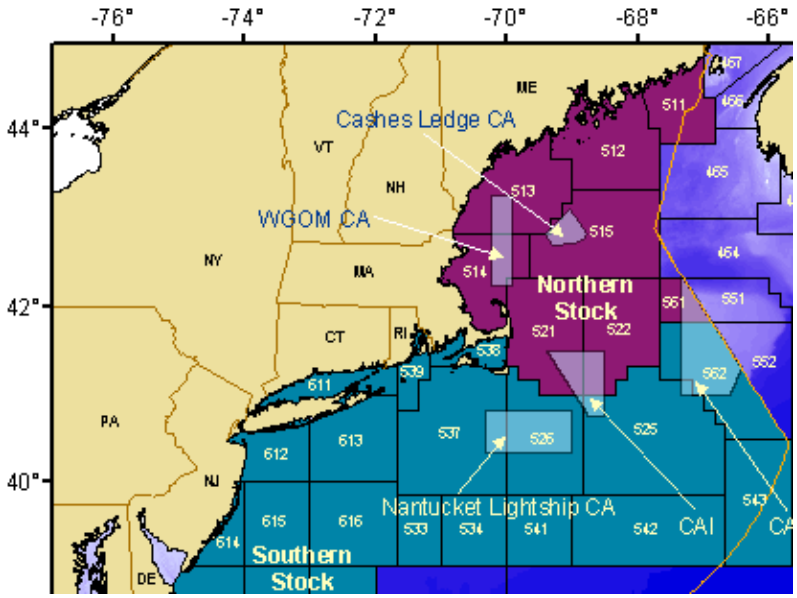

Figure 1. Statistical areas and distribution of northern and southern whiting stocks in New England (NESFC 2006).

II. Description of the Management Authority and Regulatory Process

Responsibility of whiting management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of whiting regulations under Amendment 12 of the Northeast Multispecies Fishery Management Plan (FMP). Red hake and offshore hake are also managed under Amendment 12, or the small mesh multispecies program, while the remaining 15 northeast groundfish species are separately managed under Amendment 16 of the FMP. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For whiting management, the NEFMC is advised by the Small Mesh Multispecies Oversight Committee. The Committee consists of representatives from state and federal management agencies, the fishing industry, environmental groups, as well as one representative from the Mid-

Atlantic Fishery Management Council. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the oversight committee meet these requirements, a Whiting Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the oversight committee provide detailed guidance (terms of reference) to a Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of whiting. The PDT provides reports to the oversight committee in response to the terms of reference. The PDT meets regularly to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. Figure 2 provides a visual of this process.

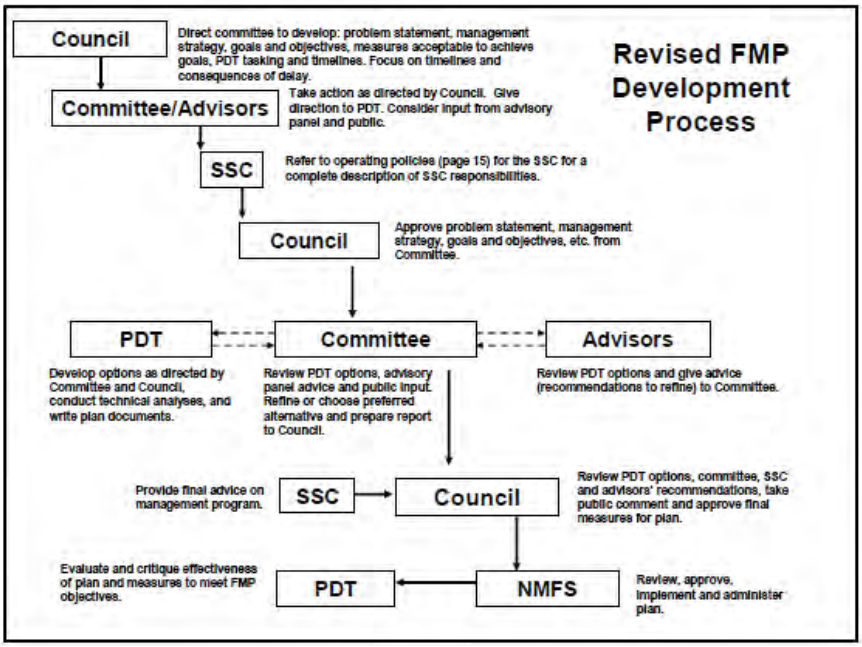

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Whiting Data

Stock Status and Biological Reference Points

Landings data and Northeast Fishery Science Center (NFSC) survey data are used in determining the biological reference points (BRP) for both the northern and southern whiting management areas. Under the small mesh multispecies program, overfishing of northern hake is defined using a relative exploitation index, or the total landings divided the NFSC autumn survey biomass index (NEFMC 2000). Overfishing of the northern stock occurs when this exploitation index is greater than the proxy of F_{MSY}=2.57, or the average exploitation index during 1973-1982. The northern stock is considered overfished when the 3 year average biomass is less than ½ the B_{MSY} proxy, where $½B_{MSY}$=3.32 kg/tow, or the average observed from 1972-1973.

According to the 51st Stock Assessment Workshop (SAW 51) conducted in 2010, utilizing data "based on trends in the three year moving averages for the age-aggregated, fall survey biomass indices from 1973-1982…and the three year averages of exploitation indices (total catch/fall survey biomass index)" (NSFC 2011), overfishing was not occurring in the northern or southern whiting stocks, and neither stock was considered overfished. The 2007-2009 northern stock survey data average was 6.79 kg/tow, which is above the overfished biomass threshold of $½B_{MSY}$ proxy=3.31 kg/tow. The 2007-2009 exploitation index of 0.15 was well below the overfishing threshold (proxy for F_{MSY}=2.57) and thus overfishing is not occurring. The 2007-2009 survey data from the southern stock (1.39 kg/tow) was above the overfished threshold of $½B_{MSY}$ proxy=0.89 kg/tow, while the assessment determined that overfishing was not occurring in the southern stock, as the current exploitation index (4.33) was below the overfishing threshold of F_{MSY} proxy=34.39 (NFSC 2011).

In addition, determining stock status using the existing BRPs found in the small mesh multispecies FMP, a term of reference in SAW 51 called for updated and refined BRPs based on additional data, modeling, or uncertainties. These new BRPs, which have not been finalized to the FMP, along with the existing BRPs for the northern and southern stocks, can be found in Table 1.

Table 1. Current biomass, exploitation indices and biological reference points for northern and southern whiting stocks (NFSC 2011).

	Current Biomass Index	Existing FMP Biomass Threshold= $½B_{MSY}$ proxy (Overfished)	New SAW 51 Biomass Threshold= $½B_{MSY}$ proxy (Overfished)	Current Exploitation Index	Existing FMP Exploitation Threshold= F_{MSY} proxy (Overfishing)	New SAW 51 Exploitation Threshold=F_{MSY} proxy (Overfishing)
Northern Stock	6.49 kg/tow	3.31 kg/tow	3.21 kg/tow	0.15	2.57	2.78
Southern Stock	1.39 kg/tow	0.89 kg/tow	0.83 kg/tow	4.33	34.39	34.19

Historical Landings Data

Historically, the northern whiting stock has been a commercially important fishery for Maine and Massachusetts, with the stock becoming of economic importance to Rhode Island in the 1990s. The southern stock is typically targeted by vessels from southern New England and the Mid-Atlantic states. Total landings for whiting peaked in 1964 at 94,000mt and have declined steadily since 1975 (NFSC 2011). In 2009, commercial landings from the southern stock were 6720 mt, while 1,038 mt from the northern stock were landed (Fig. 3). Current landings from both stocks are considered at historic lows.

Verified September 2011

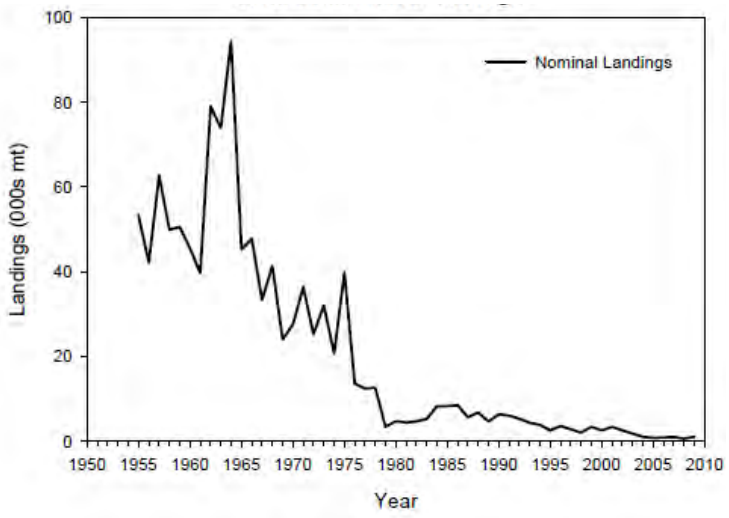

Figure 3. Historical landings of northern whiting stock (NESFC 2010).

According to NFMS survey data, biomass of the northern stock has remained above the overfished threshold since 1971, and the southern stock biomass has recovered from when it was considered overfished in 2005 (NFSC 2006).

Sources of Uncertainty
SAW 51 identifies the following sources of uncertainty for northern and southern whiting stocks (NFSC 2011):

1. The mis-reporting of whiting and offshore hake, resulting in some uncertainty in landings[1].
2. Survey data shows that that there is some north-south movement among adult whiting on Georges Banks and as a result there is an unknown extent of mixing between the northern and southern stock.
3. The abundance of larger and older whiting is decreasing, despite a relatively high biomass and low fishing mortality. The reason for this reduction is unknown.

IV. Amendment 12 to the Northeast Multispecies Fisheries Management Plan

The Northeast Multispecies Fishery Management Plan (FMP) was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks and to promote rebuilding to sustainable biomass levels. Three species (whiting, red hake, and offshore hake) are managed under the small mesh multispecies program pursuant to Amendment 12 of the Northeast Multispecies FMP, while 16 other groundfish species are managed separately, under Amendment 16 to the FMP.

Amendment 12, sometimes referred to as the small mesh multispecies FMP, was passed in 2000, to eliminate the overfishing of the small mesh multispecies and to rebuild these stocks within a ten-year period as required under the Sustainable Fisheries Act.

[1] One current proposal that is being assessed by the NEFMC would incorporate offshore hake into the ACL of the southern whiting stock. Despite being separate species, the proposal would set aside 4% of the southern stock ACL for offshore hake as a result of mixing between the species.

Amendment 12 implemented management measures such as, seasonal closures (i.e., no fishing in certain areas), gear restrictions (i.e., specified mesh size), trip limits (i.e., limiting fishermen to a certain poundage of fish per trip), limited access (i.e., limiting the number of participants in the fishery), and restrictions on the number of days a vessel is allowed to fish for groundfish each year (i.e., days-at-sea). Amendment 12 also established BRPs to define overfished and overfishing of the northern and southern whiting stocks. The overall goal of these actions was to reduce fishing mortality to rebuild whiting stocks to target biomasses. If these management measures were unsuccessful, then default measures were to be implemented during Year 4 of the rebuilding timeframe (NEFMC 2000).

The management plan enacted under Amendment 12 had a positive outcome for the whiting fishery. As a result, Framework 37 was finalized by NMFS in 2003. Framework 37 sought to eliminate the Year 4 default measures and expand fishing opportunities for the northern whiting stock, as the recent stock assessment showed the stocks could support increased fishing effort without becoming overfished (NEFMC 2003a). At the time, the northern stock was rebuilt to 176% of its target biomass, while the southern stock was no longer considered overfished. Along with eliminating default measures, Framework 37 also extended the fishing season for the offshore Cultivator Shoal whiting fishery.

Additional management efforts were finalized in 2003 under Framework 38 to the FMP. Framework 38 allowed grate raised footrope trawl gear to be exempt from the Gulf of Maine Regulated Mesh Area. This type of trawl gear had been part of an experimental fishery for the previous eight years, and data collected showed successful and compelling results in reducing bycatch of other regulated species (NEFMC 2003b). Under Framework 38, the grate raised footrope trawl gear season extends from July 1st to November 30th and requires other gear specifications, such as 2.5 inch cod end mesh and use of Nordmore grates (NEFMC 2003b). A possession limit for 7,500lbs for whiting was also implemented.

Currently, NEFMC is defining Annual Catch Limits (ACLs) for the northern and southern whiting stocks as required under MSA. Determination of ACLs and Allowable Biological Catch (ABC) is based on analytical assessment from the Council's Science and Statistical Committee, Whiting PDT, and data from the SAW 51. While overfishing is not occurring in either stock and neither stock is overfished, there was some uncertainty in the age structure data utilized, resulting in a delay in determining the appropriate assessment model (Howard 2011). The Whiting PDT is considering options based on the available data in SAW 51 and will provide NEFMC with the potential ACLs in a draft Amendment 19 in September 2011. Final approval of the ACLs will allow NEFMC to achieve the MSA-mandated 2011 deadline that requires ACLs for all commercial fish stocks (NEFMC 2011).

V. Monitoring

When fishing in certain areas, vessels are required to submit vessel trip reports (VTRs), which provide details on type of gear fished, area fished, species caught (and discarded), dealer information, and port of landing information, in addition to other details. The New England Fisheries Observer Program (NEFOP) employs at-sea observer coverage and port sampling for the groundfish fleet. The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a level

of precision (measured as the coefficient of variation [CV]) no greater than 30% for each (NOAA 2008). In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage. There are also shore-side port samplers who periodically work at fish auctions and exchanges taking biological samples. This program ensures compliance with the MSA in addition to the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

Based on the data collected through monitoring, the Northeast multispecies complex is routinely evaluated and necessary changes to management measures are made through biennial Framework adjustments.

VI. Enforcement

In general, enforcement of the NE Multispecies FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations. Enforcement of the whiting fishery is focused on compliance with DAS, seasonal closures, closed areas, gear restrictions, and trip limits, to name a few measures.

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Gulf of Maine Responsibly Harvested
Verification Report

Winter Skate
(*Leucoraja ocellata*)

☒ The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.
- *Winter skate is managed by NMFS and the NEFMC under the Northeast Skate Complex Fishery Management Plan. This plan manages fisheries harvesting seven different species of skate, and utilizes the best available science to set biological reference points and harvest restrictions.*

☒ If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.
- *Winter skate is not below management targets. As of 2016, winter skate is not overfished and overfishing is not occurring.*

☒ Sufficient data exists to determine harvest levels.
- *The last benchmark stock assessment to determine biological reference points was the 2008 Data Poor Working Group report, and the most recent assessment was in 2016, using data poor techniques. The Council sets harvest levels for the wing and bait fisheries based on the assessments, which rely on survey data.*

☒ Monitoring and compliance measures are in place to ensure acceptable harvest levels.
- *Winter skate harvest is monitored through vessel trip reports (VTRs), observers, and dealer reports. Compliance is assessed through consistency throughout these reports as well as enforcement in the field.*

☒ Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.
- *U.S. Coast Guard, NMFS Office of Law Enforcement agents, and state marine patrol agents enforce the laws and regulations governing the harvest of winter skate.*

I. Definition of the Winter Skate Fishery

Winter skate (*Leucoraja ocellata)* is harvested from the waters off of Maine, New Hampshire, and Massachusetts in the Gulf of Maine and Georges Bank. While the skate stock unit extends into southern New England and the Mid-Atlantic Bight, this report focuses on the management and harvesting of winter skate in the area outlined by the Gulf of Maine Responsibly Harvested Standard, which includes statistical areas east and north of (and inclusive of) statistical area 526 *(see figure 1 below)*.

Winter skate is primarily landed as incidental catch in the monkfish, scallop, and Northeast multispecies fisheries. It is estimated that 98% of the skate harvested for human consumption is winter skate, which is why this report is focused on winter skate within the complex of skate species. Winter skates are most commonly found in southern New England and on Georges Bank (NMFS 2003). Otter trawling is the most common method of catching winter skate and was responsible for anywhere between 65-86% of total landings between 2002-2009, with the rest landed mostly by gillnets (GARFO 2017).

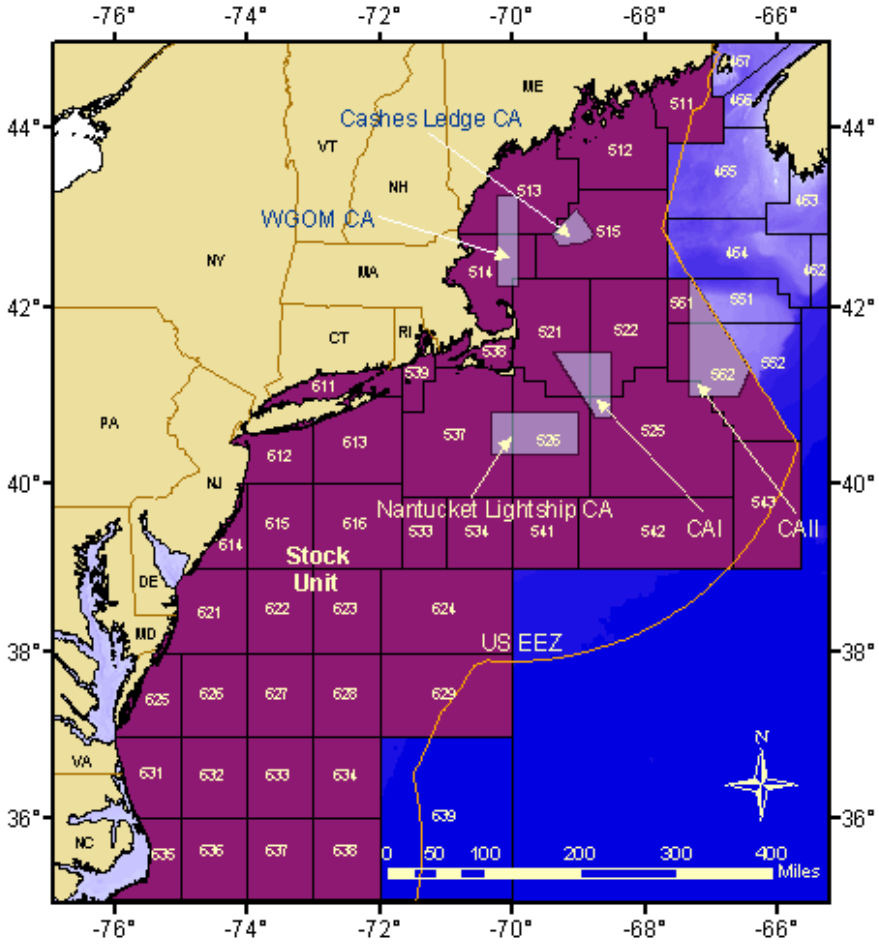

Figure 1. Fishery statistical areas for the winter skate stock (NEFSC 2006). "CA" refers to closed areas.

CRITERION: The fishery is managed by a competent authority and has a management plan in place that incorporates a science-based approach to ensure sustainability.

II. Description of Management Authority and Regulatory Process

Responsibility of winter skate management lies within the National Marine Fisheries Service (NMFS), which is a part of the National Oceanic and Atmospheric Administration (NOAA). The New England Fishery Management Council (NEFMC) facilitates the development of winter skate management measures as part of a complex of seven skate species that are managed together as the Northeast Skate Complex. The NEFMC consists of 18 voting members, including the Regional Administrator for NMFS, the principal marine resource management official from each New England state, and governor appointees.

For the Northeast skate complex FMP, a sub-set of NEFMC members form an Oversight Committee. This committee is responsible for the development of the fishery management plan and regulations that are consistent with the ten national standards outlined in the Magnuson Stevens Act (MSA), which dictate that conservation and management measures shall:

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

To help the oversight committee meet these requirements, an Advisory Panel made up of representatives from the fishing industry, scientists, and conservation organizations provides input to management measures. The chairs of the oversight committee provide detailed guidance (terms of reference) to a Skate Plan Development Team (PDT), which consists of scientists, managers and other experts on biology and/or management of skates. The Skate PDT meets at least annually to review the status of the FMP. The review includes annual updates to survey indices, updates to fishery landings and discards, a reevaluation of stock status based on updated survey indices and overfishing definitions, and a determination of whether accountability measures have been triggered. Based on this review, the PDT provides reports to the oversight committee in response to the terms of reference. The PDT meets regularly to provide

analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. The NEFMC is also assisted by the members of the Scientific and Statistical Committee (SSC); SSC members review and participate in stock assessment updates, and develop acceptable biological catch (ABC) recommendations that inform management decisions. Figure 2 provides a visual of this process.

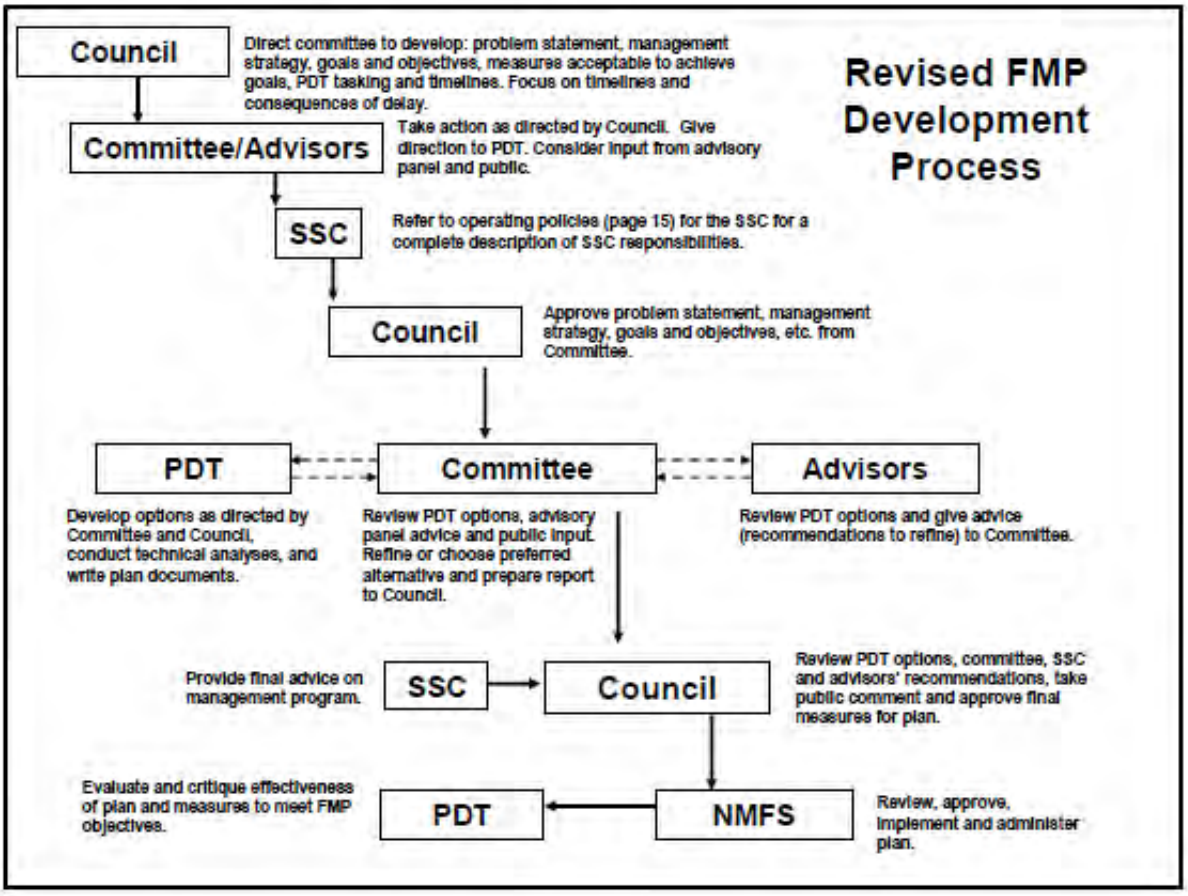

Figure 2. Fishery Management Plan Process (Fiorelli 2008)

III. Northeast Skate Complex Fisheries Management Plan

The winter skate fishery is managed as part of the Northeast Skate Complex Fisheries Management Plan (FMP), which was developed by the New England Fisheries Management Council (NEFMC) and was implemented in 2003. This management plan includes seven species of skate (winter, little, smooth, thorny, barndoor, rosette, and clearnose) from the New England and Mid-Atlantic coastal regions. When the management plan was first implemented, it was in response to findings that winter, smooth, thorny and barndoor skates were all overfished. As of 2017, the only species that remains overfished is thorny skate, and overfishing is not occurring for any of the seven species (NEFSC 2017).

The regulations under the FMP include permit requirements for vessels possessing skates and dealers purchasing skates, reporting requirements, possession limits for skate wings and whole skates, and prohibition on the possession of smooth, barndoor and thorny skates. Skates are often caught as incidental catch as part of the Northeast (NE) multispecies, scallop, and monkfish fisheries, so the skate FMP also includes management measures stipulated in those three FMPs. In order to prevent overfishing and rebuild overfished stocks in the skate complex, rules have been implemented through management measures in the skate complex, management measures in the related FMPs (NE multispecies, scallop, and monkfish), or a combination of both (NEFMC 2003).

To possess, land, or sell skates, an open access commercial skate permit is required. Skates are targeted by two different fisheries: one for bait (primarily for the lobster industry) and one for wings for human consumption. The management plan focuses on bait and wings separately, allocating percentages of the quota to each part of the fishery (GARFO 2016). Quotas are set for the directed fishery, while incidental catch landings are managed by possession limits for permit categories A and B days-at-sea (DAS) vessels, as well as non-DAS vessels, including those that operate within NE multispecies sectors.

The bait fishery is a historical and directed fishery. While little skates are the targeted species for the bait fishery, juvenile winter skates can be misidentified as little skates and thus are sometimes landed as bait. Less than 10% of bait landings are estimated to be juvenile winter skates, and the remaining 90% or more of bait landings are little skates (NMFS 2014).

Unlike the directed bait fishery, skate wings have historically been harvested as incidental catch from the NE multispecies, scallop, and monkfish fisheries. In the 1990s, skate wings became a much more directed fishery as fishermen shifted from overharvested species to species that were promoted as "underutilized," including skates and dogfish (NEFSC 2008). Today, winter skate wings account for 98% of total skate wings landed. The market prefers winter skate wings, and other types of skates desired by the market for their wings are typically only caught further south in the mid-Atlantic (personal communication, NEFMC staff). The remaining 2% are two other large species of skate that are currently prohibited, barndoor and thorny. However, this is considered a very high compliance rate for prohibited species regulations (Curtis; Sosebee 2016). Additionally, the prohibition on harvesting barndoor skates is in the process of being removed, and the NEFMC is developing management measures for barndoor harvest in the future. Table 1 depicts the different fisheries and Vessel Monitoring System (VMS) declarations under which skate is landed (NEFMC 2017).

Table 1. Total Skate Landings (lbs live weight) by program in FY 2014

VMS Declaration	Bait	Wing
Multispecies Sector	3,104,650	10,640,649
Multispecies Common Pool	303,450	332,955
Monkfish	29,864	9,811,186
Scallop	NA	42,082
No Declaration[1]	4,212,412	2,293,265
Declare Out-of-Fishery[2]	1,736,170	988,655

[1] *"No declaration" means skate has been landed during a trip that was exempt from VMS.*

[2] *"Declare Out-of-Fishery" means to declare out of the groundfish fishery for a trip, or in other words, fishing for a species that does not require a declaration (e.g. squid, or a research trip). Skates are still allowed to be landed.*

The Magnuson-Stevens Reauthorization Act (MSRA) of 2006 requires the NEFMC to determine Annual Catch Limits (ACLs) and Accountability Measures (AMs) (like size limits, trip limits, gear restrictions, or closures) that prevent overfishing or enable rebuilding within specified time frames for all stocks/species under management. Recommendations for an ACL and acceptable biological catch (ABC) are developed by the PDT. The Scientific and Statistical Committee (SSC) recommends an ABC, and the NEFMC approves final ACLs, but cannot exceed the SSC's recommendations. ACLs may be broken into subcomponents for different segments of the fishery, including state waters, commercial, recreational, etc. Accountability measures can be implemented in-season as management actions to prevent reaching or exceeding the ACL, or they can be corrective post-season management actions that address overages of an ACL.

In 2009, Amendment 3 implemented an ACL framework based on survey biomass indices which were used to update biological reference points for all species within the skate complex. This amendment also introduced seasonal quotas for the bait fishery, possession limits, Annual Catch Targets (ACTs) and Total Allowable Landings (TALs) for wings and bait to improve management of the fishery (NMFS 2009). Framework Adjustment 1 under this amendment set seasonal skate wing possession limits so that the fishery could be open year round, and also allowed vessels landing skate wings to land the carcasses as bait (NMFS 2011).

Accountability measures under the skate FMP are as follows: If the Total Allowable Landings (TAL) are exceeded by 5%, the Regional Administrator will reduce the possession limit in the next fishing year by 1% for each 1% of the overage. In the case of an ACL overage, the buffer between the ACL and ACT will be increased by 1% in the following fishing year for every 1% of the overage. If the Council fails to correct any overages, the Regional Administrator can implement the adjustments that are needed to prevent further overages or overfishing.

In 2014, Framework Adjustment 2 required species-specific reporting for the first time (NMFS 2014). Fishermen are now required to report specific skate species on vessel trip reports (NMFS 2016).

CRITERION: If stock sizes are below management target levels, whether due to natural or man-made causes, management plans are established that enable rebuilding within a specified timeframe.

CRITERION: Sufficient data exist to determine harvest levels.

IV. Winter Skate Data

Stock Status

Within the Skate Complex FMP, biological reference points (BRPs) are estimated from survey data since commercial catches have not been accurately reported by species. The last benchmark stock assessment for the Skate Complex was the 2008 Data Poor Stocks Working Group (DPWG), but survey data is used to provide annual updates and assessments of the biomass. The most recent assessment of the skate

complex occurred in 2016 (NEFSC 2017). The proxy for B_{MSY} for skates is the 75th percentile of the survey biomass index time series for each species.

The biomass proxies are quantified as the stratified average weight-per-tow from the survey data (NMFS 2009). The BRPs, as well as the winter skate biomass index, from the most recent stock update based on the 2014-2016 NEFSC autumn survey are in Table 2 below (NEFSC 2017).

Table 2. 2016 Winter Skate Biological Reference Points	
B_{MSY} proxy	5.66 kg/tow
$B_{threshold}$	2.83 kg/tow
2014-16 Biomass Index	6.65 kg/tow

For the skate complex, the overfishing threshold is based on changes in survey biomass indices because the fishing mortality reference points developed the first time skates were assessed (SARC 30 in 1999) were not accepted by the NEFMC and a different method for evaluating fishing mortality was developed by the PDT (NEFSC 2008). If the three-year moving average for winter skate biomass indices declines by more than the average coefficient of variation (CV) of the survey time series, then F is assumed to be greater than F at Maximum Sustainable Yield (F_{MSY}) and overfishing is occurring.

The winter skate biomass index in 2016 was above the B_{MSY} proxy and above the $B_{threshold}$, thus the stock is not overfished. Since the 2014-2016 average survey biomass index is greater than the 2013-2015 year index by 24.42%, overfishing is not occurring (NEFSC 2017).

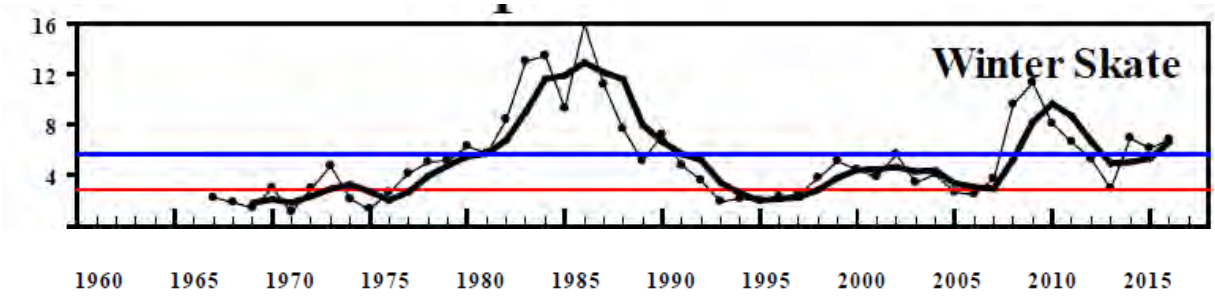

Figure 3. Offshore winter skate in the Gulf of Maine to Mid-Atlantic bight region. Biomass in stratified mean weight-per-tow (kg) with thin lines as annual indices, thick lines as 3 year moving averages and thin horizontal lines are the biomass thresholds and targets (NEFSC 2017).

The fishing mortality reference points are based on changes in survey biomass indices. If the three-year moving average of the survey biomass index for a skate species declines by more than the average coefficient of variation of the survey time series, then fishing mortality is assumed to be greater than F_{MSY} and overfishing is occurring. The 2014-16 average index was above the 2013-15 index by 24.2%, therefore this stock is not overfished and overfishing is not occurring.

Sources of Uncertainty

The sources of uncertainty recognized in the 2016 Northeast Skate Complex stock status update, and stretching back to the 2008 Data Poor Working Group are listed below:

1. Species composition of the discards. Since the 2008 Data Poor Working Group assessment, information regarding discards has improved, although species composition remains an issue. Discards have been decreasing, and skate discards in 2016 were estimated to be 10,434 mt in dead discards (NEFMC 2017). Discard mortality is assumed for the majority of species and gear types, although some recent work has been done to improve estimates for different gear types. Winter skate discard mortality rates were revised from 50% in trawl gear to 9%, for example.
2. The overfishing definitions are not based on fishing activity, but are based on changes in trawl survey indices. Distribution shifts may influence trawl survey biomass.
3. There are life history gaps for some species in the complex.
4. A high percentage of the catch is discards, which are difficult to monitor.

To address these uncertainties, landings and catch data must be species-specific to improve understanding on a stock by stock basis. This began with the implementation of Framework Adjustment 2, for which the reporting requirements went into place in August 2016 (NMFS 2016a). The development of appropriate models and several years of length and age sampling from the commercial fishery and research vessels will be required to improve understanding of life history traits and population dynamics (NEFSC 2008).

Stock History

Skate landings have been recorded in New England fisheries since the 1800s, but did not become significant until the 1950s and 1960s. In 1969, skate landings were as high as 9,500 metric tons (mt), but subsequently dropped to 800 mt by 1981 (NEFSC 2008).

Due to the rise in demand for lobster bait and an increased export market for wings, skate landings have generally increased since the 1980s. In 1993, landings reached 12,900 mt, but declined again to 7,200 mt in 1995. Commercial landings peaked in 2004 at 16,073 mt, the highest on record. This landings data is not specific to winter skate, however 98% of wing landings are estimated to be winter skate and around 10% of bait landings are likely juvenile winter skate (Curtis, Sosebee 2016). Figure 4 shows landings trends for bait and wings in recent years (NEFMC 2017).

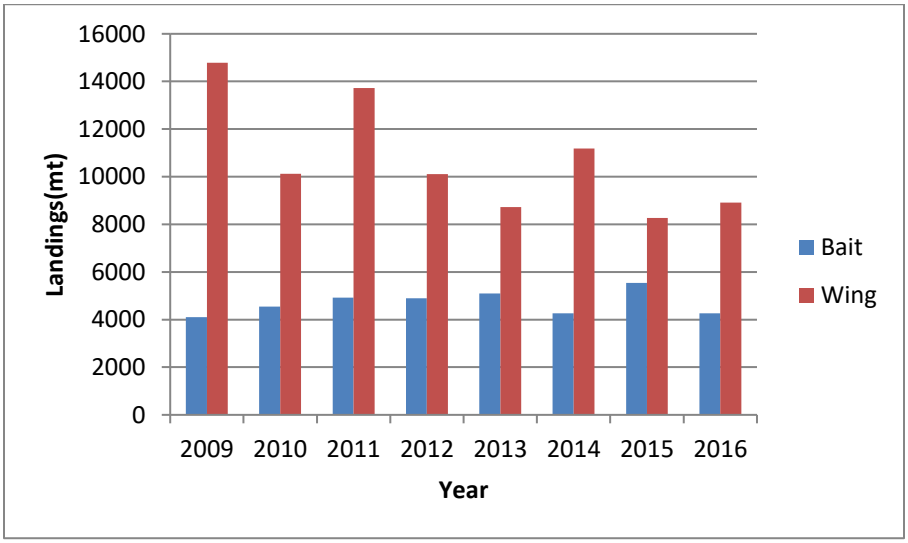

Figure 4. Bait and wing landings (mt) from fishing years 2009-2016 (NEFMC 2017).

Harvest Levels

The NEFMC approved Framework Adjustment 5 in 2017, updating Acceptable Biological Catch, Annual Catch Limits and Targets, and Total Allowable Landings based on the best scientific information available. The wing fishery was allocated 66.5% of the TAL, and 33.5% was allocated to the bait fishery. These quotas are designed to account for both scientific and management uncertainties. These TALs are shown in Table 3 (NEFMCa 2017).

Table 3. 2018-2019 Skate Specifications	
Overfishing Limit (OFL)	Undefined
Acceptable Biological Catch (ABC)	31,327 mt
Annual Catch Limit (ACL)	31,327 mt
Annual Catch Target (ACT)	23,495 mt
Total Allowable Landings (TAL)	13,157 mt (wing TAL 8,749 mt, bait TAL 4,408 mt)

Possession limits per trip are also established for skates. For skate wings caught incidentally on NE multispecies, scallop, or monkfish vessels, as well as non-DAS vessels, the possession limits are shown below in Table 4 (NMFS 2016a). These limits will roll over into fishing year 2018, as no changes have been proposed.

Table 4. Possession limits for Fishing Years 2016-2017		
Vessel	**Season**	**Trip limits (lbs) for skate wings**
NE Multispecies, Scallop, or Monkfish DAS	Season 1 (May 1-Aug 31)	2,600
	Season 2 (Sep 1-Apr 30)	4,100
NE Multispecies B DAS	May 1-Apr 30	220
Non-DAS	May 1-Apr 30	500

Framework Adjustment 4, approved by NOAA and set to take effect in March 2018, separated skate bait possession limits from the wing fishery's limits, with the goal of better controlling the catch of bait. See Table 5 below for the new bait possession limits (NMFS 2018).

Table 5. Skate Bait Fishery Seasons and Possession Limits				
Season	Percentage of Skate Bait TAL	Possession Limit	Trigger for implementing an in-season possession limit adjustment	Incidental possession limit for skate bait once a trigger has been reached
1 (May 1 – July 31)	30.8%	25,000 lbs	90% of seasonal TAL	8,000 lbs
2 (Aug 1 – Oct 31)	37.1%	25,000 lbs	90% of seasonal TAL	8,000 lbs
3 (Nov 1 – April 30)	Remainder	12,000 lbs	80% of seasonal TAL	8,000 lbs

CRITERION: Monitoring and compliance measures are in place to ensure acceptable harvest levels.

V. Monitoring

The National Marine Fisheries Service (NMFS) has the primary responsibility for monitoring and surveillance of the Northeast Skate Complex. The monitoring programs in place provide information to scientists and managers about when, where, and how fish are caught. In addition to information about fish that are landed, the monitoring programs can provide information about species that are not landed. For example, in support of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), observers record interactions with protected and endangered species.

Vessels are required to submit vessel trip reports (VTRs) for each fishing trip, which provide details on type of gear fished, area fished, species caught (and discarded), dealer information, and port of landing information, in addition to other details. These reports are due to the National Marine Fisheries Service on a weekly basis. When fishing in certain areas, such as the Eastern U.S./Canada Area, vessels are required to submit daily VTRs.

In 2014, Framework Adjustment 2 included a management measure that requires species-specific landings to be reported in order to improve understanding of skate landings composition. This reporting requirement was implemented in August 2016 (NMFS 2016a).

The New England Fisheries Observer Program (NEFOP) employs 8% at-sea observer coverage, as well as port sampling for the skate fleet. The final rule for Standardized Bycatch Reporting Methodology (SBRM) states that the Regional Administrator and the Science and Research Director will allocate at-sea observer coverage to the applicable fisheries of the Northeast Region sufficient to achieve a statistically significant sample (measured as the coefficient of variation [CV]) no greater than 30% for each stock it manages (73 FR 4736; January 28, 2008). In addition, vessels fishing in Special Access Programs (SAPs) are required to contact NEFOP prior to their trip to determine if they will have observer coverage. There are also shore-side port samplers who periodically work at fish auctions and exchanges taking biological samples. This program ensures compliance with the MSA in addition to the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA).

Skate trips are subject to at-sea monitoring (ASM) coverage only in specific cases where a vessel has a Northeast Multispecies permit *and* is fishing such that the vessel's groundfish discards would count against their allocation. This ASM coverage is designed to address discard questions in the NE Multispecies fishery. As skate vessels operate primarily under days-at-sea with trip limits, there is no requirement for ASM specific to skate.

Shore-side, there is 100% electronic dealer reporting on a weekly basis, which includes, but is not limited to, unique trip identifier, quantity of species landed, price per unit by species, and port and state landed.

CRITERION: Enforcement exists to ensure that harvesters follow regulations, and to prevent illegal practices and unreported harvest.

VI. Enforcement

In general, enforcement of the NE Skate Complex FMP is coordinated through NOAA's Office of Law Enforcement (OLE). OLE Special Agents and Enforcement conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, and conduct patrols on land, in the air and at sea. In addition to this enforcement work, the OLE administers the Cooperative Enforcement Program (CEP), which authorizes certain coastal state and territorial marine conservation law enforcement agencies to enforce federal laws and regulations in the Exclusive Economic Zone (EEZ). OLE also partners with the U.S. Coast Guard (USCG) and various other federal agencies, fishery management councils, and non-governmental organizations.

As both a directed and incidental catch fishery, skate landings must be in compliance with the regulations of the VMS declaration they are landed in (see Table 1 for the various VMS declarations). For skate landed by NE multispecies common pool vessels, enforcement is focused on compliance with DAS, seasonal closures, closed areas, gear restrictions, and trip limits. Enforcement for NE multispecies sector vessels primarily relies on monitoring catches/landings through sector reporting, dockside monitoring, dealer reporting, and VTR (in addition to some of the measures described above for which sectors are not universally exempt); however individual sectors are also responsible for self-enforcement. It is the responsibility of each sector to enforce any provisions adopted through procedures established in the operations plan and agreed to through the sector contract. Sectors may be held jointly liable for violations of the following sector operations plan requirements: annual catch entitlement (ACE) overages, discarding of legal-sized fish, and misreporting of catch (landings or discards).

NOAA's Office of General Counsel reports on any enforcement actions taken, by region, on a semi-annual basis, and also outlines regional enforcement priorities on an annual basis. Northeast winter skate is not identified as a species of concern under OLE's enforcement priorities.

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Gulf of Maine Research Institute
Science. Education. Community.

Gulf of Maine Responsibly Harvested Verification Report
Blue mussels (*Mytilus edulis*)

Criterion 1: Aquaculture operations are regulated by competent authorities that have established and acceptable environmental monitoring regulations in place.

Mussel aquaculture in Maine is managed by the Maine Department of Marine Resources (DMR) and requires a permit from the United States Army Corps of Engineers (ACOE). DMR and ACOE oversight incorporates environmental monitoring regulations that include, but are not limited to, interference with natural and supporting ecosystem processes, flora and fauna, and water quality.

Criterion 2: Regulatory oversight ensures that aquaculture operations have limited and reversible impacts on the surrounding habitat, species, and ecosystem structure and function.

State and federal rules and regulations limit the impacts mussel aquaculture may have on the surrounding environment through DMR lease and licensing requirements, ACOE permitting, and established monitoring and enforcement.

Criterion 3: Sufficient data exists to demonstrate that aquaculture operations have limited and reversible environmental impacts.

Mussel aquaculture has been studied for decades and there are several hundred peer-reviewed articles. Research shows that mussel aquaculture, especially at the scale currently conducted in the Gulf of Maine, has limited and reversible environmental impacts.

Criterion 4: Aquaculture regulations include appropriate compliance and enforcement standards.

Mussel aquaculture management by DMR includes compliance and enforcement standards. DMR is responsible for conducting annual inspections of all mussel farms to ensure compliance with existing rules and regulations.

Mussel aquaculture in Maine:

I. Background and typical operations

Blue mussels (*Mytilus edulis*) have historically been an important food source in New England. In the 1970s, the market for mussels grew, leading to the beginning of mussel aquaculture in the Gulf of Maine, which has existed in various forms for nearly 50 years (Maine DMR). The first mussel farm in the United States, Abandoned Farm, was established in Walpole, Maine in 1973 by Edward Meyers on the Damariscotta River (Morse and Rice 2010). Shortly after, more farms were started throughout the Gulf of Maine. The University of Maine Darling Marine Center began research on mussel farming in 1970 with the work of Dr. Herb Hidu. In 1979, the first lease for bottom culture mussel cultivation was granted, and in the decades since the industry has steadily grown. The Maine Department of Marine Resources (DMR) began regulating the industry in 1988, following increased concern over the demand for seed mussels and competing claims over the wild and farmed mussel fisheries (Maine DMR 2022a). In May of 1996, the Island Institute, partnering with Pemaquid Oyster Company and Great Eastern Mussel Company, deployed mussel rafts and subsequently published a guide to cultivating mussels, titled, "The Maine Guide to Mussel Raft Culture" (Aquaculture Research Institute).

Mussels are grown in one of two ways in Maine: suspended and bottom culture. The majority of mussel aquaculture in the Gulf of Maine occurs through suspended culture. Here, rafts are used to suspend vertical long lines for rope-grown mussels. Mussel spat, or seed is usually passively collected on ropes that will catch wild seed floating through the water column (Morse and Rice 2010). Alternatively, spat can be harvested from wild mussel beds. The seed is then sorted and stuffed into a biodegradable socking material that degrades over time as the mussels attach themselves to the line with byssal threads, a collection of strong, collagenous fibers that extend from the mussel shell and anchor to the surrounding hard substrate. Bottom culture requires seed to be collected either passively or by actively harvesting from wild mussel populations, which are then spread thinly across a lease site. Mussels take approximately 18 months to grow from seed to a harvestable size. Mussels are filter feeders and do not require any feed inputs, instead acquiring nutrients directly from the water column.

As of June 2023, there are five active experimental leases and 37 active standard leases that are authorized to cultivate blue mussels in Maine, with a total active lease area of approximately 812 acres.

There are an additional three standard leases (representing approximately 75 acres) that are pending approval. Furthermore, there are 46 Limited Purpose Aquaculture leases that have been approved to farm mussels (Maine DMR 2023). Of the lease and license sites authorized to cultivate blue mussels, only six farms are currently selling mussels. Preliminary data from the 2022 harvest of farm-raised blue mussels reported a total of 1,967,367 pounds of mussels harvested with a value of $3,634,049 (Maine DMR 2023).

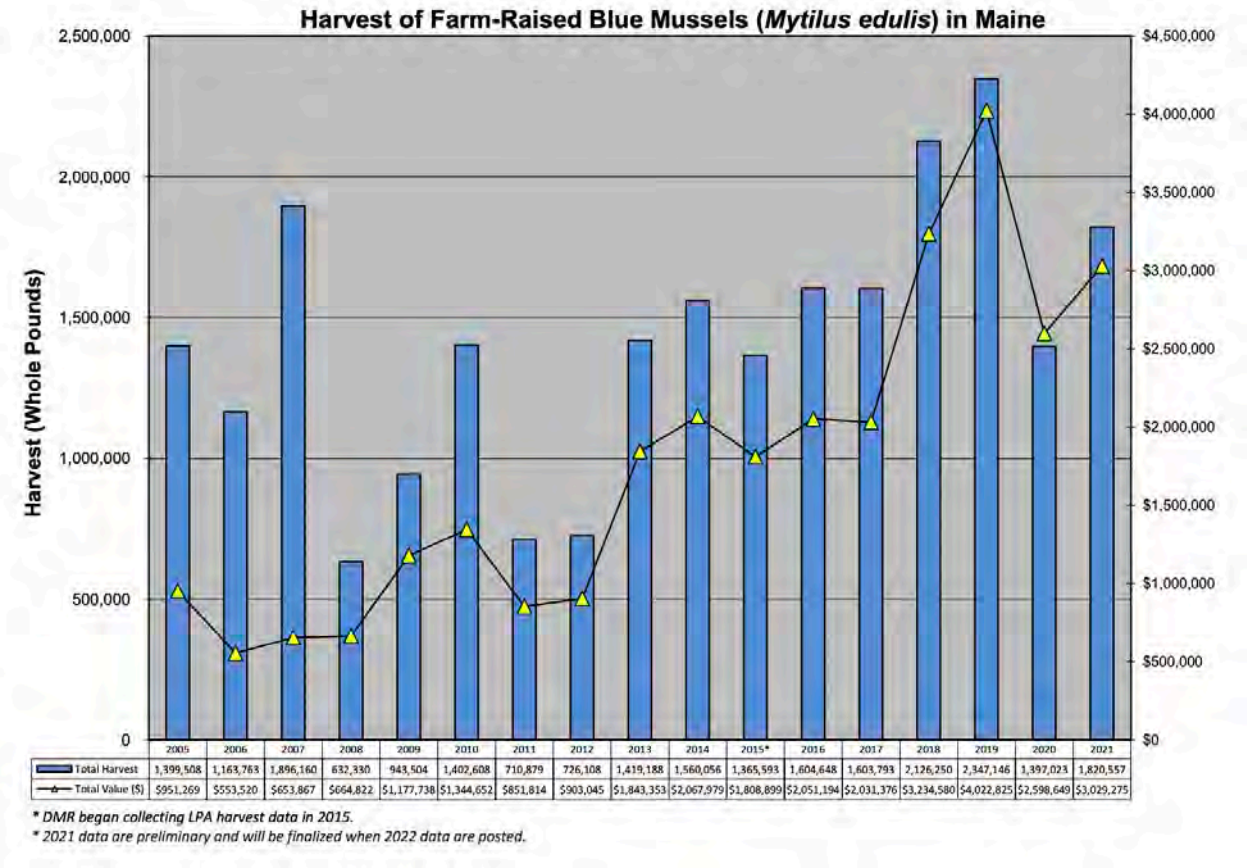

Figure 1. Farmed mussel landings in Maine (DMR 2022b)

II. Assessment against criteria

Criterion 1: Aquaculture operations are regulated by competent authorities that have established and acceptable environmental monitoring regulations in place.

Maine's aquaculture management system

Regulations for Maine's aquaculture industries have been in place since the early 1970s. DMR grants leases or licenses for all marine aquaculture operations in the state, including mussels, according to state and federal laws. DMR is also responsible for monitoring aquaculture activities, as well as addressing any compliance issues that arise. Currently, all mussel farm sites are leased or licensed within state waters (within three miles from shore) and, thus, are regulated by the state. At the time of this report, there are no aquaculture sites in federal waters in the Gulf of Maine.

Anyone wishing to establish an aquaculture farm must apply to and be approved by DMR. There are three farm classifications that are available to mussel aquaculturists: standard aquaculture lease, experimental aquaculture lease, and limited-purpose aquaculture license (LPA). Differences between the three options include farm size limitations, duration of lease or license, and renewal terms. A summary of the distinctions between the three classifications is outlined in Table 1.

Table 1. Maine's aquaculture lease and license system (DMR, 2022d)

	Standard Lease	**Experimental Lease**	**LPA License**
Size	Up to 100 acres	Up to 4 acres	Up to 400 square feet
Duration	Up to 20 years	Up to 3 years	Up to 1 year
Siting	Commissioner considers other existing aquaculture uses in decision	Commissioner considers other existing aquaculture uses in decision	No more than 3 LPAs allowed in a 1,000-foot radius
Renewal	Renewable and transferable	Renewal only available for scientific research	To renew, applicant must complete educational requirements
DMR site visit	Site visit with dive	Site visit, typically with no dive	No site visit

The process for applying for a standard lease includes a pre-application meeting with DMR, municipal officials, and the harbormaster. Additionally, there must be a public scoping session, public hearing, and defined public comment periods consistent with Maine's Administrative Procedures Act. Experimental lease applicants are not required to hold a pre-application meeting but must convene a public hearing if five or more people request it. Experimental leaseholders are also required to submit a yearly report to DMR regarding the results of their scientific or commercial research, as well as plans for the upcoming year. LPA license applicants are not required to hold a pre-application meeting or a public meeting,

though the harbormaster (or municipal official in towns without a harbormaster) must confirm that the LPA license site will not unnecessarily conflict with existing uses. Specific lease and license application requirements are detailed in Table 2. Aquaculture installations (for all lease and license sites) must also be permitted by the United States Army Corps of Engineers (ACOE). The ACOE consults with federal agencies to ensure compliance with relevant laws and acts. All mussel aquaculture operations must consider environmental impacts, proximity to threatened and endangered species, and require review by and approval from state and federal agencies.

Table 2. DMR lease and license application process (DMR 2022c; DMR 2022d)

	Standard Lease	**Experimental Lease**	**LPA License**
Pre-application meeting	✓		
Draft application	✓		
Draft application review	✓		
Scoping session	✓		
Application submission and review	✓	✓	✓
Site visit and report	✓	✓	
Public hearing	✓	30-day comment period; public hearing if there are five or more written requests	No, but harbormaster or municipal official signature required
Draft/decision/DMR review	✓	✓	✓
10-day review of proposed decision	✓	✓	No, but town and nearby landowners may comment each year
Final decision	✓	✓	✓
Notice of decision and appeal period	✓	✓	
Concurrent Army Corps of Engineers permit	✓	✓	✓

In 1973, Maine's legislature gave the Department of Marine Resources (DMR) the authority to lease state-owned waters for the practice of aquaculture in state law: Maine Revised Statutes Annotated, Title 12: Conservation, Chapter 605: General Department Activities, Subchapter 2: Leases and Special Licenses, 12 §6071-12 §6810-B (12 M.R.S.A. §6071-§6088).

Ten years later, DMR developed the regulations to govern the implementation of these laws. Chapter 2 of DMR's Procedural Rules relates specifically to how the Department will carry out the legislation set forth in 12 M.R.S.A. §6071-§6088 (DMR 2022e). More specifically, Chapter 2 covers the requirements of aquaculture leases and licenses and procedures for all cultured species. Table 3 outlines DMR's decision criteria for aquaculture leases and licenses.

Table 3. Decision criteria for aquaculture leases and licenses (DMR; DMR 2022e)

	Standard Lease	**Experimental Lease**	**LPA License**
Riparian landowner ingress and egress	✓	✓	✓
Navigation	✓	✓	✓
Fishing and other uses	✓	✓	✓
Other aquaculture uses	✓	✓	✓
Existing support system (ecologically significant flora and fauna; habitat; changes in sedimentation, etc.)	✓	✓	✓
Interference with public facilities (public beaches, parks, conserved lands, etc.)	✓		
Source of cultured species (considerations for biosecurity and sanitation)	✓	✓	✓
Lighting, noise, and visual impacts	✓		

12 M.R.S.A. §6071-§6810-B and Chapter 2 of DMR's Procedural Rules encompass the breadth of aquaculture operations in the state, from seaweeds to shellfish to salmon. This report will draw upon only those laws and regulations that relate specifically to the culture of mussels. Further, as this report

assesses whether growing mussels is environmentally responsible and so only the laws and regulations with environmental considerations will be reviewed.

Chapter 2 stipulates the establishment of an environmental baseline for standard and experimental lease sites, as summarized by the lease applicant. The environmental baseline records characteristics such as bottom features, flora and fauna, tide levels, and current speed and direction. For standard and experimental lease applications, DMR will conduct an onsite inspection of the proposed aquaculture site. The site review will cover many of the same environmental conditions described in the environmental baseline: bottom composition, depth and bottom features, flora and fauna, presence of commercial and recreational species, commercial fishing activities, distance to shore, and navigation channels and markers. DMR accesses the proposed lease site via boat and conducts dives or remote video surveillance. The site review and dives and/or video substantiate the environmental baseline conditions described by the applicant. Dives are typically not conducted for experimental leases. DMR site reviews are not required for LPA licenses, though license applicants must include information on bottom characteristics and proximity to eelgrass (*Zostera marina*) beds.

As described in 12 §6072(6)C, DMR is required to notify the following state agencies of all aquaculture lease applications: Department of Environmental Protection (DEP); Department of Agriculture, Conservation, and Forestry (DACF); and Department of Inland Fisheries and Wildlife (IF&W). Chapter 2 adds that DMR may also notify any other state agency as necessary. In the case of mussel aquaculture, the DEP is not notified, as they are only involved if the aquaculture lease application includes discharge. Growing mussels is non-discharge aquaculture as no external materials are added to or released from the system.

In their review, the DACF considers interference with and proximity to public facilities and, therefore, their input is not related to the environmental focus of this assessment. For standard leases and experimental leases, IF&W provides comments on the “existing system support.” That is, how the lease site will affect significant wildlife and marine habitat and the related flora and fauna. Typically, this translates to an investigation into the proximity of proposed lease sites to essential habitats for endangered species (such as piping plover and least tern), the presence of eelgrass beds, and bald and golden eagle nests, all of which are digitally mapped on the Maine Office of GIS’s online database. IF&W will also consider the displacement of marine vegetation, how site design and aquaculture operations will impact current flow, sedimentation impacts, and finfish migration. While IF&W will not review LPA

license applications, LPAs cannot be sited in endangered species habitat, pursuant to 12 M.R.S.A. §12803, §12804, and §12806 (related to Maine's endangered species management and research) and IF&W's rules for endangered species (09-137 CMR Chapter 8).

In addition, and as specified in 12 M.R.S.A. §6072(7-A), DMR will consider other aquaculture uses around a proposed site, specifically the intensity and frequency of proximal aquaculture operations for standard and experimental leases. For LPA licenses, there is a limit of no more than three license sites within a 1,000-foot radius.

For all aquaculture leases and licenses, the DMR will review the source of the cultured organism, i.e., the seed source. This is to address concerns with the introduction of non-native species and/or diseases or pathogens. It is illegal to introduce nonindigenous organisms without a permit from DMR. This is further addressed in 12 M.R.S.A. §6071 (Importing of certain marine organisms).

Chapter 12 of Maine Department of Marine Resources Procedural Rules outlines the regulatory processes in place to manage the harvesting of wild mussels, including, but not limited to the harvest of wild mussel seed that is used for cultivation purposes. Chapter 12 defines seed mussels as those in which a two-quart container would hold no fewer than 106 mussels, averaging a size of two inches or less (Maine DMR 2009). Mussel seed cannot be landed or traded but can be transported by boat for purposes other than landing, such as transporting to a lease site. Accordingly, only mussels that meet these criteria can be used on aquaculture lease sites. To protect wild seed mussel populations, the Department of Marine Resources, under Chapter 12, establishes Seed Mussel Conservation Areas. Seed Mussel Conservation Areas are areas where only seed-sized mussels are allowed to be harvested for grow-out. The following four areas have been designated Seed Mussel Conservation Areas: Jordan River (Trenton/Lamoine), West Bay (Gouldsboro), Narraguagus Bay (Milbridge/Harrington), and Harrington River (Milbridge/Harrington). Unless a permit from the Commissioner of the Department of Marine Resources is obtained, it is illegal to harvest mussels from these designated areas.

At the federal level, the United States Army Corps of Engineers (ACOE) is involved in the regulation of mussel aquaculture in Maine under section 10 of the River and Harbors Act of 1899. Under this Act, any installations that occur between the high-water mark and 200 miles offshore must be permitted by ACOE. This includes mussel aquaculture infrastructure (moorings, lines, and buoys). Under the National Environmental Policy Act, ACOE consults with other federal agencies when considering issuing a permit

for installing aquaculture infrastructure. Specifically, ACOE will review how an aquaculture installation and its operation will conflict with governance authorized under the Endangered Species Act and the Magnuson-Stevens Fishery Conservation and Management Act's Essential Fish Habitat provisions. Further, ACOE may also consult with the National Oceanic and Atmospheric Administration, Environmental Protection Agency, and the United States Fish and Wildlife Service on any aquaculture installation under several federal acts, including, but not limited to the Marine Mammal Protection Act and the Fish and Wildlife Coordination Act. Table 4 outlines the federal acts and statutes that ACOE permitting must comply with. Depending on the specifications and siting outlined in the lease or license application, ACOE may incorporate other federal regulations and/or agencies, such as the National Historic Preservation Act, United States Coast Guard, and Federal Aviation Administration. However, consultation with these organizations is outside the scope of the environmental focus of this report.

Table 4. Common regulations* considered by ACOE in aquaculture infrastructure permitting.

- Magnuson-Stevens Fishery Conservation and Management Act
- Fish and Wildlife Coordination Act
- Endangered Species Act
- Historic Preservation Act
- Coastal Zone Management Act
- Marine Mammal Protection Act
- Migratory Bird Treaty Act
- Bald and Golden Eagle Act

**This is not a complete list; other laws and acts may be considered on a case-by-case evaluation.*

Mussel aquaculture operations, specifically, are often eligible for Category 2 under ACOE's Maine General Permit, meaning that written approval from ACOE is required before any construction, i.e., gear deployment or site buildout. To avoid duplication of work, the ACOE can use the DMR application for leases or licenses for its review. The standard lease, experimental lease, and LPA license applications were jointly developed by DMR and ACOE to ensure they met the requirements of both agencies. Lease and license applicants are encouraged to concurrently submit applications to both DMR and ACOE.

Maine has a long history of regulating aquaculture activities and reviewing rules and regulations to address existing and upcoming activities. DMR's Chapter 2 was recently reviewed and amended in March 2022.

Criterion 2: Regulatory oversight ensures that aquaculture operations have limited and reversible impacts on the surrounding habitat, species, and ecosystem structure and function.

Management and its role in responsible harvest

Research on the environmental impacts of mussel farming demonstrates a combination of environmental benefits and potential environmental harms. Mussel cultivation can provide benefits to the marine environment, such as reducing ocean eutrophication and improving water quality (Sadusky et al. 2022; Kotta et al. 2020; Cabre et al. 2021; Gallardi 2014), increasing the capacity of coastal ecosystems to sequester carbon dioxide (Cabre et al. 2021; Tang et al. 2011), and increasing habitat availability for fish and mobile invertebrate species (Sadusky et al. 2022; Theuerkauf et al. 2021). However, there are impacts to the marine environment that may be detrimental if failed to be properly managed. These include changes to benthic habitat (McKindsey et al. 2011; Cranford et al. 2007; Giles 2006; Giles and Pilditch 2006 Chamberlain et al. 2001; Hatcher and Schofield 1994), changes to sedimentation rates and nutrient flow (Weise et al. 2009; Petersen et al. 2008; Callier et al. 2006; Strohmeier et al. 2005; Chamberlain 2002), and impacts from mussel biodeposition (McKindsey et al. 2011; Giles et al. 2009, D'Amours et al. 2008).

Current aquaculture rules and regulations in Maine address many of these concerns. For benthic impacts, the DMR site visit and subsequent report aim to determine if the lease site will impact ecologically significant flora and fauna and the associated habitat, including rooted or attached marine vegetation. Federal review, coordinated by ACOE, stipulates that aquaculture installations result in no net loss of eelgrass. DMR reviews the site report and considers the findings in a lease decision. The site visit and report also serve as an established environmental baseline for yearly inspections by DMR staff. LPA license applicants must describe the bottom characteristics of the proposed site and must verify with their signature that the application does not contain any false information. As LPAs are designed for aquaculturists to test areas for future lease sites and are limited in size, benthic impacts are considered to be limited and quickly reversible.

The accumulation of mussel biodeposits, a product of mussels filtering nutrients from the water column, can result in changes in sedimentation rates (Giles et al. 2009, Callier et al. 2006). DMR considers sedimentation and sediment resuspension in the lease determination. Additionally, research has shown

the importance of local hydrodynamic conditions in determining the extent to which mussel farming and mussel biodeposition will impact the benthic environment (Giles 2006). These studies have recommended that local hydrodynamics should be considered in the granting of leases for mussel cultivation. Maine DMR does consider such elements in the permitting process. Maine DMR also considers several other elements in the permitting process and regulation of aquaculture operations, including mussel farms. DMR considers the number, size, location, and type of proximal aquaculture sites when granting lease applications. LPAs have siting limitations in that there may be no more than three LPAs within a 1,000-foot radius. As such, any impacts from mussel biodeposition and changed sedimentation rates are occurring on a small and dispersed scale, as the density of mussel and other aquaculture leases are being closely managed by DMR. Additionally, lease and LPA sites are required to be located away from established eelgrass beds. Maine's IF&W includes this requirement in its review of lease applications. LPA applications must provide maps demarcating the boundaries of eelgrass and other essential habitats in their application and are not permitted to site within those locations. Further, ACOE permitting of any aquaculture installation requires that there is no net loss of eelgrass from resulting farm installation or operation as well as ensuring that the proposed mussel aquaculture operation will not impede navigation.

Criterion 3: Sufficient data exists to demonstrate that aquaculture operations have limited and reversible environmental impacts.

An overview of mussel aquaculture research

Mussel aquaculture has been extensively researched and shows both potential positive and negative environmental impacts (Gallardi 2014). Review papers, such as Cabre et al. (2021), Gallardi (2014), and McKindsey et al. (2011) demonstrate the extent of research on bivalve aquaculture, and mussel farming more specifically. Mussel farming can impact the surrounding environment through the addition of infrastructure to the water column, which can affect processes and modify benthic and water column habitat (Petersen et al. 2008; Strohmeier et al. 2005); through increased biodeposition and sedimentation rates (Weise et al. 2009; Callier et al. 2006; Chamberlain 2002); through impacts to seagrass and algae (McKindsey et al. 2011); through altering the benthic ecosystem (Callier et al. 2009; Ysebaert and Herman 2009; da Costa and Nalesso 2006; Stenton-dozey et al. 1999); and through changing macrofaunal communities (McKindsey et al. 2011).

Although mussels do not require any additional inputs to grow, as they filter nutrients from the water column, they produce fecal and pseudofecal matter, known collectively as biodeposits (McKindsey et al. 2011). Biodeposits can accumulate under and around farm sites as a function of the rate of biodeposit production, initial dispersal, the redistribution of biodeposits, and the rate of biodeposit decay (Giles et al. 2009). Changes in sedimentation rates can be one result of the biodeposition of mussels. Research conducted on a suspended mussel culture operation in Great-Entry Lagoon, Canada, which produces approximately 180 tons of mussels per year, found that the presence of suspended mussel cultures can increase sedimentation rates in the surrounding area of mussel farms compared to reference sites (Callier et al. 2006). Supporting these findings is a study that was conducted at three different sites in the Great-Entry Lagoon, House Harbor Lagoon, and Cascapedia Bay, Weise et al. (2009) found that sedimentation rates were two to five times higher at culture sites compared to reference sites. Additionally, biodeposits can alter the biogeochemistry of the benthic environment, including through organic enrichment, elevated levels of organic carbon (Chamberlain et al. 2001), increased sediment oxygen consumption, and nutrient release (Giles 2006; Giles and Pilditch 2006).

Importantly, studies have found that the specific hydrodynamic conditions of an area are critical in understanding the extent to which biodeposition will impact the benthic environment and nutrient dynamics, and as such, the unique hydrodynamics of a site should be taken into consideration when siting new mussel farms (Giles 2006). Research conducted off of the coast of Ireland comparing the impacts across two sites of similar size and operational time found that one site was subject to changes in sedimentation, organic enrichment, reduced microbenthic infaunal diversity, and elevated levels of organic carbon, whereas the second site showed no impacts of biodeposition and it maintained a diverse macrobenthos. This study's authors proposed that the variation between the sites was largely a result of different local current patterns (Chamberlain et al. 2001).

Other research has shown a change in species composition and community structure in and around mussel cultures, however, there are mixed findings on what type of change occurs. In some cases, species diversity increases, while in others, species diversity decreases. For instance, a study conducted in Saldanha Bay, South Africa found that disturbed communities were found at 78% of the raft sites that were sampled, with opportunistic species and deposit feeders such as polychaetes and gastropods dominating over macrofauna and suspension feeders (Stenton-dozey et al. 1999). Research conducted

at bottom culture sites in Limfjorden (northern Denmark) and Oosterschelde (The Netherlands), and suspended culture sites in Ría de Vigo (Spain) found that because of altered sedimentary conditions, the biodiversity of the sites shifted to favor more opportunistic species, although these changes occurred at a very local scale (Ysebaert et al. 2009). However, the findings differed in terms of changes in abundance and biomass, dominant feeding types, and species prevalence across mussel and reference sites at each location (Ysebaert et a. 2009). Another study, in which samples were taken from suspended mussel farms in the Magdalen Islands in eastern Canada found that species abundance and richness decreased in the presence of increased biodeposition (Callier et al. 2009). Conversely, da Costa and Nalesso (2006) found that at sites in Southeastern Brazil, species diversity and richness were higher under mussel sites whereas abundance was higher at reference sites, suggesting that mussel farming did not negatively impact the macrobenthic community (da Costa and Nalesso 2006). In Maine, Maurin et al. (2019) found that mussel farm structures exhibited great biodiversity of macrofauna.

In addition to the potentially detrimental environmental impacts of mussel farming, cultivation of mussels also provides multiple benefits for the marine environment. A review conducted by Suplicy (2018) outlines multiple potential benefits of mussel farming including the capacity to reduce ocean eutrophication and the ability of mussel farming to provide a source of protein while reducing water and land use competition for food production. Mussels are filter-feeders and remove nutrients from the water column. As mussels feed, they remove excess nutrients from the water column and assimilate it into tissue, which is then removed from the environment as the product is harvested (Petersen et al. 2016). As such, mussels aid in reducing excess nutrients, reducing ocean eutrophication, and improving water quality (Sadusky et al. 2022; Cabre et al. 2021; Kotta et al. 2020; Gallardi 2014). Furthermore, research has shown that mussel aquaculture increases habitat availability for fish and mobile invertebrate species (Sadusky et al. 2022; Theuerkauf et al. 2021). Overall, mussel cultivation provides several potential environmental benefits to surrounding water quality and habitat, all while contributing a lower-impact protein source (Fry 2012).

It is worth noting that Maine's mussel aquaculture industry is relatively new and small in scale, resulting in less research available on specific impacts of mussel farming in Maine. Current research is largely from other regions of prominent mussel cultivation such as the Magdalen Islands (Canada), Prince Edward Island (Canada), the Firth of Thames (New Zealand), Saldanha Bay (South Africa), and Ría de Vigo (Spain), among others. Mussel cultivation in these regions operates at different, mostly larger scales

compared to that of Maine, and as such, the extent to which these impacts will be felt in Maine waters is unclear. For example, a study on the impacts of biodeposition in Great-Entry Lagoon (Canada) studied three mussel cultivation sites each ranging in size between 1.25 – 2.5 square kilometers, equating to individual farms up to 617.76 acres. While the study indicated that biodeposition resulted in increased sedimentation rates at this scale (Weise et al. 2009), there is currently a total of 745.96 harvestable acres spread across 47 leases dispersed across the entire coast of Maine. As such, it is important to acknowledge that the scope of cultivation occurring in Maine is not equivalent to that of the regions where the majority of this research has taken place.

Criterion 4: Aquaculture regulations include appropriate compliance and enforcement standards.

Compliance and enforcement standards for Maine mussel farms

Staff from DMR's Division of Aquaculture, Bureau of Public Health, and Marine Patrol conduct annual inspections for all aquaculture leases and LPAs to verify that the sites comply with the existing rules and regulations. Under the US Food and Drug Administration (FDA), the National Shellfish Model Ordinance requires an annual inspection for shellfish aquaculture operations. Inspections involve a surface assessment to verify site location, gear, cultured species, and farm conditions. Additionally, DMR responds to and follows up on any complaint issued against an aquaculture lease or LPA license site. DMR doesn't publish enforcement action data, so the details of enforcement in this fishery are unknown. Furthermore, Chapter 2 (Aquaculture Regulations) stipulates that the leaseholder must maintain an escrow or bond account to cover the cost of clean-up after major storms or from terminated or abandoned leases. The amount of the escrow is commensurate with size and whether there is discharge associated with the aquaculture operation. See Table 5 below.

Table 5. Escrow or performance bond amounts

Category of Aquaculture Lease	Escrow account or performance bond amount
No structure, no discharge	None
No structure, discharge	$500
Structure, no discharge, ≤400 sq. ft.	$1,500
Structure, no discharge, >400 sq. ft.	$5,000
Structure, discharge	$25,000

V. Future Considerations

Mussel cultivation in Maine waters is a growing and relatively new industry. While DMR has established a rigorous lease application process and substantial regulatory structures that manage the industry, the evolution of the industry in Maine could pose future challenges that should be considered. As mussel aquaculture scales up, state rules and regulations must evolve and adapt to ensure responsible harvest. It will remain important that DMR and other regulatory bodies advance rules and regulations alongside an expanding industry. As such, this assessment report will need to be updated and re-evaluated as the industry grows and changes. The following factors are noted as potential trigger points for a re-evaluation of this report:

- **Wild mussel populations and seed collection:** Mussel cultivation in Maine waters and the health of wild mussel populations are connected due to the use of wild populations for seed. If pressure grows on wild mussel stocks, or other seed collection methods such as hatcheries grow, additional regulation may be needed.
- **Establishment of hatchery for seed supply:** As the mussel aquaculture sector grows, natural limitations and fluctuations in wild seed sets will likely create incentives for hatcheries to produce seed for farms to use instead of, or in addition to, wild sets. Hatcheries would minimize potential conflicts between wild harvest and farmed blue mussel industries. They could also develop specialized strains.
- **Significant scaling up of industry:** Significant scaling up of the mussel industry in Maine will magnify concerns around mussel aquaculture. As the industry grows, consideration regarding how increased cultivation could amplify impacts may need to be addressed.
- **Movement to offshore harvesting:** If mussel cultivation begins to move offshore out of state waters, a federal management structure would be required and would be evaluated in a separate assessment.

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