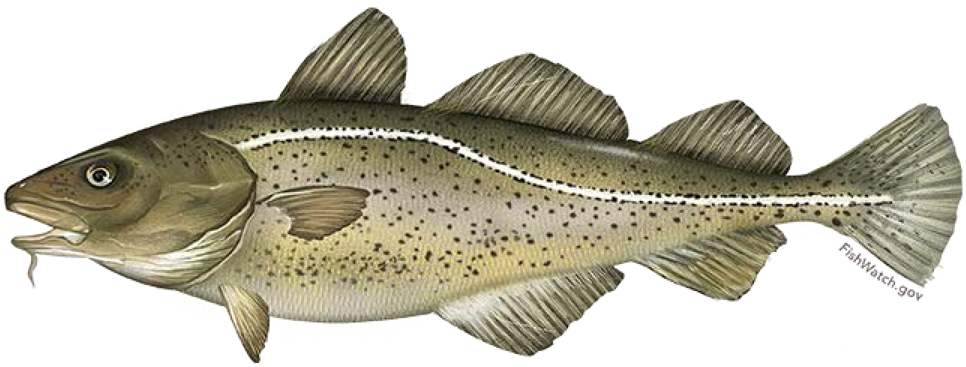
Northeast Multispecies Fishery Management Plan

DRAFT Amendment 23

Including a Draft Environmental Impact Statement



Formal Submission Draft

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Prepared by the

New England Fishery Management Council

In consultation with the

Mid-Atlantic Fishery Management Council

National Marine Fisheries Service

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AMENDMENT 23 TO THE NORTHESAT MULTISPECIES FISHERY MANAGEMENT PLAN

Proposed Action:	Propose improvements to the commercial Northeast Multispecies (groundfish) monitoring program.
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Abstract: The New England Fishery Management Council, in consultation with NOAA's National Marine Fisheries Service, has prepared Amendment 23 to the Northeast Multispecies Fishery Management Plan, which includes a final environmental assessment that presents the range of alternatives to achieve the goals and objectives of the action. The proposed action focuses on improvements to the existing commercial groundfish monitoring program. The document describes the affected environment and valued ecosystem components and analyzes the impacts of the alternatives on both. It addresses the requirements of the National Environmental Policy Act, the Magnuson Stevens Fishery Conservation and Management Act, the Regulatory Flexibility Act, and other applicable laws.

1.0 EXECUTIVE SUMMARY

In New England, the New England Fishery Management Council (Council) is charged with developing management plans that meet the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (M-S Act). The Northeast Multispecies (Groundfish) Fishery Management Plan (FMP) specifies the management measures for thirteen groundfish species (cod, haddock, yellowtail flounder, pollock, plaice, witch flounder, white hake, windowpane flounder, Atlantic halibut, winter flounder, redfish, ocean pout, and Atlantic wolffish) off the New England and Mid-Atlantic coasts. Commercial and recreational fishermen harvest these species. The commercial groundfish fishery consists of primarily “sectors”, voluntary self-selecting groups with individual catch entitlements, as well as “common pool” vessels that fish outside the sector system under more traditional input management measures such as possession limits and days-at-sea. The FMP has been updated through a series of amendments and framework adjustments.

Amendment 16, which became effective on May 1, 2010, adopted a broad suite of management measures to achieve the fishing mortality targets necessary to rebuild overfished stocks and meet other requirements of the M-S Act.

Amendment 16 also updated the requirements for sector and common pool monitoring programs, including at-sea monitoring and dockside monitoring requirements. Following that action, Framework 45 adjusted the dockside monitoring program. Framework 48 later discontinued the dockside monitoring program. Additionally, Framework 48 specified the overall goals and objectives of the groundfish monitoring program (Section 3.3.2). Framework 55 clarified that the primary goal of the monitoring program is to verify area fished, catch, and discards by species and gear type; and should be done in the most cost effective means practicable. Framework 55 further clarified that all other goals and objectives of groundfish monitoring programs are considered equally weighted secondary goals.

Amendment 23 would maintain the current goals and objectives of the groundfish monitoring program, but consider measures to further improve documentation of catch, or catch accounting. It is the Council’s intent that the catch reporting requirements are fair and equitable for all commercial groundfish fishermen, while maximizing the value of collected catch data, and minimizing costs for the fishing industry and the National Marine Fisheries Service (NMFS). The goals and objectives of this action are more fully described in Section 3.3., and the purpose and need is included in Section 3.2.

This draft amendment document and draft environmental impact statement (DEIS) encapsulates the work of the Council on this action. The components of this DEIS include the Alternatives Under Consideration (Section 4.0), the Alternatives Considered but Rejected (Section 5.0), the Affected Environment (Section 6.0), and the Environmental Impacts of the Management Alternatives (Section 0). In January 2020, the Council selected preferred alternatives and approved the DEIS for submission to NMFS.

Proposed Action.

Table 1 is a summary of the draft alternatives, with preferred alternatives identified. The Council recommends the following as preferred alternatives in Amendment 23. Preferred alternatives are subject to change.

- *Commercial Groundfish Monitoring Program Revisions (Sectors Only).* Sets the standard at a fixed total at-sea target monitoring (ASM) coverage level, based on a percentage of trips, at 100% coverage. Allows additional sector monitoring tools, in addition to human ASM, including the audit model with electronic monitoring (EM) and maximized retention with electronic monitoring combined with dockside monitoring (DSM). Establishes a review process to evaluate the monitoring coverage rate. Allows for additional monitoring tools and vessel specific coverage levels through a future framework adjustment.

- *Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool).* No action would maintain the status quo, no mandatory dockside monitoring program for sectors and the common pool.
- *Sector Reporting.* The Council did not select a preferred alternative in this section. No action would maintain current sector reporting requirements.
- *Funding/Operation Provisions of Groundfish Monitoring (Sectors and Common Pool).* Allows for waivers from monitoring requirements for sectors and common pool under certain conditions.
- *Management Uncertainty Buffers for the Commercial Groundfish Fishery (Sectors Only).* Eliminates the management uncertainty buffer for sector sub-ACLs (allocated stocks only) with 100% monitoring of all sector trips.
- *Remove Commercial Groundfish Monitoring Requirements for Certain Vessel Under Certain Conditions.* Removes monitoring program requirement for vessels fishing exclusively west of 71 degrees 30 minutes west longitude from at-sea and dockside monitoring coverage requirements. Establishes a review process for vessel to be removed from commercial groundfish monitoring program requirements

Environmental Consequences of Proposed Action.

Table 2 summarizes the potential impacts of the management measures under consideration in Amendment 23 on each of the VECs identified in this amendment and described in the Affected Environment and compared to No Action.

Impacts on Managed Resources.

Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which should result in more accurate information on catch and fully accounted for discard mortality. In the short term, improved catch accounting should reduce fishing effort and fishing mortality, which in the long term should allow for rebuilding of overfished stocks. In the longer-term analytical assessments should improve with better catch data. Allowing sectors to use additional sector monitoring tools should improve data quality and reduce uncertainty, and contribute to improved catch accounting. Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and may have indirect impacts on the managed resource but would not be expected to change total fishing effort. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort but could result in lower monitoring coverage levels, which could impact the managed resource. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. This option requires that 100% monitoring coverage is selected, which will reduce uncertainty in catch information and reduce fishing mortality. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have negative impacts on the managed resource, particularly for stocks with substantial catches in this area (SNE/MA stocks, some of which are in rebuilding plans) as catch information would be less accurate and fishing effort in this area may increase; however, total fishing effort is not expected to be affected.

Impacts on Nontarget Species.

Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which should result in more accurate information on catch and fully accounted for discard mortality. In the short term, improved catch accounting should reduce fishing effort and fishing mortality, which in the long term should allow for rebuilding of overfished stocks. Allowing sectors to use additional sector monitoring tools should improve data quality and reduce uncertainty, and contribute to improved catch accounting. Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and may have indirect impacts on non-target species but would not be expected to change total fishing effort. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort but could result in lower monitoring coverage levels, which could impact non-target species. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. This option requires that 100% monitoring coverage is selected, which will reduce uncertainty in catch information and reduce fishing mortality. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have negative impacts on non-target species, as catch information would be less accurate and fishing effort in this area may increase; however, total fishing effort is not expected to be affected.

Impacts on Physical Environment and Essential Fish Habitat.

Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, may result in reduced groundfish fishing activity and provide some minor short-term benefits to habitat. Over the long term, if 100% coverage contributes to higher catch limits, fishing effort could increase in the future, which would have negative impacts to habitat. Allowing sectors to use additional sector monitoring tools could increase fishing effort, if the use of EM in place of human at-sea monitors as a monitoring tool facilitates greater effort. Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and would not be expected to change total fishing effort. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have slight negative impacts on habitat, as fishing effort in this area may increase; however, total fishing effort is not expected to be affected.

Impacts on Protected Resources.

The modifications in management measures may affect protected resources, but the preferred alternatives identified in this action are not expected to have substantial impacts on protected resources. Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which should have indirect benefits to protected resources by providing additional information on interactions with fishing gear, which should reduce uncertainty in bycatch estimates. While changes in total fishing effort are not expected, if over the long term 100% monitoring coverage contributes to rebuilding of stocks to sustainable levels and higher catch limits, fishing effort could increase in the future, which may increase potential interactions with protected species. Allowing sectors to use additional sector monitoring tools is expected to have indirect negative impacts on protected resources, as there may be a loss of data on interactions with fishing gear compared to use of human at-sea monitors if information on protected species is not collected through EM. However, any indirect negative impacts would not be expected to have a significant adverse impact, and could be mitigated with a properly designed protocol including specific camera angles and data recording standards to potentially document more protected species interactions. Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and would not have impacts on protected resources. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort but could result in lower monitoring coverage levels, which could indirectly impact protected resources.

Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. This option requires that 100% monitoring coverage is selected, which will provide additional information on gear interactions which reduces uncertainty in bycatch estimates. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have direct and indirect low negative impacts on protected resources, as fishing effort may increase in the exemption area, and a loss of data on interactions with fishing gear would occur; however, total fishing effort is not expected to be affected.

Impacts on Human Communities.

The preferred alternatives proposed in this action are expected to have substantial socioeconomic impacts. Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which will result in higher operating costs than under past and current coverage levels. 100% monitoring coverage may be seen as overly burdensome by fishing communities. However, under 100% monitoring coverage enforceability and risk of non-compliance improve, which should improve the fairness and equitability of management measures. In the short term, impacts of 100% monitoring coverage on human communities could be reduced if federal reimbursements for monitoring costs and government subsidies are available. Impacts over the long-term will vary depending on whether federal reimbursements of monitoring costs will continue into the future. Allowing sectors to use additional sector monitoring tools reduces costs of monitoring relative to human at-sea monitors and should improve flexibility in the management system. Initial costs of installing EM may be high which may have negative impacts in the short term, but over the long-term EM may be more cost effective than human at-sea monitors. Distributional impacts of allowing sectors to use EM as a sector monitoring tools are expected, as vessels that participate more, or are more efficient, may have positive impacts as EM is cheaper than human observers for these vessels, and vessels that participate less may have negative impacts, as EM is less cost effective for these vessels.

Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and may have indirect impacts on human communities but would not be expected to impose additional costs. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is expected to have positive impacts, to the extent that fishing effort is constrained by the selected coverage level. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks results in higher operating costs since 100% monitoring coverage required for this option; however, revenues are maximized relative to other monitoring options in this action, maximizing operating profits relative to the other 100% monitoring options. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have positive impacts on fishing communities that fish exclusively in the exemption area as monitoring costs would be reduced; however, low positive impacts for the fleet overall.

Alternatives to the Proposed Action.

There are a number of alternatives analyzed in the document that are not identified as preferred alternatives (Table 1). The potential impacts for all alternatives under consideration compared to No Action are provided (Table 2). Summaries of the most substantial impacts are provided.

Table 1 - Amendment 23 Alternatives, with Council preferred alternatives indicated (Pref).

	Alternatives	Description
4.1	***Commercial Groundfish Monitoring Program (Sectors only)***	
4.1.1	**Sector monitoring standard (coverage level)**	
4.1.1.1	Sector Monitoring Standard Option 1 (No Action)	Minimum coverage levels must meet CV precision standard specified in SBRM using fishery performance criteria, and other factors can be considered
4.1.1.2	**(Pref)** Sector Monitoring Standard Option 2 (Fixed total at-sea monitoring coverage level based on % of trips)	Fixed total would be identified for deploying human observers at-sea. Sectors would achieve the standard through use of human observers or options for substitute sector monitoring tools (Section 4.1.2)
	Sub-option 2A – 25%	
	Sub-option 2B – 50%	
	Sub-option 2C – 75%	
	(Pref) Sub-option 2D – 100%	
4.1.1.3	Sector Monitoring Standard Option 3 (Fixed total at-sea monitoring coverage level based on % of catch)	Fixed total would be identified for deploying human observers at-sea. Sectors would achieve the standard through use of human observers or options for substitute sector monitoring tools (Section 4.1.2)
	Sub-option 3A – 25%	
	Sub-option 3B – 50%	
	Sub-option 3C – 75%	
	Sub-option 3D – 100%	
4.1.2	**Sector monitoring tools (options for meeting monitoring standards)**	
4.1.2.1	Sector Monitoring Tools Option 1 – EM in place of human at-sea monitors	Sectors could choose EM to monitor catch in place of human at-sea monitors (but not to replace NEFOP human observers). EM would only be required to run on trips selected for coverage under the selected coverage rate selected above.
4.1.2.2	**(Pref)** Sector Monitoring Tools Option 2 – Audit model EM	Approve the use of audit model EM in place of human at-sea monitors (but not to replace NEFOP human observers). EM runs 100% of trips and subset of hauls or trips reviewed to verify VTR reported

	Alternatives	Description
		discards. Video review rate would be determined by NMFS and could be reduced through evaluation by NMFS. The Council supports the initial review rates provided from NMFS in its proposed EM option for sectors.
4.1.2.3	**(Pref)** Sector Monitoring Tools Option 3 – Maximized retention EM	Approve the use of maximized retention EM in place of human at-sea monitors (but not to replace NEFOP human observers). EM runs 100% of trips and verifies that all allocated, non-prohibited GF are landed, paired with dockside monitoring to sample catch. Vessels would be required to land all GF of all sizes, no discarding of non-prohibited fish.
4.1.3	**Total Monitoring Coverage Level Timing**	Has varied over time, but ASM coverage level usually available before SBRM analysis used to determine NEFOP levels. Regulations require sectors submit prelim rosters by Dec 1.
4.1.3.1	Coverage Level Timing Option 1 (No Action)	Announced when necessary analyses are available.
4.1.3.2	Coverage Level Timing Option 2 – Knowing total monitoring coverage level at a time certain	3 weeks prior to annual sector enrollment deadline – this option would only apply to current CV method for target coverage levels (4.1.1.1).
4.1.4	**Review process for sector monitoring coverage**	
4.1.4.1	Coverage Review Process Option 1 (No Action)	No official schedule – sector monitoring coverage rates would be reviewed periodically as part of the goals and objectives of the sector monitoring program
4.1.4.2	**(Pref)** Coverage Review Process Option 2 –Establish a review process for monitoring coverage rates	Once 2 years of fishing year data is available and periodically after that. Metrics would be developed and indicators for how well program has improved accuracy while minimizing costs. This review would most likely be done by the Groundfish PDT with substantial support by NEFSC and GARFO.
4.1.5	**(Pref)** Addition to list of framework items	Council would be able to consider adding new sector monitoring tools that meet or exceed monitoring standards or vessel specific coverage levels by framework action.
4.2	***Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool)***	
4.2.1	**Dockside monitoring program (DSM) (Sectors and Common Pool)**	
4.2.1.1	**(Pref)** DMS Option 1 (No Action)	No current requirement, but a sector can develop as part of its operations plan, and NMFS can approve.

	Alternatives	Description
4.2.1.2	DSM Option 2 – Mandatory DSM for entire commercial GF fishery	Mandatory DSM for entire GF fishery (sectors and common pool) at 100% of all trips.
4.2.2	**Dockside monitoring program structure and design**	
4.2.2.1	DSM funding responsibility	
4.2.2.1.1	DSM Funding Responsibility Option A – Dealer responsibility	Dealers responsible for DSM costs.
4.2.2.1.2	DSM Funding Responsibility Option B – Vessel responsibility	Vessels responsible for DSM costs.
4.2.2.2	DSM program administration	
4.2.2.2.1	DSM Administration Option A – Individual contracts with DSM providers	Dealers or vessels contract directly with third-party dockside monitor providers.
4.2.2.2.2	DSM Administration Option B –NMFS administered DSM program	Single DSM program administered by NMFS, through approved independent third-party dockside monitor providers.
4.2.2.3	Options for lower dockside monitoring coverage levels (20% coverage)	
4.2.2.3.1	Lower coverage levels Option A	DSM would be randomly assigned to ports with low volumes of groundfish landings (2016-2018) - all ports except New Bedford, MA; Gloucester, MA; Boston, MA; Portland, ME; Chatham, MA; Point Judith, RI; Seabrook, NH; Rye, NH; and Portsmouth, NH - at a lower coverage level, 20%. Periodic re-evaluation of what constitutes a low volume port would occur after 2 years of data available, every 3 years after that.
4.2.2.3.2	Lower coverage levels Option B	Vessels with less than 46,297 pounds annual average (2016-2018) or dealers that receive landings from vessels with less than 46,297lbs pounds would have lower coverage, 20%. Periodic re-evaluation of what constitutes a low volume vessel would occur after 2 years of data available, every 3 years after that.
4.2.2.4	Options for DSM safety and liability associated with fish hold inspections	

	Alternatives	Description
4.2.2.4.1	Fish hold inspection Option A – DSM fish hold inspections required	Would be allowed access for inspection, they must have insurance, they can refuse but must document reason.
4.2.2.4.2	Fish hold inspection Option B – Alternative methods for inspecting fish holds (cameras)	Cameras can be used to verify all retained catch is offloaded, as an alternative to dockside monitors directly accessing fish holds.
4.2.2.5.3	Fish hold inspection Option C – No fish hold inspection required, captain signs affidavit	Captain certify all catch has been removed, subject to penalties
4.3	***Sector Reporting***	
4.3.1	Sector Reporting Option 1 (No Action)	Weekly reporting of landings and discards and year end reports.
4.3.2	Sector Reporting Option 2 – Grant RA authority to streamline sector reporting requirements	RA could revise reporting requirements if specific details are deemed sufficient by the RA.
4.4	***Funding/Operational provisions of groundfish monitoring program (Sectors and Common Pool)***	
4.4.1	Funding Provisions Option 1 (No Action)	Industry is required to fund at-sea monitoring costs.
4.4.2	Funding Provisions Option 2 – Provisions for an increase or decrease in funding for the GF monitoring program	
4.4.2.1	Funding Provisions Sub-option 2A – Higher monitoring coverage levels if NFMS funds are available (Sectors Only)	At-sea monitoring could be set at higher coverage levels than required if NMFS gets additional funds. Could be done on a limited basis to evaluate bias.
4.2.2.2	**(Pref)** Funding Provisions Sub-option 2B – waivers for monitoring requirements allowed (Sectors and Common Pool)	Vessels could be issued waivers to exempt them from industry-funded monitoring requirements, for either a trip or the fishing year, if coverage was unavailable due to insufficient funding for NMFS shoreside costs for the specified target coverage level.

	Alternatives	Description
4.5	***Management uncertainty buffers for the commercial groundfish fishery (Sectors only)***	
4.5.1	Management Uncertainty Buffer Option 1 (No Action)	5% of the ABC by default, and for stocks with less uncertainty it is set at 3% (no state water catch), for stocks with more it is set at 7% (zero possession and discard only stocks)
4.5.2	**(Pref)** Management Uncertainty Buffer Option 2 – Elimination of management uncertainty buffer for Sector ACLs with 100% monitoring of all sector trips	Revise the management uncertainty buffer for the sector ACL for each allocated groundfish stock to be zero, if the option for 100 percent at-sea monitoring is selected.
4.6	***Remove commercial groundfish monitoring program requirements for certain vessels fishing under certain conditions***	
4.6.1	Removal of monitoring requirements Option 1 (No Action)	Sector vessels fishing exclusively with extra-large mesh gillnets greater than 10 inches and in the SNE/MA or inshore GB BSA are not subject to at-sea monitoring
4.6.2	Removal of monitoring requirements Option 2 – Vessels fishing exclusively west of 72 30 W would not be subject to monitoring requirements on trips in that area	
4.6.2.1	Removal of monitoring requirements Option 2A (Sectors only)	Sector vessels fishing exclusively west of 72 30 W would not be subject to at-sea monitoring. Measures under No Action would remain in place.
4.6.2.2	Removal of monitoring requirements Option 2B (Sectors and Common Pool)	Vessels fishing exclusively west of 72 30 W would not be subject to DSM. Measures under No Action would remain in place.
4.6.3	**(Pref)** Removal of monitoring requirements Option 3 – Vessels fishing exclusively west of 71 30 W would not be subject to monitoring requirements on trips in that area	
4.6.3.1	**(Pref)** Removal of monitoring requirements Option 3A (Sectors only)	Sector vessels fishing exclusively west of 71 30 W would not be subject to at-sea monitoring. Measures under No Action would remain in place.
4.6.3.2	**(Pref)** Removal of monitoring requirements Option 3B (Sectors and Common Pool)	Vessels fishing exclusively west of 72 30 W would not be subject to DSM. Measures under No Action would remain in place.

	Alternatives	Description
4.6.4	Review process for vessels removed from commercial groundfish monitoring program requirements	
4.6.4.1	Review process for vessels removed from commercial groundfish monitoring program requirements Option 1 (No Action)	Currently there is no formal review process to verify that the catch composition from vessels fishing on trips not subject to monitoring requirements have little to no groundfish.
4.6.4.2	**(Pref)** Review process for vessels removed from commercial groundfish monitoring program requirements Option 2: Implement a review process	After two years of fishing data is available, and every three years after that, the PDT would review catch composition from vessels fishing on trips not subject to monitoring requirements to verify that the catch composition has little to no groundfish.

Table 2 - Draft Impacts of Amendment 23 alternatives.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.1	***Commercial Groundfish Monitoring Program (Sectors only)***		
4.1.1	**Sector monitoring standard (coverage level)**		
4.1.1.1	Sector Monitoring Standard Option 1 (No Action)	The average total, target and realized coverage levels from 2010-2017 have been 25% and 22% respectively (13% ASM-only). There are multiple uncertainties with the current system (i.e. observed trips are not representative of unobserved trips), which have ***negative*** biological impacts on regulated groundfish and other species. For all human at-sea monitoring coverage options: at-sea monitoring has indirect ***low positive to positive*** impacts on protected species, depending on the coverage level option, by providing information on interactions with fishing gear. For all human at-sea monitoring coverage options: impacts to EFH are ***negligible to positive***, depending on the coverage level option.	<u>*Static monitoring costs*</u> – Estimated at 13% and 22%. At 13% $0.86 - $0.93 mil. and $1.45-$1.57 mil. at 22%. NEFOP contribution to observer coverage rates overall is about $0.64 mil. <u>*Dynamic fleet and vessel impacts*</u> – Similar costs to static estimates above for 13% and 22% ($0.9 mil. and $1.5 mil. respectively). Aggregate fleet-wide revenue $1 mil. lower under 13% coverage ($70.8 vs. $71.3 mil.). Increased cost may induce fisherman with higher operating costs to exit fishery. Larger vessels that participate more could see increase in gross revenue and operating profits. <u>*Enforceability and Compliance*</u> – Low and Low. The risk of noncompliance under status-quo levels of monitoring has a high risk of non-compliance with reporting requirements, and a very low ability for enforcement to detect and prosecute violations. ***Overall, if the industry bears the cost for monitoring (No Action) there will be negative impacts relative to status quo, since industry has been reimbursed for monitoring costs. Impacts are increasingly negative when risks of non-compliance and low enforceability are considered.*** <u>*Social Impacts*</u> – For all at-sea monitoring options: ***neutral to negative*** social impacts depending on the coverage level option. Higher at-sea monitoring coverage levels could produce ***negative impacts*** on crew attitudes if the increased costs result in decreases in crew compensation, and could exacerbate existing negative attitudes towards fisheries management.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.1.1.2	Sector Monitoring Standard Option 2 (Fixed total at-sea monitoring coverage level based on <u>% of trips</u>)	Higher levels of monitoring are expected to have ***positive*** biological impacts on groundfish and other species. In the short-term improvements in monitoring reduce fishing mortality through better catch accounting. In the long-term analytical assessments should improve with better catch data, thus improvements in catch advice and management.	Overall, the static and dynamic economic impacts of Option 2 range from neutral to negative (more negative as coverage rate increases). The risk of non-compliance and ability to enforce violations improves under higher coverage standards (higher scores under higher coverage standards). ***Overall, operating costs are higher (negative impacts from reduced profits) under higher coverage standards, but enforceability and risk of non-compliance improve under higher standards (positive impacts).***
	Sub-option 2A – 25%	A 25% fixed percentage coverage rate is expected to have ***neutral*** biological impacts relative to the No Action, and would continue to have ***negative*** biological impacts. Further, 75% of the groundfish trips would not have accurate estimates of discards since PDT analysis has shown that observed trips are not representative of unobserved trips.	<u>*Static monitoring costs*</u> - $1.64-$1.8 mil., similar to No Action at 22%. <u>*Dynamic fleet and vessel impacts*</u> – Aggregate fleet-wide revenue slightly higher than No Action 22% coverage ($71.5 mil.). Operating profits slightly lower than 13% coverage, and equal to 22% estimate. <u>*Enforceability and Compliance*</u> – Low and Low.
	Sub-option 2B – 50%	***Low positive*** compared to No Action (22% average coverage rate). This option would provide accurate estimates of groundfish landings and discards for half of all the groundfish trips. However, there is the potential for strong incentives to misreport on the unobserved trips under 50% coverage. Therefore, impacts to regulated groundfish from this option would still be considered to be ***negative***, similar to the option for 25% coverage.	<u>*Static monitoring costs*</u> - $3.24 - $3.54 mil. <u>*Dynamic fleet and vessel impacts*</u> – Aggregate fleet-wide revenue slightly lower than at 25% ($71.1 mil). Operating profits substantially lower than at 25% ($48.2 mil, or $2 mil. lower than at 25%). <u>*Enforceability and Compliance*</u> – Medium and Low.
	Sub-option 2C – 75%	***Positive*** compared to No Action (22% average coverage rate). Since 75% of all groundfish trips will have accurate estimates of discards this option has positive biological impacts on groundfish and other species.	<u>*Static monitoring costs*</u> - $4.57 - $5.2 mil. <u>*Dynamic fleet and vessel impacts*</u> - Aggregate fleet-wide revenue higher than at 50% ($72.3 mil). Operating profits lower than at 50% ($47.6 mil). <u>*Enforceability and Compliance*</u> – Medium-high and medium.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
	Sub-option 2D – 100%	***Positive*** compared to No Action (22% average coverage rate). Discard mortality would be fully accounted for under 100% coverage.	<u>*Static monitoring costs*</u> - $5.44 - $6.0 at 91% ASM (assuming 9% NEFOP coverage). <u>*Dynamic fleet and vessel impacts*</u> - Aggregate fleet-wide revenue lower than 75% ($71 mil). Operating profits lower than at 75% ($46.2 mil). <u>*Enforceability and Compliance*</u> – High and High.
4.1.1.3	Sector Monitoring Standard Option 3 (Fixed total at-sea monitoring coverage level based on <u>% of catch</u>)	Higher levels of monitoring are expected to have ***positive*** biological impacts on groundfish and other species. The PDT completed a simulation analysis of what coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock. The simulations show that 50% coverage across all trips would result in a 90% probability that at least 25% of the total catch of every allocated stock was observed.	Overall, the static and dynamic economic impacts of Option 3 are negative (more negative as coverage rate increases). The risk of non-compliance and ability to enforce violations improves under higher coverage standards (higher scores under higher coverage standards). ***Overall, operating costs are higher (negative impacts from reduced profits) under higher coverage standards, but enforceability and risk of non-compliance improve under higher standards (positive impacts).***
	Sub-option 3A – 25%	A 25% percentage coverage rate of total catch of each allocated groundfish stock is expected to have ***low positive*** biological impacts for regulated groundfish relative to the No Action. However, there are still concerns that the unobserved portion of groundfish trips would not have accurate estimates of discards since PDT analysis has shown that observed trips are not representative of unobserved trips.	<u>*Static monitoring costs*</u> - $3.24 - $3.54 mil. <u>*Dynamic fleet and vessel impacts*</u> – Aggregate fleet-wide revenue slightly lower than at 25% ($71.1 mil). Operating profits substantially lower than at 25% ($48.2 mil, or $2 mil. lower than at 25%). <u>*Enforceability and Compliance*</u> – Medium and Low.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
	Sub-option 3B – 50%	The simulation exercise showed that increasing coverage rates to 70% of trips would confer roughly a 90% chance that 50% of total catch was observed for each allocated groundfish stock. Thus, 50% monitoring coverage rate of total catch of each allocated groundfish stock is expected to have ***positive*** biological impacts. However, there are still concerns that the unobserved portion of groundfish trips would not have accurate estimates of discards since PDT analysis has shown that observed trips are not representative of unobserved trips.	*Static monitoring costs* - $4.3 - $4.8 mil. *Dynamic fleet and vessel impacts (under 75% coverage):* Fleetwide revenue may increase by $1.4 million, offsetting static costs. *Enforceability and Compliance* – Medium and medium.
	Sub-option 3C – 75%	Increasing coverage rates to 90% of trips would confer roughly a 90% chance that 75% of total catch was observed for each stock. Therefore a 75% percentage coverage rate of total catch of each allocated groundfish stock is expected to have ***positive*** biological impacts relative to the No Action. However, there are still concerns that the unobserved portion of groundfish trips would not have accurate estimates of discards.	*Static monitoring costs* - $5.44 - $6.0 at 91% ASM (assuming 9% NEFOP coverage). *Dynamic fleet and vessel impacts* - Aggregate fleet-wide revenue lower than 75% ($71 mil). Operating profits lower than at 75% ($46.2 mil). *Enforceability and Compliance* – High and High.
	Sub-option 3D – 100%	***Positive*** compared to No Action (22% average coverage rate). Discard mortality would be fully accounted for under 100% coverage.	*Static monitoring costs* - $5.44 - $6.0 at 91% ASM (assuming 9% NEFOP coverage). *Dynamic fleet and vessel impacts* - Aggregate fleet-wide revenue lower than 75% ($71 mil). Operating profits lower than at 75% ($46.2 mil). *Enforceability and Compliance* – High and High.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.1.2	**Sector monitoring tools (options for meeting monitoring standards)**		
4.1.2.1	Sector Monitoring Tools Option 1 – EM in place of human at-sea monitors	Generally ***neutral*** impacts assuming data from EM equivalent to human observers. For stocks that are more difficult to identify from video (red hake), potential low negative impacts compared to human observers. But EM can monitor every tow and there is no potential for coercion or falsifying data. For all sector monitoring tools options: EM may have ***indirect negative*** impacts to protected species – potential loss of information on interactions. However, any loss of data is not expected to have a significant adverse impact. For all sector monitoring tools options: ***low negative impacts*** to EFH if substitution facilitates greater fishing effort.	Depending on the coverage level selected, this option may be more costly than human observers as year one equipment and installation costs are approximately $10k per vessel. That equates to approximately 15-20 observed sea days. Video review can be anywhere from $150 to $700 per day. If video review for these vessels were to average $400 per day, the Council would need to select an ASM level that induces more than approximately 35 observed sea days for vessels opting EM in place of ASM in order for this option to reduce costs. Distributional impacts expected – vessels that participate more, or are more efficient may have ***positive economic impacts*** (EM cheaper than human observers), and vessels that participate less may have ***negative economic impacts***. <u>Enforceability and compliance</u> – low, and similar to scores above under each coverage level Social Impacts – For all Sector Monitoring Tools options: ***Long-term neutral to positive social impacts*** if EM is more cost effective than human at-sea monitors over time, but ***short-term negative impacts*** as a result of the initial costs associated with installing EM equipment and additional responsibilities that accompany the maintenance of EM systems.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.1.2.2	Sector Monitoring Tools Option 2 – Audit model EM	If developed correctly, audit model EM should produce similar biological impacts to 100% human observer coverage, and ***positive*** biological impacts compared to current No action rates. Potentially low negative impacts for stocks difficult to identify from video.	*Static monitoring costs* – In year 1 cost of $5.72 mil. ($2.68 with subsidy); year2 = $2.01 mil.; and year3 = $1.23 mil. *Enforceability and Compliance* – High and High, but non-compliance still possible if review rate is low, cameras focused on discards rather than landings, and no dockside monitoring component. ***Overall, year 1 static monitoring costs are slightly higher than Sub-Option 3D, 100% ASM, but are significantly lower in subsequent years or under the subsidized scenario. Un-subsidized costs under Option 2 would have a negative impact on the fishery relative to No Action, and possibly more highly negative impacts relative to Status Quo.***
4.1.2.3	Sector Monitoring Tools Option 3 – Maximized retention EM	If developed correctly, max retention EM should produce similar biological impacts to 100% human observer coverage, and ***positive*** biological impacts compared to current No action rates. Potentially low negative impacts for stocks difficult to identify from video. If there is a shift to targeting smaller younger fish likely negative biological impacts.	*Static monitoring costs* - In year 1 cost of $5.19 mil. ($2.15 with subsidy); year2 = $2.15 mil.; and year3 = $1.82 mil. *Enforceability and Compliance* – High and High, but non-compliance still possible if review rate is low, cameras focused on discards rather than landings, and no dockside monitoring component. ***Overall, year 1 static monitoring costs are slightly higher than Sub-Option 3D, 100% ASM, but are significantly lower in subsequent years or under the subsidized scenario. Un-subsidized costs under Option 2 would have a negative impact on the fishery relative to No Action, and possibly more highly negative impacts relative to Status Quo.***
4.1.3	**Total Monitoring Coverage Level Timing**		
4.1.3.1	Coverage Level Timing Option 1 (No Action)	Option 1/No Action and Option 2 would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is administrative because it only affects the timing of	***Low negative*** to the extent it affects the ability for businesses to anticipate annual operating costs and make participation decisions as a result. Vessels have been compensated so unclear what impacts have been to date.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.1.3.2	Coverage Level Timing Option 2 – Knowing total monitoring coverage level at a time certain	information availability for business planning (***no impact***).	***Indirect positive*** impacts if individuals able to forecast monitoring costs and compare costs across providers to adopt cost-minimizing strategies. Federal reimbursement has been uncertain so difficult to assess realized impacts.
4.1.4	**Review process for sector monitoring coverage**		
4.1.4.1	Coverage Review Process Option 1 (No Action)	Option 1/No Action would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative (***no impact***).	***No direct economic impacts*** are anticipated.
4.1.4.2	Coverage Review Process Option 2 –Establish a review process for monitoring coverage rates	Establishing a review could have ***indirect positive impacts*** on groundfish from an evaluation of the efficacy of monitoring coverage rates to determine, for example, whether there is evidence of bias, and whether the monitoring standards are being met.	If review occurs more frequently than under Option 1/No Action, some ***positive*** economic impacts may result if issues with monitoring coverage levels or other components of the monitoring program are detected and determined to be suboptimal to achieve the goals of the program, such as if illegal behavior persists affecting ex-vessel markets, the ACE lease market, and reduced competitiveness among rule-followers and rule-breakers.
4.1.5	Addition to list of framework items	This option would not be expected to have direct or indirect impacts on regulated groundfish species or other species. Impacts would be fully analyzed in future actions (***no impact***).	This measure is expected to have ***neutral*** economic impacts. There is no expectation that the establishment of this administrative measure will have any discernibly positive or negative economic impact.
4.2	***Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool)***		
4.2.1	**Dockside monitoring program (DSM) (Sectors and Common Pool)**		

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.2.1.1	DSM Option 1 (No Action)	In the absence of dockside monitoring, information on sector catches is expected to be less reliable, and it is possible that sectors could exceed their ACE, increasing the risk of overfishing. Under No Action, there is a much greater probability that landings could be misreported and/or underreported, which has occurred in the groundfish fishery in the recent past. Thus, ***negative*** impacts on groundfish and other species are possible under this option. For all dockside monitoring options: dockside monitoring has ***no impacts, direct or indirect***, on protected species.	***No direct economic impacts*** to the fishing industry since DSM costs will be similar to recent fishing years ($0). *Enforceability and Compliance* – Low and low to medium, so ***indirect negative impacts***. Reduced quota accountability decreases the functionality of the quota market to send appropriate price signals when quota is limiting and reduces the benefits of efficient harvesting strategies, such as decreased catch of non-target stocks. Additionally, overharvesting degrades long-term fishing revenue. *Social Impacts* – ***Neutral to positive social impacts*** as this would maintain status quo of no DSM requirement, and could precipitate ***positive impacts*** on the attitudes and beliefs among fishery participants and stakeholders who have in the past voiced concerns with such a DSM program.
4.2.1.2	DSM Option 2 – Mandatory DSM for entire commercial GF fishery	This option intended to deter misreported landings, and provide independent verification of groundfish landings; therefore, should result in increased certainty in the magnitude of groundfish catches at the species level. More accurate in-season monitoring of landings, which will help ensure that sectors do not exceed the ACE, and that common pool vessel do not exceed daily catch limits. This independent verification of catch will reduce the risk of overfishing. Therefore, ***positive*** biological impacts for regulated groundfish species and ***low positive*** for other species.	***Low negative direct impacts*** since operating costs would increase, could increase consolidation into major ports to reduce monitoring costs, but increased dockside monitoring ***may lead to indirect positive economic impacts*** from increased quota accountability. Range of total dockside monitoring costs about $900,000, approximately $130 per trip, or about $4,000 per vessel annually (in 2010 average cost was $110 per trip). Additional uncertainties and caveats were explored and sensitivity analyses presented to provide greater range of possible costs. Common pool costs are expected to be higher than sector costs because over 50% of common pool offloads in minor ports. Predicted monitoring costs at vessel-level varies greatly, with larger proportion of total revenues for smaller vessels and vessels landing farther from major ports. For larger vessels over 50 feet, average costs for DMS ranges from 0.5% to under 3%.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
			Enforceability and Compliance – High and high, but only ensures dockside reporting requirements unless coupled with at-sea monitoring. *Social Impacts* – ***Negative social impacts*** due to increased costs and responsibilities for commercial groundfish captains and crew.
4.2.2	**Dockside monitoring program structure and design**		
4.2.2.1	DSM funding responsibility		
4.2.2.1.1	DSM Funding Responsibility Option A – Dealer responsibility	Option A and Option B would not be expected to have direct or indirect impacts on regulated groundfish or other species. This measure is primarily administrative, ***no impact***.	Direct economic impacts ***are uncertain*** *Enforceability and Compliance:* neutral, neutral
4.2.2.1.2	DSM Funding Responsibility Option B – Vessel responsibility		Direct economic impacts ***are uncertain*** *Enforceability and Compliance:* neutral, neutral
4.2.2.2	DSM program administration		
4.2.2.2.1	DSM Administration Option A – Individual contracts with DSM providers	Option A and Option B would not be expected to have direct or indirect impacts on regulated groundfish or other species. This measure is primarily administrative, ***no impact***.	Relative to Option B, economic impacts may be ***neutral to low positive,*** because of flexibility in contract negotiation, but may increase possible transaction costs. *Enforceability and Compliance:* neutral, neutral
4.2.2.2.2	DSM Administration Option B –NMFS administered, single DSM provider		Relative to Option A, economic impacts may be ***neutral to low negative***, because of decreased flexibility in contract negotiation, but this option may minimize possible transaction costs. *Enforceability and Compliance:* neutral, neutral

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.2.2.3	Options for lower dockside monitoring coverage levels (20% coverage)		
4.2.2.3.1	Lower coverage levels Option A	Relative to No Action (no required dockside monitoring program), Option A and Option B would have ***positive*** impacts on regulated groundfish, since the dockside monitoring program is intended to deter misreported landings, and provide independent verification of groundfish landings, and therefore should result in increased certainty regarding the magnitude of groundfish landings at the species level.	Compared to No Action (no DSM) this option has ***low negative direct economic impacts***, less than 1% fleetwide revenue. Under 30% of recent offloads to ports with low gf landings and 50% of total DSM costs from these ports. If coverage reduced from 100% to 20% coverage at these ports, total estimated costs of DMS go to $600,000 (from $900,000), 39% reduction. *Enforceability and Compliance* – medium to high and medium to high.
4.2.2.3.2	Lower coverage levels Option B		This includes about 100 unique or common pool vessels from 2016-2018, if coverage reduced to Compared to No Action (no DSM) this option has ***low negative to negative direct economic impacts.*** Coverage of 20% DSM for these vessels would cost about $600,000, a 36% reduction from 100% DSM. Overall, low-volume vessels account for 65% of landed non-groundfish pounds, but only 2.3% of all landed groundfish pounds. *Enforceability and Compliance* - medium to high and medium to high.
4.2.2.4	Options for DSM safety and liability associated with fish hold inspections		
4.2.2.5.1	Fish hold inspection Option A – DSM fish hold inspections required	Fish hold inspections as part of a DSM help to ensure that all landings are accounted for, which therefore should result in increased certainty in the magnitude of groundfish catches at the species level. This independent verification of catch will reduce the risk of overfishing; ***positive*** biological impacts for regulated groundfish and ***low positive*** for other species.	***Low negative to low positive impacts*** This option may increase the cost burden to either dealers or vessels, thus low negative economic impacts. However, without hold inspections, the ability to misreport landings is increased, and in a quota managed fishery there exists an incentive to evade quota constraints through misreporting or underreporting catch. Therefore, overall fish hold inspections are expected to have low positive impacts from improved compliance and enforceability of reporting requirements.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.2.2.4.2	Fish hold inspection Option B – Alternative methods for inspecting fish holds (cameras)	Similar ***positive and low positive*** impacts to Option A, provided that alternative methods (cameras) can account for all catch.	***Neutral to negative impacts,*** relative to Options A or C due to possible increased cost burden associated with purchasing cameras, to the extent this occurs. Low positive impacts from improved compliance and enforceability of reporting requirements.
4.2.2.4.3	Fish hold inspection Option C – No fish hold inspection required, captain signs affidavit	***Low positive*** impacts since this option would not include an independent verification of catch, captain only.	This alternative would have ***neutral economic impacts*** relative to Option A, since neither requires vessels to purchase and maintain additional equipment, but potentially ***positive economic impacts*** relative to Option B, for vessels that do not already have cameras as part of an EM system. ***Negative impact*** on both compliance and enforceability relative to Option B or C since reducing the ability to perform hold inspections has been noted by enforcement to limit their capabilities to investigate possible illegal activities
4.3	***Sector Reporting***		
4.3.1	Sector Reporting Option 1 (No Action)	Option 1/No Action and Option 2 would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative (***no impact***).	***Neutral to low negative*** impacts on the groundfish fishery to the extent that it simplifies the reporting process and reduces transaction costs associated with complying with regulations.
4.3.2	Sector Reporting Option 2 – Grant RA authority to streamline sector reporting requirements		***Neutral to low positive*** impacts on the groundfish fishery to the extent that it simplifies the reporting process and reduces transaction costs associated with complying with regulations. In addition, if discards and ACE balances were determined more quickly, fishing businesses might make benefit from more certain financial planning, such as when to lease in or lease out quota.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.4	***Funding/Operational provisions of groundfish monitoring program (Sectors and Common Pool)***		
4.4.1	Funding Provisions Option 1 (No Action)	Option 1/No Action would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative (***no impact***).	***Neutral to high negative impacts*** on the groundfish fishery, depending if and what the degree of funding limitations might be for NMFS to administer the program.
4.4.2	Funding Provisions Option 2 – Provisions for an increase or decrease in funding for the GF monitoring program		
4.4.2.1	Funding Provisions Sub-option 2A – Higher monitoring coverage levels if NMFS funds are available (Sectors Only)	Sub-Option 2A would be expected to have ***indirect positive*** impacts on regulated groundfish species, as there is a potential for higher monitoring coverage levels under this option.	***Neutral to strongly positive*** impacts relative to No Action/Option 1 depending on the coverage rate and programs selected under Sector Monitoring Standards and Tools since it could cover up to 100% of monitoring costs in a given year which could compromise a significant proportion of operating costs in any given year.
4.2.2.2	Funding Provisions Sub-option 2B – waivers for monitoring requirements allowed (Sectors and Common Pool)	Sub-Option 2B would be expected to have ***indirect low negative*** impacts on regulated groundfish species, as there is a potential for lower monitoring coverage levels under this option.	***Positive*** impacts on fishing businesses to the extent that fishing effort would be constrained by the monitoring standard and coverage rate selected in this action.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.5	***Management uncertainty buffers for the commercial groundfish fishery (Sectors only)***		
4.5.1	Management Uncertainty Buffer Option 1 (No Action)	Option 1/No Action would likely have ***neutral to low positive*** biological impacts to regulated groundfish, as management uncertainty buffers are a part of the ACL-setting process, designed to constrain fishing effort to allowable levels. Maintaining current management uncertainty buffers would likely keep the groundfish fishery operating at current levels, and changes in effort would not be expected.	Overall, the direct economic impacts of Option A/No Action are the loss of potential fishery revenue, 3-7% of each stock's ACL, which has a ***neutral to low-negative impact*** on the fishery, depending on the stock and fishing effort in any given year. *Enforceability and Compliance* – neutral and neutral to low negative.
4.5.2	Management Uncertainty Buffer Option 2 – Elimination of management uncertainty buffer for Sector ACLs with 100% monitoring of all sector trips	It is difficult to predict whether the removing the buffers would result in substantial increases in fishing effort. This option has the potential to increase fishing effort and landings since setting the buffer to zero would result in higher sector ACLs. Therefore, relative to No Action, Option 2 has the potential to result in ***low negative*** impacts on regulated groundfish. However, 100% monitoring is required to select Option 2, and having comprehensive monitoring would essentially create a census of commercial catch. This would provide ***positive*** impacts to regulated groundfish as there would be greater certainty in the magnitude and age structure of the commercial catch, and lower risks of the sector ACL being exceeded. Impacts on protected species range from ***direct low negative to negative impacts, to indirect low positive impacts***. This option has the potential to increase fishing effort, which would have ***negative impacts*** on protected species. However relative to Option 1/ No Action, Option 2 may also result in	Under FY18 conditions, a ~3-5% increase in the sector sub-ACLs allows fleet-wide catch and revenues from groundfish to increase by 7-8%, and overall catch and revenue to increase by greater than 5% (~5.5%). However, compared to No Action, monitoring costs under any of the 100% coverage options (ASM, EM, or blended) increase operating costs and decrease operating profits relative to status quo, meaning the direct economic impact is ***low-negative to negative***. *Enforceability and Compliance* – high and high. ***Overall, while operating expenses increase under Option 2 relative to No Action, where No Action represents status quo levels of monitoring, revenues are maximized under this option relative to other monitoring options in this action, maximizing operating profits relative to the other 100% monitoring options in this action.***

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
		indirect positive impacts to protected species since 100% monitoring is required to select Option 2.	
4.6	***Remove commercial groundfish monitoring program requirements for certain vessels fishing under certain conditions***		
4.6.1	Removal of monitoring requirements Option 1 (No Action)	Under Option 1/No Action, impacts on regulated groundfish are expected to be ***low negative*** because reducing observer coverage also reduces the precision of discard estimates. Groundfish catches are low on these trips, but have the potential to introduce bias if not applied across all broad stock areas – limiting the ability of using info in stock assessments. For all removal of at-sea monitoring requirements: Impacts on protected species are ***(directly and indirectly) low negative to negative.*** Reducing monitoring coverage may result in increased fishing effort in these areas, and results in loss of data on interactions with fishing gear.	No Action has ***positive*** economic impacts on the groundfish fishery to the extent that it minimizes monitoring costs, but may carry some risk of non-compliance since discards and landings are not independently verified and incentives for non-compliance exist in the fishery, even when catch of allocated stocks may be small. *Social Impacts* - For all removal of monitoring requirements: ***neutral*** social impacts for commercial groundfish fishery participants and communities, since the measures to remove monitoring requirements apply to vessels that catch very few groundfish and primarily target non-groundfish stocks and species.
4.6.2	Removal of monitoring requirements Option 2 – Vessels fishing exclusively west of 72 30 W would not be subject to monitoring requirements on trips in that area		
4.6.2.1	Removal of monitoring requirements Option 2A (Sectors only)	***Low Negative*** biological impacts to regulated groundfish from Option 2A and 2B, as lower monitoring coverage would likely reduce the accuracy of catch estimates. However, catch composition for groundfish on trips fishing in this area is relatively low (less than 5% with exception of S. windowpane) and majority of total groundfish catch would receive monitoring.	Because of the low levels of groundfish landings in this area, exempting these trips from monitoring coverage is expected to result in positive economic impacts to those who fish in the exempted area, but ***neutral*** economic impacts on the fishery as a whole, relative to No Action/Option 1. *Enforceability and Compliance* – neutral to positive and positive. May nevertheless incentivize increased effort and possibly illegal behavior in the fishery in order to avoid observer costs as well as costs imposed

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
4.6.2.2	Removal of monitoring requirements Option 2B (Sectors and Common Pool)	For all removal of monitoring requirements, impacts on EFH are ***negligible to slight negative.***	Direct economic impacts of Sub-Option 2B are ***low positive to positive*** when compared to a comprehensive DSM program under Option 2, alternative 7.4.4.1.2. Overall direct economic impacts are ***low positive*** because the overall cost reductions of this alternative are small compared to the estimated cost of a comprehensive DSM program, but distributional impacts may be more ***strongly positive***. *Compliance/Enforceability:* Indirect economic impacts may be low negative relative to No Action due to ***possible negative impacts*** on compliance and enforceability of reporting requirements
4.6.3	Removal of monitoring requirements Option 3 – Vessels fishing exclusively west of 71 30 W would not be subject to monitoring requirements on trips in that area		
4.6.3.1	Removal of monitoring requirements Option 3A (Sectors only)	***Negative*** biological impacts to regulated groundfish from Option 3A and 3B, as lower monitoring coverage would likely reduce the accuracy of catch estimates. Catch composition for groundfish on trips fishing in this area is relatively low for some stocks, but substantial for others (S. windowpane, SNE/MA winter flounder, SNE/MA YT flounder, and ocean pout). Some of these stocks are in rebuilding plans. Impacts on GOM and GB stocks are expected to be ***low negative***, but impacts on SNE/MA stocks expected to be ***high negative***.	Compared to Sub-Option 2A, levels of groundfish landings in the proposed exemption area are substantially higher, exempting these trips from monitoring coverage is expected to result in ***positive to high positive economic impacts*** to those who fish in the exempted area, but at most low positive economic impacts on the fishery as a whole, relative to No Action/Option 1, depending on the coverage rate selected under 4.1.1.1. *Compliance/Enforceability:* Compared to Sub-Option 2A, this option is expected to have ***negative*** effects on compliance since it affects a larger proportion of total fishing effort. With respect to enforceability, this alternative is expected to have ***neutral to low negative*** impacts compared to No Action and neutral to low negative impacts relative to Sub-Option 2A.
4.6.3.2	Removal of monitoring requirements Option 3B (Sectors and Common Pool)		Exempting trips in this area from monitoring coverage is expected to result in ***positive to high positive*** economic impacts to those who fish in the exempted area, and ***low positive to positive*** economic impacts on the fishery as a whole, relative to No Action/Option 1, depending on the DSM coverage rate selected under 4.1.1.1.

	Alternatives	Biological and Physical Impacts	Economic and Social Impacts
			Compliance/Enforceability: Compared to Sub-Option 2B, this option is expected to have ***negative effects*** on compliance since it affects a larger proportion of total fishing effort. With respect to enforceability, this alternative is expected to have ***negative impacts*** compared to No Action and low negative impacts relative to Sub-Option 2B since it may reduce the ability for enforcement to detect misreporting dockside.
4.6.4	Review process for vessels removed from commercial groundfish monitoring program requirements		
4.6.4.1	Vessels removed from monitoring requirements do not have formal review process (No Action)	This option would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative, ***no impact***.	There may be some ***negative, indirect economic impacts*** if no review process is implemented and changes in effort or catch composition by exempted vessels change drastically.
4.6.4.2	Implement a review process for vessels removed from commercial groundfish monitoring program requirements	Requiring a periodic review could have ***indirect positive impacts*** on groundfish by confirming that measures for removal of monitoring requirements are not impacting estimates of groundfish catch. If impacts are found in the review exemptions can be revisited.	Overall, this alternative is expected to have ***neutral*** economic impacts since it is not expected that a review will impose any additional costs on fishing businesses. *Compliance/Enforceability:* ***Neutral to low positive*** impacts on compliance relative to status quo if it limits potential effort shifts in the two years before the review begins, however, if fishermen have a high discount rate, they may still perceive that benefits associated with reducing or eliminating short-term (1-2 year) monitoring costs to be worth shifting operations to an exempted area, depending on whether Option 2 or 3 is ultimately selected.

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ABC	Acceptable Biological Catch
ACE	Annual Catch Entitlement
ACL	Annual Catch Limit
ALWTRP	Atlantic Large Whale Take Reduction Plan
AM	Accountability Measure
APA	Administrative Procedures Act
ASAP	Age-structured assessment program; assessment model
ASM	At-sea monitoring
ASMFC	Atlantic States Marine Fisheries Commission
B	Biomass
CAA	Catch at Age
CAI	Closed Area I
CAII	Closed Area II
CC	Cape Cod
CEQ	Council on Environmental Quality
CPUE	Catch per unit of effort
CV	Coefficient of Variation
CZMA	Coastal Zone Management Act
DAH	Domestic Annual Harvest
DAS	Days-at-sea
DEA	Data Envelopment Analysis
DFO	Department of Fisheries and Oceans (Canada)
DMF	Division of Marine Fisheries (Massachusetts)
DMR	Department of Marine Resources (Maine)
DSEIS	Draft Supplemental Environmental Impact Statement
DSM	Dockside monitoring
DWF	Distant-Water Fleets
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive economic zone
EFH	Essential fish habitat
EIS	Environmental Impact Statement
ELM	Extra-large mesh

EM	Electronic monitoring
ESA	Endangered Species Act
F	Fishing mortality rate
FAAS	Flexible Area Action System
FEIS	Final Environmental Impact Statement
FMP	Fishery Management Plan
FSCS	Fisheries Scientific Computer System
FSEIS	Final Supplemental Environmental Impact Statement
FW	Framework
FY	Fishing year
GAMS	General Algebraic Modeling System
GARFO	Greater Atlantic Regional Fisheries Office
GB	Georges Bank
GEA	Gear Effects Evaluation
GIFA	Governing International Fisheries Agreement
GIS	Geographic Information System
GARFO	Greater Atlantic Regional Fisheries Office
GMRI	Gulf of Maine Research Institute
GOM	Gulf of Maine
GRT	Gross registered tons/tonnage
HAPC	Habitat area of particular concern
HCA	Habitat Closed Area
HPTRP	Harbor Porpoise Take Reduction Plan
I/O	Input/output
ICNAF	International Commission for the Northwest Atlantic Fisheries
IFQ	Individual fishing quota
IOY	Initial Optimal Yield
IRFA	Initial Regulatory Flexibility Analysis
ITQ	Individual transferable quota
IVR	Interactive voice response reporting system
IWC	International Whaling Commission
LOA	Letter of authorization
LPUE	Landings per unit of effort
LWTRP	Large Whale Take Reduction Plan
M	Natural Mortality Rate
MA	Mid-Atlantic
MA DMF	Massachusetts Division of Marine Fisheries
MAFAC	Marine Fisheries Advisory Committee
MAFMC	Mid-Atlantic Fishery Management Council
MARFIN	Marine Fisheries Initiative
ME DMR	Maine Department of Marine Resources
MEY	Maximum economic yield
MMC	Multispecies Monitoring Committee
MMPA	Marine Mammal Protection Act
MPA	Marine protected area
MRFSS	Marine Recreational Fishery Statistics Survey
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	Maximum sustainable yield

MWT	Midwater trawl; includes paired mid-water trawl when referring to fishing activity or vessels in this document
mt	Metric tons
NAO	North Atlantic Oscillation
NAPA	National Academy of Public Administration
NAS	National Academy of Sciences
NEFMC	New England Fishery Management Council
NEFOP	Northeast Fishery Observer Program
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NLCA	Nantucket Lightship closed area
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NS	National Standard
NSGs	National Standard Guidelines
NSTC	Northern Shrimp Technical Committee
NT	Net tonnage
NWA	Northwest Atlantic
OBDBS	Observer database system
OA2	Omnibus Essential Fish Habitat Amendment 2
OCS	Outer Continental Shelf
OFL	Overfishing Limit
OLE	Office for Law Enforcement (NMFS)
OY	Optimum yield
PBR	Potential Biological Removal
PDT	Plan Development Team
PRA	Paperwork Reduction Act
PREE	Preliminary Regulatory Economic Evaluation
PS/FG	Purse Seine/Fixed Gear
PSC	Potential Sector Contribution
QCM	Quota change model
RFA	Regulatory Flexibility Act
RFFA	Reasonably Foreseeable Future Action
RIR	Regulatory Impact Review
RMA	Regulated Mesh Area
RPA	Reasonable and Prudent Alternatives
SA	Statistical Area
SAFE	Stock Assessment and Fishery Evaluation
SAP	Special Access Program
SARC	Stock Assessment Review Committee
SASI	Swept Area Seabed Impact
SAV	Submerged Aquatic Vegetation
SAW	Stock Assessment Workshop
SBNMS	Stellwagen Bank National Marine Sanctuary
SBRM	Standardized Bycatch Reporting Methodology
SCAA	Statistical catch-at-age assessment model
SEIS	Supplemental Environmental Impact Statement
SFA	Sustainable Fisheries Act
SFMA	Southern Fishery Management Area (monkfish)

SIA	Social Impact Assessment
SNE	Southern New England
SNE/MA	Southern New England-Mid-Atlantic
SSB	Spawning stock biomass
SSC	Scientific and Statistical Committee
TAC	Total allowable catch
TALFF	Total Allowable Level of Foreign Fishing
TC	Technical Committee
TED	Turtle excluder device
TEWG	Turtle Expert Working Group
TMGC	Trans-boundary Management Guidance Committee
TMS	Ten minute square
TRAC	Trans-boundary Resources Assessment Committee
TRT	Take Reduction Team
TSB	Total stock biomass
USAP	U.S. At-Sea Processing
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VEC	Valued Ecosystem Component
VMS	Vessel monitoring system
VPA	Virtual population analysis
VTR	Vessel trip report
WGOM	Western Gulf of Maine
WO	Weigh-out
YPR	Yield per recruit

3.0 BACKGROUND AND PURPOSE

3.1 Background

The Northeast Multispecies Fishery Management Plan (FMP) specifies the management measures for thirteen groundfish species (cod, haddock, yellowtail flounder, pollock, plaice, witch flounder, white hake, windowpane flounder, Atlantic halibut, winter flounder, redfish, ocean pout, and Atlantic wolffish) off the New England and Mid-Atlantic coasts. Some of these species are sub-divided into individual stocks that are attributed to different geographic areas. Commercial and recreational fishermen harvest these species. The commercial groundfish fishery consists of primarily "sectors" as well as the "common pool." The regulations at 50 CFR § 648.87 define a sector as "[a] group of persons (three or more persons, none of whom have an ownership interest in the other two persons in the sector) holding Northeast multispecies limited access vessel permits who have voluntarily entered into a contract and agree to certain fishing restrictions for a specified period of time, and which has been granted a total allowable catch (TAC) in order to achieve objectives consistent with applicable FMP goals and objectives." Each sector receives a total amount (in pounds) of fish it can harvest for each stock. Fishermen who do not join a sector fish in the "common pool". Vessels in the common pool are allocated a certain number of Days at Sea (DAS). Vessels that fish in the common pool are managed by a variety of input and effort controls such as DAS, trip limits, closed areas, minimum fish sizes, and gear restrictions. These effort controls are subject to in-season adjustments. The FMP has been updated through a series of amendments and framework adjustments.

Amendment 16, which became effective on May 1, 2010, adopted a broad suite of management measures to achieve the fishing mortality targets necessary to rebuild overfished stocks and meet other requirements of the M-S Act. Amendment 16 greatly expanded the sector management program and adopted a process for setting Annual Catch Limits (ACLs) that requires catch levels to be set in biennial specifications packages. This action included a host of mortality reduction measures for "common pool" (i.e. non-sector) vessels and the recreational component of the fishery. A detailed discussion of the history of the FMP up to 2009 can be found in Amendment 16 (NEFMC 2009b).

Most relevant to this action, Amendment 16 also updated the requirements for sector and common pool monitoring programs, including at-sea monitoring and dockside monitoring requirements. Following that action, Framework 45 made adjustments to the dockside monitoring program. Framework 48 later discontinued the dockside monitoring program. Additionally, Framework 48 specified the overall goals and objectives of the groundfish monitoring program (Section 3.3.2). Framework 55 clarified that the primary goal of the monitoring program is to verify area fished, catch, and discards by species and gear type; and should be done in the most cost effective means practicable. Framework 55 further clarified that all other goals and objectives of groundfish monitoring programs are considered equally-weighted secondary goals.

The final documents for all prior actions can be found on the internet at http://www.nefmc.org.

3.2 Purpose and Need

The need, or problem this action was developed to address is: the need to implement measures to improve the reliability and accountability of catch reporting in the commercial groundfish fishery to ensure there is precise and accurate representation of catch (landings and discards). Accurate catch data are necessary to ensure that catch limits are set at levels that prevent overfishing and to determine when catch limits are exceeded.

The purpose, or potential solutions considered in this action focus on measures that adjust the current monitoring program to improve accounting and accuracy of collected catch data. It is the Council's intent that the catch reporting requirements are fair and equitable for all commercial groundfish fishermen, while maximizing the value of collected catch data, and minimizing costs for the fishing industry and the National Marine Fisheries Service.

3.3 Goals and Objectives

3.3.1 Goals and Objectives of the Northeast Multispecies FMP

The goals and objectives of the Northeast Multispecies FMP remain as described in Amendment 13 (for example, manage the Northeast multispecies complex at sustainable levels, consistent with the National Standards and other required provisions of the Magnuson-Stevens Fishery Conservation and Management Act and other applicable law; achieve, on a continuing basis, optimum yield for the U.S. fishing industry), as well as the goals in Amendment 18, and will continue to frame the long-term management of the resource and fishery. Section 2.3 of Amendment 13 presents the overall goals and objectives of the Northeast Multispecies FMP, and Section 3.3.2 of Amendment 18 includes a description of the goals that were added to the overall program specific to promoting fleet diversity and several other goals.

3.3.2 Goals and Objectives of groundfish monitoring program

Framework 48 to the Multispecies FMP specified the overall goals and objectives of the groundfish monitoring program. Framework 55 clarified that the primary goal is to verify area fished, catch, and discards by species and gear type; and should be done in the most cost effective means practicable. Framework 55 further clarified that all other goals and objectives of groundfish monitoring programs at §648.11(l) are considered equally-weighted secondary goals.

The goals and objectives of the groundfish monitoring program, are as follows:

Goal 1: Improve documentation of catch

Objectives:

- Determine total catch and effort, for each sector and common pool, of target or regulated species.
- Achieve coverage level sufficient to minimize effects of potential monitoring bias to the extent possible while maintaining as much flexibility as possible to enhance fleet viability.

Goal 2: Reduce cost of monitoring

Objectives:

- Streamline data management and eliminate redundancy.
- Explore options for cost-sharing and deferment of cost to industry.
- Recognize opportunity costs of insufficient monitoring.

Goal 3: Incentivize reducing discards

Objectives:

- Determine discard rate by smallest possible strata while maintaining cost-effectiveness.
- Collect information by gear type to accurately calculate discard rates.

Goal 4: Provide additional data streams for stock assessments

Objectives:

- Reduce management and/or biological uncertainty.

- Perform biological sampling if it may be used to enhance accuracy of mortality or recruitment calculations.

Goal 5: Enhance safety of monitoring program

Goal 6: Perform periodic review of monitoring program for effectiveness

3.3.3 Goals and Objectives of Amendment 23

This action would maintain the current goals and objectives of the groundfish monitoring program described above (Section 3.3.2), but consider measures to better address Goal #1: improve documentation of catch, described as "improved catch accounting" during the scoping process for this action. The objectives associated with that goal are: 1) determine total catch and effort, for each sector and common pool, of target or regulated species; and 2) achieve coverage level sufficient to minimize effects of potential monitoring bias to the extent possible while maintaining as much flexibility as possible to enhance fleet viability.

3.4 PUBLIC SCOPING

3.4.1 Notice of Intent and Scoping Process

NMFS published a Notice of Intent (NOI) on February 17, 2017 to announce its intent to develop an amendment (later named Amendment 23) and prepare an Environmental Impact Statement (EIS) to analyze the impacts of the proposed management alternatives. The announcement stated that Amendment 23 would "consider changes to the groundfish monitoring and reporting system to ensure it is providing accurate catch information necessary to manage the fishery efficiently." The scoping period extended from February 17, 2017 until April 3, 2017 and included six scoping hearings.

3.4.2 Scoping Comments

Comments were received from a variety of stakeholders, including nonprofit organizations, individual fishermen, fishing corporations, state agencies, and other interested citizens. Oral (n=25) and written (n=19) comments were received from individuals or organizations (duplicates removed). All written comments and summaries of hearings, as well as a complete summary of scoping comments, are provided in Appendix I and at www.nefmc.org. The majority of the oral and written comments indicated that the intent of Amendment 23 is very important.

4.0 ALTERNATIVES UNDER CONSIDERATION

4.1 COMMERCIAL GROUNDFISH MONITORING PROGRAM REVISIONS (SECTORS ONLY)

The following sections describe options to adjust the groundfish monitoring program for sector vessels. If adopted, these options may replace or add to existing monitoring and reporting requirements or programs, to improve data collection (e.g., improved discard monitoring systems, dockside monitoring for landings, etc.).

Sectors are responsible for developing and implementing a monitoring program, described in their operations plans, that satisfies NMFS and Council requirements for monitoring sector catch and discards (Amendment 13, Amendment 16, FW 45, FW 48, and FW 55). Sectors describe in their monitoring plans how they will achieve the target coverage levels set as monitoring standards (Section 4.1.1), through a selection of monitoring tools (Section 4.1.2).

Annual funding available to cover NMFS' cost responsibilities may vary. The realized coverage in a given year could be limited by the amount of Federal funding available to cover NMFS cost responsibilities. Additionally, NMFS may be authorized to reimburse industry cost responsibilities if Federal funding is available, but NMFS cannot be obligated to pay sampling costs in industry-funded sampling programs.

4.1.1 Sector Monitoring Standards (Target Coverage Level)

Amendment 16 specified a target coverage level standard for sectors and required industry-funded at-sea monitoring beginning in 2012. This requirement focused on the coefficient of variation (CV) of discard estimates, a measure of the precision of discard estimates, but also noted that other factors could be considered when determining coverage levels. A target coverage level standard is set for all sectors, but there is no guarantee that target coverage rates can be realized across sectors because there are numerous reasons coverage rates vary including interactions between Standardized Bycatch Reporting Methodology (SBRM) and At-Sea Monitoring program (ASM) coverage requirements, and operational reasons such as random variability, vessel non-compliance, provider selection preference, observer safety considerations, etc. NOAA Fisheries currently issues waivers from at-sea monitoring for selected trips in specific circumstances, including if an observer or at-sea monitor is not available to cover the trip, or for other logistical reasons (e.g., late observer, safety). The options below and in Section 4.4.2.2 Option 2B Waivers from Monitoring Requirements Allowed (Sectors and Common Pool) would not change that authority or process and NMFS intends to continue issuing waivers on the same basis.

Framework 48 clarified that the CV standard is intended to apply to discard estimates at the overall stock level for all sectors combined. Currently, a system for fishery performance criteria is used in setting groundfish sector coverage levels (FW 55). Application of the CV standard is filtered consistent with existing goals for the monitoring program, such that stocks that meet the performance criteria are not drivers for the annual coverage level. More information on the fishery performance criteria can be found in Section 6.6.10.1.

Adequate coverage (combined NEFOP, ASM and EM) is required to generate accurate discard estimates with a known level of precision. All of the options below – including requirements for coverage adequate for the accuracy and precision of estimates - would be interpreted and applied consistent with the overarching goals and objectives of the sector monitoring program. This action does not propose any changes to SBRM, and these sector monitoring standards would not change the process for determining NEFOP coverage rates.

4.1.1.1 Sector Monitoring Standard Option 1: No Action

If Option 1/No Action is adopted, groundfish monitoring target coverage level requirements would remain as defined in Amendment 16 and subsequent framework actions (FW 48 and FW 55). Electronic monitoring may be used if deemed sufficient by NMFS. Currently, the target at-sea monitoring/electronic monitoring coverage level must at least meet the CV precision standard specified in the Standardized Bycatch Reporting Methodology (currently a 30 percent CV) for discard estimates at the stock level for all sectors and gears combined. Additionally, sector coverage levels are calculated based on the most recent 3-year average of the total required coverage level (based on realized stock level CVs) necessary to reach the required CV for each stock, and are set using fishery performance criteria so that stocks that meet the performance criteria (not overfished, with overfishing not occurring according to the most recent available stock assessment, and that in the previous fishing year have less than 75 percent of the sector sub-ACL harvested, and less than 10 percent of catch comprised of discards) are not drivers for the annual coverage level. The minimum coverage level based on a CV standard is only appropriate for sector monitoring purposes if there is no evidence that behavior on observed and unobserved trips is different. If there is evidence that behavior is different, then a higher coverage level may be required to ensure the accuracy of discard estimates and to minimize the potential for bias in fisheries dependent information. Coverage levels are announced once the agency has completed its annual determination.

4.1.1.2 Sector Monitoring Standard Option 2: Fixed Total At-Sea Target Monitoring Coverage Level Based on a Percentage of Trips (*Preferred Alternative*)

A fixed target total at-sea monitoring coverage level would be identified and would replace the current CV standard (including the performance criteria) for deploying human at-sea monitors (Section 4.1.1.1: Option 1/No Action). One of the following coverage levels - an annual target coverage level of all sector trips - would be selected by the Council in this action and would apply to all future fishing years (unless changed in a subsequent action):

4.1.1.2.1 Sub-option 2A - 25 percent

4.1.1.2.2 Sub-option 2B - 50 percent

4.1.1.2.3 Sub-option 2C - 75 percent

4.1.1.2.4 Sub-option 2D - 100 percent (*Preferred Alternative*)

For whichever coverage rate is chosen, sectors would achieve the target monitoring standard through the use of human at-sea monitors, or through the options for substitute sector monitoring tools if selected by the Council in Section 4.1.2 of this action. Each sector would be responsible for meeting the target coverage rate at the sector level. The substitute options for sector monitoring tools are expected to achieve or exceed the monitoring standard. For example, under Sector Monitoring Tools Option 1, the camera would be on for the standard sub-option selected (25% -100% of trips), while for Tools Option 2 and 3, the camera would be on all the time (Section 4.1.2).

Total at-sea monitoring coverage is combined NEFOP and ASM. This measure would not change the trip selection system or any aspect of the process for how trips are selected for coverage and deployed.[1]

Rationale: The goal of a standard is to achieve a monitoring coverage level that ensures precise and accurate catch (landings and discards) estimation and minimizes the potential for biases in the estimates. A fixed at-sea monitoring coverage level removes uncertainty about what the level of monitoring coverage will be each year. For these options the coverage level would be set based on a percentage of trips, which is similar to the current method used to select trips for monitoring coverage.

The rationale for the Council's preferred alternative, at-sea monitoring coverage target of 100 percent of trips (Section 4.1.1.2.4) is that it increases the accuracy of catch estimates and reduces the potential for bias more than all the other options considered in this action. Coverage of 100 percent of trips is the only option that completely removes bias, and this option scores the highest in terms of compliance and enforcement of the monitoring program. The Council identified this option as preferred to get a sense of what is possible in this action under the maximum level of coverage. This option carries the highest estimate of cost; therefore, when this document is out for public hearing the Council hopes to solicit the broadest range of public comment possible to better understand the maximum costs associated with this action. In addition, the Council discussed that more data is needed in this fishery to improve the overall science; improved monitoring will not solve all of the issues facing the management plan, but this option will provide more information to support better management of this fishery. Finally, the Council discussed that when this option is combined with other measures in this document; specifically, additional monitoring tools (4.1.2) and removal of management uncertainty buffers (4.5), the increased costs to industry are minimized.

4.1.1.3 Sector Monitoring Standard Option 3: Fixed Total At-Sea Target Monitoring Coverage Level Based on a Percentage of Catch

This option would consider an alternative method to using a precision standard for determining target coverage levels for human at-sea monitors. The current CV standard for determining the annual coverage level target focuses on precision of discard estimates. The options below would instead focus on ensuring accurate and precise estimation of total catch (landings and discards) for each stock through fixed levels of independent verification.

A target percentage of the total catch (landings and discards combined) of each stock would be independently verified. This would replace the current CV standard (including the performance criteria) for deploying human at-sea monitors (Section 4.1.1.1: Option 1/No Action). One of the following verification levels - an annual target percentage of total catch to be independently verified for each allocated groundfish stock - would be selected by the Council and would apply to all future fishing years (unless changed in a subsequent action):

4.1.1.3.1 Sub-option 3A - 25 percent

4.1.1.3.2 Sub-option 3B - 50 percent

[1] See Northeast Fisheries Science Center, Fisheries Sampling Branch website for more information: https://www.nefsc.noaa.gov/fsb/notification.html

4.1.1.3.3 Sub-option 3C - 75 percent

4.1.1.3.4 Sub-option 3D - 100 percent

For whichever target coverage level is chosen, sectors collectively would be required to meet the target percentage of total catch to be independently verified for each allocated groundfish stock, targeted at the total sector sub-ACL level. Sectors would describe in their monitoring plans how the selected target coverage level of total catch for each allocated groundfish stock, targeted at the total sector sub-ACL level, would be achieved through a combination of monitoring tools. While these alternatives would set monitoring coverage based on a percentage of catch for each allocated stock, in practice coverage needs to be assigned at the trip level since it is not feasible to monitor percentage of total catch for each stock in-season across all sectors.

Simulations were performed in order to investigate what overall monitoring coverage levels would be necessary to achieve a given target percentage of total catch to be independently verified for any given allocated stock (see Section 7.5.3.1.3). The simulations, based on FY2018 catch data, suggest that the proportion of trips that need to be monitored to observe, for example, 50% of the total catch of each allocated stock varies considerably between stocks (see Figure 45 in Section). The simulations demonstrate that in order to achieve the given target percentage of total catch to be independently verified for each allocated groundfish stock within a given probability using FY2018 catch data, the overall coverage levels must be higher, effectively moving up a coverage level (e.g. 50% target coverage of each allocated stock would require 75% overall monitoring on trips through stratified random sampling) (see Section 7.5.3.1.3).

For example, based on the simulation analysis using FY2018 catch data (Section 7.5.3.1.3), if the Council selects a target of 50% of catch sub-option, this would mean in practice each sector would have a target coverage level of ~75% of trips. Should catch rates change for any of the stocks with high variability that are driving the overall coverage, the level of observer coverage needed to capture a given percentage of catch for these stocks, or any allocated stock, is likely to change, and therefore could be different each year depending on the previous year's catch rates. Each year, the stock with the lowest and most variable catch rate will drive the coverage rate needed to meet the catch percentage target while other stocks will likely far exceed that target, resulting in a total proportion of catch observed that is significantly higher than the target for many stocks. The required target level of catch monitoring may be met by human at-sea monitors, or the options for substitute sector at-sea monitoring tools in Section 4.1.2. The substitute options for sector monitoring tools are expected to achieve or exceed the monitoring standard. Total at-sea monitoring coverage is combined NEFOP and ASM.

Rationale: The goal of a standard is to achieve a monitoring coverage level that ensures precise and accurate catch (landings and discards) estimation and minimizes the potential for biases in the estimates. Specifically, the goal of these options is to set the target coverage level based on catch to help ensure an accurate estimate of total catch is independently verified. The premise is that a fixed percentage of coverage per stock would help ensure all stocks are being monitored at a minimum level. This option would have the same target percentage of coverage of catch for each stock, but the overall coverage rate may vary from year to year based on an analysis of the past year's catch data, and would need to be higher than the target percentage of catch in order to reliably achieve this target for each allocated stock.

4.1.2 Sector Monitoring Tools (Options for meeting monitoring standards)

The Council must first select a monitoring standard (target coverage level) from Section 4.1.1, before selecting one or more of the sector at-sea monitoring tools considered in this section. The Council could select more than one sector at-sea monitoring tool in this section. Depending on what the Council selects, sectors would have the option to select one or more of the following options for at-sea monitoring tools to address monitoring standards, to be used as a substitute at-sea monitoring tool for human at-sea monitors. These alternatives would create a suite of at-sea monitoring options that would be expected to achieve or exceed the monitoring standard selected in Section 4.1.1. Each sector would be given the flexibility to choose the at-sea monitoring options that best meet the needs of its members. Through their sector operations plans, sectors would develop monitoring plans that describe how the chosen substitute at-sea monitoring tools would achieve the selected monitoring standard.

The regulations at 648.87(b)(2)(v)(B) allow electronic monitoring to be used in place of human observers if the technology is deemed sufficient by NMFS for a specific trip type, based on gear type and area fished, in a manner consistent with the Administrative Procedure Act. Amendment 23 does not remove or alter that authority. However, if chosen, the tools in this section would be available for sectors to include in their operations plans without requiring a separate determination of sufficiency by NMFS. A sector operations plan, including the sector monitoring plan, would still require approval by NMFS. Additional forms of electronic monitoring (EM), beyond any selected in this section, would still be subject to approval or disapproval by NMFS. If the Council chooses to make additional monitoring tools a framework item (see Section 4.1.5), then the Council could use a future framework to approve additional tools that would be available for sectors to include in their operations plans without requiring a separate determination of sufficiency by NMFS. The intent is to make selected tools available now, but to also allow for the future development and adoption of additional tools.

The options below are at-sea monitoring tools that sectors could choose to achieve the monitoring standard selected in Section 4.1.1, as a substitute to human at-sea monitors. This action does not propose any changes to SBRM, and these substitute at-sea monitoring tools could not be used to replace NEFOP observers.

4.1.2.1 Sector Monitoring Tools Option 1 – Electronic Monitoring in place of Human At-Sea Monitors

Amendment 16 specified that electronic monitoring (EM) may be used in place of human observers or at-sea monitors if the technology is deemed sufficient by NMFS for a specific trip based on gear type and area fished.

This option would authorize sectors to choose EM to monitor catch in place of human at-sea monitors. EM would be run only on trips that are selected for coverage under the specified coverage rate or monitoring standard. For observed trips, observed discards from the vessel's EM video footage would be used as the discard record. Unobserved trips would have discards calculated using a rate based on all EM-monitored trips in the same strata by the vessel's sector.

This option would maintain the current authority of the Regional Administrator to approve EM. NMFS would develop equipment standards, video review standards, video storage requirements, and catch handling guidelines during implementation. The final video review rate would be selected by NMFS. After implementation, EM video review rates would be evaluated and possibly modified on a regular basis. Video review would be conducted by third-party providers. Cost allocation would follow the NOAA policy directive on cost allocation in electronic monitoring programs for Federally managed fisheries[2].

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[2] NMFS Procedure 04-115-02, Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries, May 7, 2019: https://www.fisheries.noaa.gov/national/laws-and-policies/science-and-technology-policy-directives

Vessel operators would be required to submit for review by NMFS an individual Vessel Monitoring Plan (VMP) that would document the installation of the EM system on the vessel and the vessel's specific plans and procedures for operations, catch handling, and maintenance. Vessels could not use EM unless NMFS approves the VMP for the vessel. The VMP would need to be carried on board the vessel to facilitate implementation and enforcement. NMFS will develop standards for VMPs that would likely include details such as: vessel summary; EM system overview; operator responsibilities; equipment breakdowns; installation details; guide for vessel operator; EM program contract; and signature page.

Rationale: The goal is to provide sectors with additional at-sea monitoring tools to monitor catch that ensure precise and accurate catch (landings and discards) estimation depending on the coverage rate selected above. This option may not eliminate some bias with lower coverage levels because the vessel knows when they are covered and when they are not. This option was considered to provide sectors with more flexibility related to monitoring because it allows EM as a direct replacement for human at-sea monitors on a trip-by-trip basis, which may be preferred by some vessels. A process by which NMFS selects video review rates during implementation and video review rates are evaluated and possibly modified on a regular basis would help to ensure accurate reporting and that costs are minimized to the extent practicable.

4.1.2.2 Sector Monitoring Tools Option 2 – Audit Model Electronic Monitoring Option (*Preferred Alternative*)

This option would approve the use of an audit model electronic monitoring program in place of human at-sea monitors, in which EM runs on 100 percent of trips and a subset of hauls or trips is reviewed to verify vessel trip report (VTR)-reported discards. Discards are required to be reported at the haul level, and the vessel operator must follow catch handling protocols for the camera to record species and length data for all discarded groundfish. For trips that meet the sector monitoring standards, VTR-reported discards would be used as the discard record and EM video would be used as an audit to validate the VTR-reported discards. Trips that do not meet the standards would have discards calculated using available data (either the EM data or another discard data source).

This option would maintain the current authority of the Regional Administrator to approve EM. The video review rate would be selected by NMFS to ensure accurate VTR reporting, and may be reduced in the future through evaluations of the data by NMFS, particularly for vessels that report accurately. NMFS would develop standards for the audit model EM during implementation that address equipment requirements, video review standards, video storage requirements, and catch handling guidelines. The final video review rate would be selected by NMFS. The EM video review rates for the audit model EM option would initially be similar to guidance provided from NMFS in its proposed EM option for sectors[3]; for example, 50 percent of trips (or hauls) as a rate for Year 1 of the program, 30 percent of trips (or hauls) for Year 2 or 50 percent for vessels not meeting reporting requirements, and 15 percent of trips (or hauls) in Year 3. Additionally, there would be the potential for increased review rates, up to 100 percent, for vessels not meeting reporting requirements. Ultimately, NMFS has authority to set final EM video review rates, and rates may vary by vessel, especially if vessels have demonstrated acceptable compliance (i.e. extensive experience with EM under a NMFS approved Exempted Fishing Permit (EFP)). After implementation, EM video review rates would be evaluated by NMFS and possibly modified on a regular basis. Video review would be conducted by third-party providers. Cost allocation would follow the

[3] Letter from NMFS to the Council: "Letter to NEFMC re approval of audit-model EM and video review rates", dated November 26, 2019: https://s3.amazonaws.com/nefmc.org/191126_Letter_GARFO-to-NEFMC-re-approval-of-audit-model-EM-and-video-review-rates.pdf

NOAA policy directive on cost allocation in electronic monitoring programs for Federally managed fisheries[4].

Vessel operators would be required to submit for review by NMFS an individual Vessel Monitoring Plan (VMP) that would document the installation of the EM system on the vessel and the vessel's specific plans and procedures for operations, catch handling, and maintenance. Vessels could not use EM unless NMFS approved the VMP for the vessel. The VMP would be carried on board the vessel to facilitate implementation and enforcement. NMFS will develop standards for VMPs that would likely include details such as: vessel information summary; EM system overview; operator responsibilities; equipment breakdowns; installation details; guide for vessel operator; EM program contract; and signature page.

Rationale: The goal of this alternative is to provide sectors with additional at-sea monitoring tools to monitor catch that ensure precise and accurate catch (landings and discards) estimation and minimize the potential for biases in the estimates because EM is on 100% of trips. This option offers an EM solution that is completely free of "pre-trip selection logistics" and bias. One important element of this option is that it maximizes the value of vessel-reported discard data in management because under this option the VTR-reported discards are the default record, while the EM serves as an audit of the industry reported VTR. This model was initially designed for lower volume groundfish trips since it requires extra catch handling.

Additionally, this option helps to incentivize reducing regulatory discards, which is goal #3 of the groundfish monitoring program. A process by which NMFS selects video review rates during implementation and video review rates are evaluated and possibly modified on a regular basis would help to ensure accurate reporting and that costs are minimized to the extent practicable, consistent with monitoring program goal #2 (reduce costs of monitoring). The Council identified this alternative as preferred mainly to get monitoring costs down because of comments that the cost of human at-sea monitors is not considered feasible for this fishery. The analyses suggest when both Sector Monitoring Tools Option 2 and Option 3 are available to vessels, costs of 100% monitoring may be considerably cheaper—between 44% and 60% less than humans alone when costs are compared over a three year period.

4.1.2.3 Sector Monitoring Tools Option 3 - Maximized Retention Electronic Monitoring Option (*Preferred Alternative)*

This option would approve the use of a maximized retention model with electronic monitoring for sectors to use in place of human at-sea monitors, in which EM runs on 100 percent of trips and verifies that all allocated groundfish are landed, paired with dockside monitoring for catch verification. For this approach, vessels would be required to land all allocated groundfish of all sizes, i.e. only prohibited fish could be discarded. This would eliminate the need to monitor allocated groundfish discards at sea. All allocated groundfish species would be retained and verified by dockside monitoring and accounted for through dealer reports. Discards of prohibited groundfish stocks at-sea would still need to be monitored and accounted for by requiring the vessel operator to make all allowable discards within view of the camera. The vessel operator also would be required to sort the catch and retain all allocated groundfish, keeping the sublegal groundfish separate for accounting.

To ensure compliance and full catch accountability, this option would include 100 percent dockside monitoring and 100 percent electronic monitoring of all trips. Vessels participating in the maximized retention EM model would be required to have dockside monitoring on 100 percent of trips, whether or

[4] NMFS Procedure 04-115-02, Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries, May 7, 2019: https://www.fisheries.noaa.gov/national/laws-and-policies/science-and-technology-policy-directives

not dockside monitoring is implemented for the fishery as a whole or is implemented with reduced rates for some vessels or ports. Similar to the audit model option, video review rates could be much lower than 100 percent when vessels are determined to be complying with relevant protocols.

This option would maintain the current authority of the Regional Administrator to approve EM. NMFS would develop standards for the maximized retention model EM during implementation that address equipment requirements, video review standards, video storage requirements, and catch handling guidelines. The final video review rate would be selected by NMFS; rates may vary by vessel, especially if vessels have demonstrated acceptable compliance (i.e. extensive experience with EM under a NMFS approved EFP). After implementation, EM video review rates would be evaluated by NMFS and possibly modified on a regular basis. Video review would be conducted by third-party providers. Cost allocation would follow the NOAA policy directive on cost allocation in electronic monitoring programs for Federally managed fisheries[5].

Vessel operators would be required to submit for review by NMFS an individual Vessel Monitoring Plan (VMP) that would document the installation of the EM system on the vessel and the vessel's specific plans and procedures for operations, catch handling, and maintenance. Vessels could not use EM unless NMFS approved the VMP for the vessel. The VMP would be carried on board the vessel to facilitate implementation and enforcement. NMFS will develop standards for VMPs that would likely include details such as: vessel information summary; EM system overview; operator responsibilities; equipment breakdowns; installation details; guide for vessel operator; EM program contract; and signature page.

Rationale: The goal of this alternative is to provide sectors with additional at-sea monitoring tools to monitor catch that ensures precise and accurate catch (landings and discards) estimation while simultaneously reducing regulatory discards, and to provide sectors with more flexibility in monitoring. Similar to Option 2, this option offers an EM solution that is completely free of pre-trip selection logistics and bias that maximizes the value of fishery dependent information in management. This option may be better suited for large-volume vessels where the catch handling protocols of the audit model present logistical challenges.

Additionally, this option helps to incentivize reducing regulatory discards, which is a goal #3 of the groundfish monitoring program. A process by which NMFS selects video review rates during implementation and video review rates are evaluated and possibly modified on a regular basis would help to ensure accurate reporting and that costs are minimized to the extent practicable, consistent with monitoring program goal #2 (reduce costs of monitoring). The Council identified this alternative as preferred mainly to get monitoring costs down because of comments that the cost of human at-sea monitors is not considered feasible for this fishery. The analyses suggest when both Sector Monitoring Tools Option 2 and Option 3 are available to vessels, costs of 100% monitoring may be considerably cheaper—between 44% and 60% less than humans alone when costs are compared over a three year period.

4.1.3 Total Monitoring Coverage Level Timing

4.1.3.1 Coverage Level Timing Option 1: No Action

The timing for announcing the required total monitoring coverage has varied over time (see Table 64 in Section 6.6.10.2). Currently, NMFS publishes the total monitoring coverage level once the necessary analysis is completed. Typically, analysis to determine the at-sea monitoring (ASM) coverage level is

[5] Ibid

available sooner than the Standardized Bycatch Reporting Methodology (SBRM) analysis used to determine the Northeast Fisheries Observer Program (NEFOP) coverage level.

Current regulations set December 1 as the deadline for sectors to submit preliminary rosters, but grant NMFS flexibility to set a different date. For example, in FY 2013, managers asked for a later date, and they agreed on March 29, 2013. Beginning in FY 2014, NMFS established a standard roster deadline of four weeks after potential sector contribution (PSC) letters are sent out, although in several years, there have been agreed-upon extensions. There have been several years throughout FY2010 to FY2019 in which the date sector rosters were due occurred before the date the total monitoring coverage rate was announced (see Table 64 in Section 6.6.10.2). This can complicate groundfish fishery participant's business planning as the decision of whether or not to participate in sectors for the upcoming fishing year may be influenced by the monitoring coverage rate for a given year.

Option 1/No Action would continue the current process of making the total monitoring coverage level available once the necessary analyses are completed.

4.1.3.2 Coverage Level Timing Option 2: Knowing Total Monitoring Coverage Level at a Time Certain

This measure would consider a time certain for knowing the total monitoring coverage level as a target date of three weeks prior to the annual sector enrollment deadline set by NMFS. This option would apply to the current coefficient of variation (CV) method for determining total coverage levels under the No Action (Section 4.1.1.1 Option 1/No Action). This option also applies to the option for a fixed total monitoring coverage level based on a percentage of catch (Section 4.1.1.3/Option 3) because, while the target percentage of catch to be verified for each allocated groundfish stock would be fixed, the overall coverage level necessary to achieve the target could vary annually, as this requires an analysis of the previous year's catch data. This option does not apply to the option for a fixed total monitoring coverage level based on a percentage of trips (Section 4.1.1.2/Option 2).

This measure identifies knowing the target monitoring coverage level at a specific date in advance of the start of the fishing year to facilitate business planning by permit holders and sectors. The feasibility of setting a fixed date is related to the method used for setting coverage rates and the desired timeliness of the underlying data used in the analysis.

Certain alternatives for determining target monitoring coverage levels may not require extensive analysis to determine target coverage levels for the upcoming fishing year. For example, alternatives for fixed target coverage levels would provide sectors a clear understanding of the target monitoring coverage level for upcoming years. However, alternatives that base the coverage rate on an analysis of past years' data, such as the current coefficient of variation (CV) method for determining total coverage levels (Section 4.1.1.1 Option 1/No Action), as well as Option 3, which requires an analysis of catch levels from the previous year to determine the overall target coverage as a percentage of trips that would be needed to achieve the percentage of coverage target for each groundfish stock, must trade off timeliness of the data available with completion of the analysis by the deadline. A desire to know the total monitoring coverage level at an earlier date will require the use of less recent data in order to complete the analysis by the earlier deadline.

Rationale: Knowing the target total monitoring coverage level at a specific date in advance of the start of the fishing year would provide flexibility to groundfish fishery participants by making the necessary information available for participants to decide whether to participate in sectors for the upcoming year, to finalize their business planning, and to negotiate with at-sea monitoring providers prior to the start of the upcoming fishing year.

4.1.4 Review Process for Sector Monitoring Coverage

4.1.4.1 Coverage Review Process Option 1: No Action

Under Option 1/No Action, the efficacy of sector monitoring coverage rates would not be reviewed on a prescribed basis. The groundfish monitoring program would continue to be reviewed as part of the goals and objectives of the groundfish sector monitoring program through Goal 6: Perform periodic review of monitoring program for effectiveness (see Section 3.3.2 for the complete list of goals and objectives of the groundfish monitoring program).

4.1.4.2 Coverage Review Process Option 2: Establish a Review Process for Monitoring Coverage Rates (*Preferred Alternative)*

This measure would establish a review process to evaluate the efficacy of sector monitoring coverage rates, to occur once two full fishing years of data is available and periodically thereafter. The review process is intended to be flexible and somewhat general, but would include establishing metrics and indicators of how well the monitoring program improved accuracy while maximizing value and minimizing costs. The review process will be further developed when the Council selects its preferred alternative for the sector monitoring standards that set coverage levels (Section 4.1.1) because the scope of the review would be different if 100 percent coverage levels are selected compared to 25 percent. For example, if the Council selects monitoring standards of 100 percent in this action, a review process would be more limited because there would be comprehensive monitoring. Under that scenario a review would likely include metrics such as discard estimate CVs and a measure of how catch (discards and landings) changed following comprehensive monitoring.

On the other hand, if the Council selects a lower monitoring standard (25 percent, 50 percent, or 75 percent, or No Action (no set standard)), it would likely be necessary to include additional metrics in a review to ensure monitoring targets are being met and they are effective. For example, the review process with lower standards would likely include analyses of whether the program is operating in a way the Council intended, is catch accurately being measured, is there is evidence of bias, are monitoring standards being met, etc. This review would most likely be done by the Groundfish Plan Development Team (PDT) with substantial support by other relevant NEFSC and GARFO staff. Establishment of a review process for monitoring coverage rates may result in an adjustment to the goals and objectives of the groundfish monitoring program (see Section 3.3.2).

Rationale: Periodic review of the monitoring coverage rates will allow for an evaluation of whether the monitoring program is meeting the goal of improved accuracy of catch data, while maximizing value and minimizing costs of the program through a future action. The Council identified this option as preferred to ensure the Council evaluates this program to be sure enhanced levels of monitoring data are working as intended and the increased costs to industry are providing expected benefits from improved accuracy and reduced potential for bias in catch data.

4.1.5 Addition to List of Framework Items (*Preferred Alternative)*

Many management measures can be adjusted through a framework action. This alternative would add the following to the list of measures that can be adjusted in the future:

- Addition of new sector monitoring tools that meet or exceed the Council's selected monitoring standard.
  The regulations at 648.87(b)(2)(v)(B) allow electronic monitoring to be used in place of human observers if the technology is deemed sufficient by NMFS for a specific trip type, based on gear type and area fished, in a manner consistent with the Administrative Procedure Act. Amendment 23 does not remove or alter that authority. Amendment 23 includes options for electronic monitoring that are based on technology would be available for sectors to include in their operations plans without requiring a separate determination of sufficiency by NMFS. Further evolution of technology or development of analytical methods could lead to additional or better tools for achieving the goals of the monitoring program. It is beyond Amendment 23 to forecast technology changes, but it is expected that in the future there may be additional technologies that would benefit the monitoring program that the Council could adopt through a framework. The intent is to make selected tools available now, but to also allow for the future development and adoption of additional tools.

- Vessel specific coverage levels.
  A vessel-specific coverage level would require each vessel to meet the target coverage level, rather than evaluating the target at the sector level. The intent would be to reduce the variation in the amount of industry-funded monitoring coverage each vessel is responsible for. This would not ensure equal industry-funded coverage and would not increase equity in total coverage because the observer coverage from the Northeast Fisheries Observer Program would continue to be set based on the Standardized Bycatch Reporting Methodology and other requirements independent of the industry-funded coverage target. A vessel-specific coverage target could increase parity in monitoring costs between vessels, but may also lead to higher overall coverage and costs if government-funded observer coverage does not count towards fulfillment of the industry-funded monitoring coverage target.

Rationale: The intent through Amendment 23 is to identify a range of monitoring tools that the Council would select and NMFS would approve for use by sectors to achieve the selected monitoring standard. Should new monitoring tools become available in the future, allowing these to be considered for use by sectors through a framework adjustment facilitates more efficient incorporation of new monitoring tools into the groundfish monitoring program. Additionally, there is interest in considering vessel specific coverage levels, which may be best done in a future action after the monitoring coverage level and monitoring tools have been selected in this action, as the issues surrounding vessel specific coverage levels are different at lower coverage levels than at higher levels and may vary depending on the monitoring tool. Furthermore, adjustments have been made to the PTNS system in recent years, and if improvements are not realized the Council can initiate a future framework action to address concerns about unequal coverage rates including vessel specific coverage levels.

4.2 COMMERCIAL GROUNDFISH MONITORING PROGRAM REVISIONS (SECTORS AND COMMON POOL)

The following measures in this section apply to both the sector and common pool segments of the commercial groundfish fishery.

4.2.1 Dockside Monitoring Program (Sectors and Common Pool)

4.2.1.1 Dockside Monitoring Option 1: No Action (*Preferred Alternative)*

There is currently no requirement for dockside monitoring for the groundfish fishery. However, any sector can choose to develop and implement a dockside monitoring program as part of its operations plan, through approval by NMFS. Amendment 16 established a dockside monitoring program in the groundfish fishery, in order to verify landings of a vessel at the time it is weighed by a dealer and to certify the landing weights are accurate as reported on the dealer report. The dockside monitoring program was in place for FY2010 and part of FY2011, and set coverage levels at 50 percent of trips for FY2010 and 20 percent of trips in subsequent years. The dockside monitoring requirement was later eliminated (FW 48), because the information collected through the dockside monitoring program duplicated information collected by dealers, and in part due to unresolved issues that reduced the utility of the program data. More information on the previous dockside monitoring program can be found in Section 6.6.10.1.1and in the Groundfish Plan Development Team Dockside Monitoring Discussion Paper (Appendix III).

Option 1/No Action would not require dockside monitoring for the groundfish fishery, except as part of the maximized retention electronic monitoring option if that is selected. Sectors would continue to have the ability to develop and implement a dockside monitoring program as part of their operations plans.

Rationale: The Council identified this option as preferred at this time because there are concerns that there may not be sufficient resources to review and use the data from a dockside monitoring program. The data may be collected, but if the resources are not there to review it to verify landings, the utility of the program is reduced. In addition, there are concerns that the economic burden of this program would likely fall on the crew, and become a trip expense that would be paid for by the crew, regardless of whether the program is funded by dealers or vessels. Depending on how the program is implemented, there may be unintended consequences from effort shifts and changes in where vessels land as a result of a mandatory dockside monitoring program. Overall, there are still many concerns surrounding the previous dockside monitoring program that was implemented and removed several years ago.

4.2.1.2 Dockside Monitoring Option 2: Mandatory Dockside Monitoring Program for the Commercial Groundfish Fishery

This measure would develop a mandatory dockside monitoring (DSM) program for the commercial groundfish fishery (sectors and common pool) requiring 100 percent coverage of groundfish trips. If adopted, this requirement would also apply to sector vessels fishing exclusively with extra-large mesh (ELM) gillnets of 10 inches (25.4 cm) or greater on a sector trip fishing exclusively in the SNE/MA and Inshore GB Broad Stock Areas that are currently removed from at-sea monitoring requirements (see Section 4.6.1).

The following measures would create a DSM program for the groundfish fishery that would focus on monitoring landings by independently verifying that landed catch is weighed and accurately reported by dealers. The goal of the DSM program is to verify dealer-reported landings (species and weights) by providing an independent landings data stream that may be compared to dealer-reported landings in order to ensure accurate accounting of landings.

This measure would maintain dealer reports as the official record, and the dockside monitor report would be used as a comparison to the dealer report. During implementation, NMFS would establish a process to reconcile discrepancies between a dealer report and dockside monitor report, as well as a process for instances in which discrepancies between a dealer report and dockside monitor report are unable to be reconciled. This could, for example, include recommendation that NOAA's Office of Law Enforcement (OLE) be involved in reviewing and investigating discrepancies between dockside monitor and dealer reported landings. This measure would include requirements for reporting in a format usable by existing data systems be a contract requirement for dockside monitor providers to meet, so that dockside monitoring data could be easily tracked and compared to dealer data. Dockside monitor providers will provide data to NMFS as specified by the Regional Administrator.

For instances in which a trip that is selected for monitoring chooses to offload landings to a truck before weighout at a dealer (i.e. offloaded in one port and trucked to a dealer in another port or location), the dockside monitor(s) will monitor landings at the point of offload (e.g. offloads to a truck) and at the dealer where weighout occurs, because the goal of the DSM program is to ensure the accuracy of dealer reports and allow for independent verification of landings. The details of this requirement would be specified by NMFS.

Rationale: The goal is to establish a dockside monitoring program that allows for independent verification of landings for the entire commercial groundfish fishery, which will ensure accurate reporting by dealers, ensure species are reported correctly, improve the fair market value for landed fish, and add unique value to current enforcement activities. Maintaining dealer reports as the official landings record would make program implementation simpler as it would not require extensive changes to the current data management system. Further, the Enforcement Committee recommended that the dealer report remain the official record. An established process for reconciling discrepancies between the dealer and dockside monitor report may help to incentivize accurate reporting and would give the dockside monitor reports increased utility as an independent verification tool.

If Option 2 is selected, the Council would choose from the following sub-options under "Dockside Monitoring Program Structure and Design" to determine the responsibility of DSM program costs and how the DSM program will be structured, and to specify details of the DSM program. Many of the options below are designed to address issues identified with the previous dockside monitoring program that reduced the utility of the information collected by the program.

4.2.2 Dockside Monitoring Program Structure and Design

4.2.2.1 Dockside Monitoring Program Funding Responsibility

Two different options for the responsibility of the costs of dockside monitoring, either as a dealer-funded program (Option A) or a vessel-funded program (Option B), are outlined below. For either option, dockside monitoring would follow cost sharing responsibilities for industry-funded monitoring programs, in which "industry would be responsible for costs directly attributable to the sampling portion of a monitoring program, and NMFS would be responsible for costs directly attributable to the administrative portion of the monitoring program…"[6] If a fixed rate of coverage is required, then fishing effort would need to be reduced to match the level of monitoring that can be covered by available funding for

[6] NEFMC. Environmental Assessment for the Industry-Funded Monitoring Omnibus Amendment. December 2018.

shoreside costs. Alternatively, the program would have to address how the fishery would operate if NMFS is unable to fund its shoreside costs for coverage at the specified level (see Section 4.4.2.2). NMFS would develop standards for any dockside monitoring program whether it was a dealer responsibility or a vessel responsibility.

4.2.2.1.1 Dockside Monitoring Funding Responsibility Option A - Dealer Responsibility

If this option is chosen, groundfish dealers (dealers receiving >1 pound of groundfish from federal permit holders) would be responsible for the costs of dockside monitoring. Dealers would be required to implement an independent third-party dockside monitoring system for monitoring landings. The details of the dockside monitoring system must be provided in the dealer's dockside monitoring plan. Each dealer would prepare a dockside monitoring plan that covers the specifics of how the required dockside monitoring program will be implemented at their location (e.g., site plan, safety plan) and how to ensure all landings of groundfish are monitored, that must be reviewed and approved annually by NMFS in order for the dealer to purchase groundfish. NMFS will develop standards for dockside monitoring plans if implemented and would likely include details such as: site layout plan; description of offloading and sorting spaces, how catch is accurately sorted, weighed, and recorded; methods to prevent unsorted catch from entering areas other than sorting areas; scales used and location; and catch monitor's observation area.

Rationale: The goal of the dockside monitoring program is to verify landings (species and weights) by providing an independent landings data stream that may be compared to dealer-reported landings in order to ensure accurate reporting by dealers.

4.2.2.1.2 Dockside Monitoring Funding Responsibility Option B - Vessel Responsibility

Under this option, vessels would be responsible for the costs of dockside monitoring. Each sector would be required to develop and implement an independent third-party dockside monitoring system that is satisfactory to NMFS for monitoring landings. For common pool vessels, there would need to be detailed dockside monitoring program standards for these vessels to follow, as opposed to individual dockside monitoring plans for each common pool vessel.

Rationale: The goal of the dockside monitoring program is to verify landings (species and weights) by providing an independent landings data stream that may be compared to dealer-reported landings in order to ensure accurate accounting of landings for the entire commercial groundfish fishery.

4.2.2.2 Dockside Monitoring Program Administration

4.2.2.2.1 Dockside Monitoring Administration Option A - Individual contracts with dockside monitor providers

Individual dealers or vessels (depending on the option selected above) would be required to contract directly with third-party dockside monitor providers and provide a copy of the contract to NMFS to have their dockside monitoring plans approved. Vessels enrolled in sectors would be covered by a monitoring plan included in their sector's operations plans and the sector would contract directly with monitoring providers. A copy of each contract would need to be provided by either the sector, the common pool vessel, or the dockside monitoring provider, as specified by NMFS.

Rationale: The ability for dealers or sectors/vessels to directly negotiate and contract with third-party dockside monitors provides increased flexibility. Sectors currently contract directly with third-party providers for at-sea monitors.

4.2.2.2.2 Dockside Monitoring Administration Option B – NMFS-administered dockside monitoring program

This measure would create a single dockside monitoring program for all dealers or sectors/vessels to use, contracting through independent third-party dockside monitor providers. Multiple monitoring providers could be approved to provide services, maintaining competition. Unlike other regions, NMFS does not have authority to collect funds for monitoring. If this approach was pursued, NMFS would set up and administer the program, but dealers or sectors/vessels would be directly billed by the providers. Parties would not be required to directly contract.

Rationale: A single, NMFS-administered dockside monitoring program for all dealers or vessels would simplify program implementation compared to having individual dealer or sector/common vessel contracts with dockside monitor providers. This would particularly simplify the process for common pool vessels.

4.2.2.3 Options for Lower Dockside Monitoring Coverage Levels (20 percent coverage)

These measures would allow lower levels of dockside monitoring for either ports or vessels with low groundfish landings. For instances in which a trip that is selected for monitoring chooses to offload landings to a truck before weighout at a dealer (i.e. offloaded in one port and trucked to a dealer in another port or location), the dockside monitor(s) will monitor landings at the point of offload (e.g. offloads to a truck) and at the dealer where weighout occurs, because the goal of the DSM program is to ensure the accuracy of dealer reports and allow for independent verification of landings. The details of this requirement would be specified by NMFS NMFS.

The Council could choose one or both of these options.

In addition to possible options for lower coverage levels for ports or vessels with low groundfish landings considered in this section, this action also considers options to fully remove dockside monitoring requirements (if implemented) for some vessels based on fishing location (Section 4.6.2 and 4.6.3), that likely include some of the same vessels.

4.2.2.3.1 Option A – Lower coverage levels for <u>ports</u> with low volumes of groundfish landings

This option would allow for lower levels of dockside monitoring for low groundfish volume ports to act as a "spot check." Dockside monitors would be randomly assigned to offloads at these ports at a coverage level less than 100 percent - the target would instead be 20%.

Offloads at ports that received ~98 percent of total annual groundfish landings for 2016-2018 based on port of landing would be monitored at 100 percent coverage. These "major" ports are the top nine in groundfish landings – New Bedford, MA; Gloucester, MA; Boston, MA; Portland, ME; Chatham, MA; Point Judith, RI; Seabrook, NH; Rye, NH; and Portsmouth, NH. Offloads in these nine major ports would be monitored at 100 percent coverage, whether dockside monitoring is a dealer-funded program or a vessel-funded program. All other ports would be considered "low volume" as characterized by lower landings volumes, and offloads in these ports would be monitored at the lower coverage levels of 20 percent. This means that ports which land approximately 2 percent of total groundfish pounds would be exempted from 100 percent coverage and offloads in these ports would be monitored at 20 percent coverage instead, as a spot check.

Originally, when this alternative was first being developed the criteria used to determine the ports that would be considered low volume and would be subject to lower coverage were those ports with total annual groundfish landings volumes in the 5th percentile of total annual landings volume from 2016-2018. Under the 5th percentile criteria the major ports were: New Bedford, MA; Gloucester, MA; Boston, MA; Portland, ME. However, the list of major ports was expanded to the top nine in order to address concerns about landings of individual stocks, particularly stocks of concerns due to poor stock status. There are several stocks in relatively poor condition that are landed primarily in one or two ports that fall outside the list of major ports using the original criteria, such as Southern New England stocks landed in Point Judith, RI for example. Therefore, the criteria was expanded to shift several ports that fall within the top nine ports for groundfish landings into the 100 percent dockside monitoring category to improve monitoring of landings for those stocks. This measure would include a periodic re-evaluation of what constitutes a "low volume port" based on landings volumes, to occur after two years of landings data is available and every three years after that.

This option would also include incentives to accurately report landings. For dealers located in low volume ports that are subject to lower dockside monitoring coverage, their dockside monitoring coverage rate could increase if their dealer reports are not similar to the dockside monitor reports. For vessels landing in remote ports that are subject to lower dockside monitoring coverage, their dockside monitoring coverage rate could increase if their vessel hail-in reports are not similar to the dockside monitor reports. Comparisons could be done for each trip subject to coverage. The details would be developed and specified by NMFS. During implementation, NMFS would establish a process to compare corresponding dealer reports and dockside monitor reports, as well as a process for increasing a dealer's dockside monitoring coverage rate if their dealer reports are not similar to the dockside monitor reports.

Rationale: There are operational challenges with conducting dockside monitoring in low volume ports where landings volumes may be low and infrequent, including logistical difficulties with timely notice to a provider that a dockside monitor is needed. Lower coverage levels for these low volume ports may minimize costs and improve feasibility of the overall dockside monitoring program. Monitoring levels are assigned in proportion to the risk of potential catch misreporting (by volume). Increasing the coverage rate should dealer reports or vessel hail-in reports not be similar to the dockside monitor reports would focus resources on problem areas and help to incentivize accurate reporting of landings.

4.2.2.3.2 Option B – Lower coverage levels for vessels with total groundfish landings volumes in the 5th percentile of total annual landings

This option would allow for lower levels of dockside monitoring for low volume vessels to act as a "spot check." Dockside monitors would be randomly assigned to offloads of these vessels at a coverage level less than 100 percent - the target would instead be 20%.

Vessels with total annual groundfish landings volumes in the 5th percentile of total annual landings volume from 2016-2018 were determined to be low volume and offloads from these vessels would be monitored at a lower "spot check" coverage. This means that vessels which land approximately 5 percent of total groundfish pounds each year would be exempted from 100 percent coverage and offloads from these vessels would be monitored at 20 percent coverage instead, as a spot check. Vessels that landed 95 percent of groundfish for 2016-2018 would have 100 percent coverage of their offloads monitored. The vessels that cover ~95 percent of total groundfish landings are those that landed 46,297lbs or more annually on average from 2016-2018. Offloads from vessels landings 46,297lbs or more annually, would be monitored at 100 percent coverage, whether dockside monitoring is a dealer-funded program or vessel-funded program. Offloads from vessels with annual landings volumes of less than 46,297lbs would be monitored at the lower coverage rate of 20 percent. When this criteria is used, there are 97 unique sector or common pool vessels over 2016-2018 that would be included in this option (see Section 7.5.4.2.3.2). This measure would include a periodic re-evaluation of what constitutes a "low volume vessel" based on landings volume, to occur after two years of landings data is available and every three years after that.

This option would also include incentives to accurately report landings. For low volume vessels that are subject to lower dockside monitoring coverage, their dockside monitoring coverage rate could increase if their vessel hail-in reports are not similar to the dockside monitor reports. For dealers receiving offloads from low volume vessels that are subject to lower dockside monitoring coverage, their dockside monitoring coverage rate could increase if their dealer reports are not similar to the dockside monitor reports. Comparisons could be done for each trip subject to coverage. The details would be developed and specified by NMFS. During implementation, NMFS would establish a process to compare corresponding vessel hail-in reports and dockside monitor reports, as well as a process for increasing a vessel's dockside monitoring coverage rate if their vessel hail-in reports are not similar to the dockside monitor reports.

Rationale: There are operational challenges with conducting dockside monitoring for low volume vessels, many of which may land in small, remote ports, including logistical difficulties with notifying a provider that a dockside monitor is needed with sufficient notice. Lower coverage levels for these low volume vessels may minimize costs and improve feasibility of the overall dockside monitoring program. Monitoring levels are assigned in proportion to the risk of potential catch misreporting (by volume). Increasing the coverage rate should dealer reports or vessel hail-in reports not be similar to the dockside monitor reports would help to incentivize accurate reporting of landings.

4.2.2.4 Dockside Monitoring Fish Hold Inspection Requirements

4.2.2.4.1 Fish Hold Inspection Option A - Dockside monitor fish hold inspections required

This measure would require fish hold inspections and would require that monitors be allowed to access the fish hold of vessels directly to verify that all of the retained catch is offloaded and accounted for at the conclusion of an offload. This option would require that the dockside monitoring service provider is responsible for providing insurance coverage associated with having monitors inspect the fish hold of the vessel, similar to how at-sea monitor and observer providers are responsible for providing insurance coverage for at-sea observers on board vessels. Due to safety reasons, dockside monitors would only enter fish holds that have been emptied and therefore would be unlikely to have captured gases. This measure would also allow dockside monitors to forego a fish hold inspection due to safety concerns, and would require the dockside monitor to document the reason why a fish hold inspection could not be conducted.

Rationale: Fish hold inspections at the conclusion of an offload are an important component to dockside monitoring in order to ensure that all landings have been accounted for and independently verified. Requiring dockside monitor providers to carry insurance coverage for dockside monitors inspecting fish holds may address liability concerns with having dockside monitors directly inspect fish holds (although there may be additional individual vessel insurance concerns). Specifying that dockside monitors only enter fish holds that have been emptied and allowing dockside monitors to forego a fish hold inspection due to safety concerns would address safety concerns.

4.2.2.4.2 Fish Hold Inspection Option B – Alternative methods for inspecting fish holds (cameras)

This measure would require fish hold inspections, and would allow for inspections to be done by either a human dockside monitor directly accessing the fish hold, or through the use of cameras to verify that all of the retained catch is offloaded and accounted for, as an alternative method to dockside monitors directly accessing fish holds for inspections. The use of cameras as an alternative to human dockside monitors directly accessing fish holds may be particularly well suited for use on vessels with EM systems. A vessel using EM could have camera placement to cover its holds included in the vessel monitoring plan submitted for approval by NMFS. Alternatively, dockside monitors responsible for checking a hold is empty could use cameras remotely (e.g., on poles).

Rationale: Fish hold inspections at the conclusion of an offload are an important component to dockside monitoring in order to ensure that all landings have been accounted for and independently verified, however, there are safety and liability concerns with having dockside monitors inspect fish holds. Alternatives to having dockside monitors directly inspect fish holds, such as the use of cameras, ensure that fish hold inspections still occur as part of dockside monitoring while mitigating safety and liability concerns associated with dockside monitors inspecting fish holds. Allowing a choice between using human dockside monitors directly accessing fish holds or cameras to inspect fish holds provides increased flexibility.

4.2.2.4.3 Fish Hold Inspection C – No fish hold inspection required, captain signs affidavit

This option would not require inspections of fish holds at the conclusion of an offload as a part of dockside monitoring, and instead would require captains to affirm whether the vessel's hold still contains groundfish, subject to the penalties of perjury. This could be incorporated into a vessel trip report rather than being a new document.

Rationale: There are safety and liability concerns with having dockside monitors inspect fish holds. An alternative model to having dockside monitors inspect fish holds is to require captains to sign an affidavit, subject to the penalties of perjury, certifying that all catch has been removed from the fish hold concluding the offload, or an estimate of retained catch.

4.3 SECTOR REPORTING

The alternatives in this section will consider changes to the administration of the groundfish sector reporting system.

4.3.1 Sector Reporting Option 1: No Action

Currently, sectors are required to report all landings and discards by sector vessels to NMFS on a weekly basis. Additionally, sectors are required to submit annual year-end reports (Amendment 13 and Amendment 16). Current regulations require that approved sectors must submit an annual year-end report to NMFS and the Council, within 60 days of the end of the fishing year, that summarizes the fishing activities of its members, including harvest levels of all species by sector vessels (landings and discards by gear type), enforcement actions, and other relevant information required to evaluate the performance of the sector. More information on sector reporting requirements and the NMFS year-end report guidance can be found in Section 6.6.10.1.

Option 1/No Action would continue to require sectors to report all landings and discards to NMFS on a weekly or daily basis, and would continue to require that sectors submit annual year-end reports to NMFS and the Council.

4.3.2 Sector Reporting Option 2 - Grant Regional Administrator the Authority to Streamline Sector Reporting Requirements

This measure would grant the Regional Administrator authority to revise the sector monitoring and reporting requirements currently prescribed in the regulations [648.87(b)(1)(v) and (vi)] to streamline the sector reporting process. For example, this could include eliminating the requirement for sectors to submit weekly and daily reports in lieu of the agency providing monitoring summaries for the sectors to use while continuing reconciliation to confirm accuracy.

Currently, sectors must report all landings and discards by vessels to NMFS on a weekly basis. At the time this was developed, sectors were expected to use real-time information from their vessels to monitor catch. In practice, NMFS provides sector managers with a weekly download of official trip data (dealer and VTR landings data, observer discard data, and calculated discard rates for unobserved trips), which most sectors use to update their sector accounting and then submit a weekly report to NMFS. Some sectors use data collected directly from vessels in their reports. Data reconciliation occurs regularly between the sectors and NMFS to improve monitoring accuracy by identifying and resolving any data errors in either the sector's or NMFS' information.

A more efficient process might be developed that would still involve timely monitoring and reconciliation of data sources between sectors and NMFS. If deemed sufficient by the Regional Administrator, an alternative to the process currently prescribed in the regulations may satisfy the need to:

- Summarize trips validated by dealer reports;
- Oversee the use of electronic monitoring equipment and review of associated data;
- Maintain a database of VTR, dealer, observer, and electronic monitoring reports;
- Determine all species landings by stock areas;
- Apply discard estimates to landings;
- Deduct catch from ACEs allocated to sectors; and

- Determine sector catch and ACE balances.

Additional changes to streamline sector reporting could include such items as[7]:

- Using NMFS reconciled data to determine when the trigger for sector daily catch reporting has been reached (required when 90 percent of any ACE has been caught), rather than using sector self-reported data. As described above, sector data is not any more timely and the reconciled data is more accurate, so using NMFS reconciled data would be more efficient and reliable than relying solely on sector reports.

- Modifying trip end hails to accommodate catch reporting and to eliminate redundancy.

Rationale: Granting the Regional Administrator the authority to streamline the sector reporting process would help to reduce reporting redundancies, provide flexibility to sectors and sector managers, and improve timeliness of data processing.

[7] These items were initially included in a letter from NMFS to the Council: "Bullard to NEFMC re sector reporting streamlining", dated August 14, 2013.

4.4 FUNDING/OPERATIONAL PROVISIONS OF GROUNDFISH MONITORING (SECTORS AND COMMON POOL)

The alternatives in this section consider provisions for when there are changes in federal funding of the groundfish monitoring program, including provisions for either an increase or decrease in funding.

4.4.1 Funding Provisions Option 1: No Action

Beginning in 2012, Amendment 16 required that the at-sea monitoring program would be industry funded. However, since then NMFS has had sufficient funding to pay for all or some of industry's sampling costs of the groundfish at-sea monitoring program. Currently, NMFS is reimbursing industry for 100 percent of its at-sea monitoring costs through a grant with the ASMFC. It is anticipated that once these appropriated funds are used, sampling costs of at-sea monitoring would be fully paid for by industry, unless additional NMFS funds are available.

Option 1/No Action would continue to require industry to fund at-sea monitoring costs.

4.4.2 Funding Provisions Option 2 - Provisions for an Increase or Decrease in Funding for the Groundfish Monitoring Program

The Council could choose one or both of these options.

4.4.2.1 Funding Provisions Sub-Option 2A – Higher Monitoring Coverage Levels if NMFS Funds are Available (Sectors Only)

This measure, if chosen, would allow for at-sea monitoring at higher coverage levels than the target coverage required (see Section 4.1.1), up to 100 percent, provided that NMFS has determined funding is available to cover the additional administrative costs to NMFS and sampling costs to industry in a given year. The higher monitoring coverage levels would be determined by the amount of available additional funding from NMFS in a given year, and would be announced once NMFS has determined the amount available. Available funding in regard to this alternative refers to funds appropriated specifically for groundfish monitoring costs and not to the prioritization of funds described in the Industry Funded Monitoring (IFM) Omnibus Amendment. If this option is selected, but Federal funding is not available to increase the coverage beyond the target set in Section 4.1.1, then industry must meet the target coverage and pay for its monitoring costs. The No Action for industry-funded at-sea monitoring costs at the selected minimum target coverage level would remain in place in years in which additional funds to cover industry costs are not available.

Rationale: Monitoring coverage at 100 percent, or as close to 100 percent, increases the accuracy of catch estimates and reduces the potential for bias. Higher coverage levels, even for a limited time, may inform understanding of the magnitude of bias, and inform future actions on the value of higher monitoring coverage levels. Coverage of 100 percent of trips is the only way to completely remove bias; however, it may be impracticable for industry or NMFS to fund their costs associated with complete coverage, resulting in a lower coverage level. Higher levels of coverage would substantially increase costs, and given that industry is responsible for monitoring costs, would create an added burden to both industry as well as NMFS. However, increased monitoring supported by additional funding from NMFS for a limited time could improve cost-effectiveness of the current and future monitoring system by providing a baseline to evaluate bias. This evaluation could inform future monitoring program design to increase efficiency and reduce bias when coverage is lower than 100 percent.

4.4.2.2 Funding Provisions Sub-Option 2B - Waivers from Monitoring Requirements Allowed (Sectors and Common Pool) (*Preferred Alternative)*

This measure would allow waivers for exempting vessels from industry-funded monitoring requirements, for either a trip or the fishing year, if coverage was unavailable due to insufficient funding for NMFS shoreside costs for the specified target coverage level. This would include coverage for at-sea monitoring, electronic monitoring, and dockside monitoring. Selection of this option preserves the Council's intent for additional monitoring in the groundfish fishery, but would not prevent vessels from participating in the groundfish fishery if monitoring coverage was not available.

Rationale: In the absence of waivers from monitoring requirements, vessels would be required to reduce fishing effort to match the available level of monitoring (i.e., the fleet would not fish if NMFS does not have funding for the program). Reducing fishing effort to match available monitoring may lack sufficient justification and may be inconsistent with MSA National Standards. Additionally, years in which fishing effort is reduced to match available funds would not be representative of other years, and so statistical comparisons of effort and catch between years would be difficult. The Council discussed that it is not the intent of this action to prevent vessels from fishing if target coverage levels are not being met, or if NMFS does not have funding for their share of shoreside costs. NMFS will continue to work with sectors during the year to help maintain target coverage levels to the extent possible.

4.5 Management Uncertainty Buffers for the Commercial Groundfish Fishery (Sectors)

The following measures in this section only applies to sectors in the commercial groundfish fishery.

4.5.1 Management Uncertainty Buffer Option 1: No Action

Option 1/No Action would maintain the current process for setting management uncertainty buffers for the different sub-components of the commercial groundfish fishery annual catch limits (ACLs) for different groundfish stocks. These buffers are evaluated in each specification setting action.

The current default adjustment for management uncertainty for groundfish stocks is 5 percent of the ABC. For stocks with less management uncertainty, the buffer is set at 3 percent of the ABC; for stocks with more uncertainty, the buffer is set at 7 percent of the ABC. Stocks not caught in state waters have a lower management uncertainty buffer of 3 percent of the ABC; zero possession, discard-only stocks have a higher management uncertainty buffer of 7 percent of the ABC. The current management uncertainty buffers for groundfish stocks are provided in Table 3.

The current process for evaluating management uncertainty buffers includes consideration of the following elements: 1) enforceability of management measures, 2) monitoring adequacy (including timeliness, completeness, and accuracy of monitoring data), 3) precision, 4) latent effort, and 5) other fishery catch.

Table 3 - Management uncertainty buffers (as a proportion of the ABC) for each groundfish stock.

Stock	Management Uncertainty Buffer
GB cod	0.05
GOM cod	0.05
GB haddock	0.05
GOM haddock	0.05
GB yellowtail flounder	0.03
SNE/MA yellowtail flounder	0.05
CC/GOM yellowtail flounder	0.05
American plaice	0.05
Witch flounder	0.05
GB winter flounder	0.03
GOM winter flounder	0.05
SNE/MA winter flounder	0.05
Redfish	0.05
White hake	0.05
Pollock	0.05

Table 3 cont.

Stock	Management Uncertainty Buffer
Northern windowpane flounder	0.07
Southern windowpane flounder	0.07
Ocean pout	0.07
Atlantic halibut	0.05
Atlantic wolffish	0.07

Shading denotes different management uncertainty buffers, light grey 3%, no shade 5% and dark 7%.

Rationale: Management uncertainty is the likelihood that management measures will result in a level of catch that is greater than the catch objective and is related to the effectiveness of management measures. Lower effectiveness of management measures results in greater management uncertainty, i.e., greater likelihood that measures will result in a catch that exceeds the catch level objective. An increase in the adjustment for management uncertainty may be warranted if there is a greater likelihood that management measures will result in a catch that exceeds the catch level objective. According to National Standard guidelines, adjustments to management uncertainty buffers should consider uncertainty in the ability of managers to constrain catch so the ACL is not exceeded, and uncertainty in quantifying the true catch amounts (i.e., estimation errors).

4.5.2 Management Uncertainty Buffer Option 2 - Elimination of Management Uncertainty Buffer for Sector ACLs with 100 Percent Monitoring of All Sector Trips (*Preferred Alternative)*

To select this sub-option, the Council must also select the option for 100 percent coverage in either Section 4.1.1.2 Option 2: Fixed Total At-Sea Monitoring Coverage Level Based on a Percentage of Trips, or Section 4.1.1.3 Option 3: Fixed Total Monitoring Coverage Level Based on a Percentage of Catch.

If the option for 100 percent at-sea monitoring is selected, this measure would revise the management uncertainty buffer for the sector ACL for each allocated groundfish stock to be zero. This measure would apply whether the option for 100 percent at-sea monitoring was determined as a fixed percentage of sector trips (Section 4.1.1.2 Option 2) or as a percentage of catch (Section 4.1.1.3 Option 3). The revised management uncertainty buffers would apply only to sectors, and not to the common pool component of the fishery, or other sub-ACLs or sub-components for any stocks.

This option would retain the process by which the Council evaluates and sets management uncertainty buffers, and management uncertainty buffers could be adjusted in future actions. The buffers would continue to be evaluated to ensure that 100 percent monitoring coverage effectively constrains catch to prevent the ACLs from being exceeded and removes uncertainty in quantifying true catch amounts. If 100-percent monitoring coverage is determined not to be effective, or if any of the additional elements evaluated when setting management uncertainty buffers (see Section 4.5.1) have the potential to result in catches that could exceed ACLs, then the need for buffers would be evaluated as part of each specification action.

Rationale: Uncertainty of whether management measures will result in catch that stays below the catch objective depends in part on the adequacy of fishery monitoring data, one of the five elements of management uncertainty evaluated when fishery specifications are developed. If sectors were monitored at 100 percent at-sea monitoring coverage, this comprehensive catch accounting would help constrain catch so the ACL is not exceeded. Eliminating uncertainty in quantifying the true catch amounts could allow the management uncertainty buffers for the sector ACLs for all allocated groundfish stocks to be zero. The process for evaluating and setting management uncertainty buffers will remain in place, and management uncertainty buffers could be adjusted in future actions.

When the Council selected this as preferred alternative, some members commented that eliminating the management uncertainty buffer for the sector ACL for all allocated groundfish stocks helps to directly provide benefits with the increased costs of 100 percent monitoring coverage. Providing additional catch in the form of eliminating the management uncertainty buffer is a way to give the industry something back for their investment in 100 percent at-sea monitoring. Coupling this alternative with 100 percent at-sea monitoring helps to minimize some of the costs on enhanced monitoring.

4.6 Remove Commercial Groundfish Monitoring Requirements for Certain Vessels Fishing Under Certain Conditions

The measures in the following section could apply to both the sector and common pool segments of the commercial groundfish fishery depending on the options selected.

4.6.1 Removal of Monitoring Program Requirements Option 1: No Action (Sectors Only)

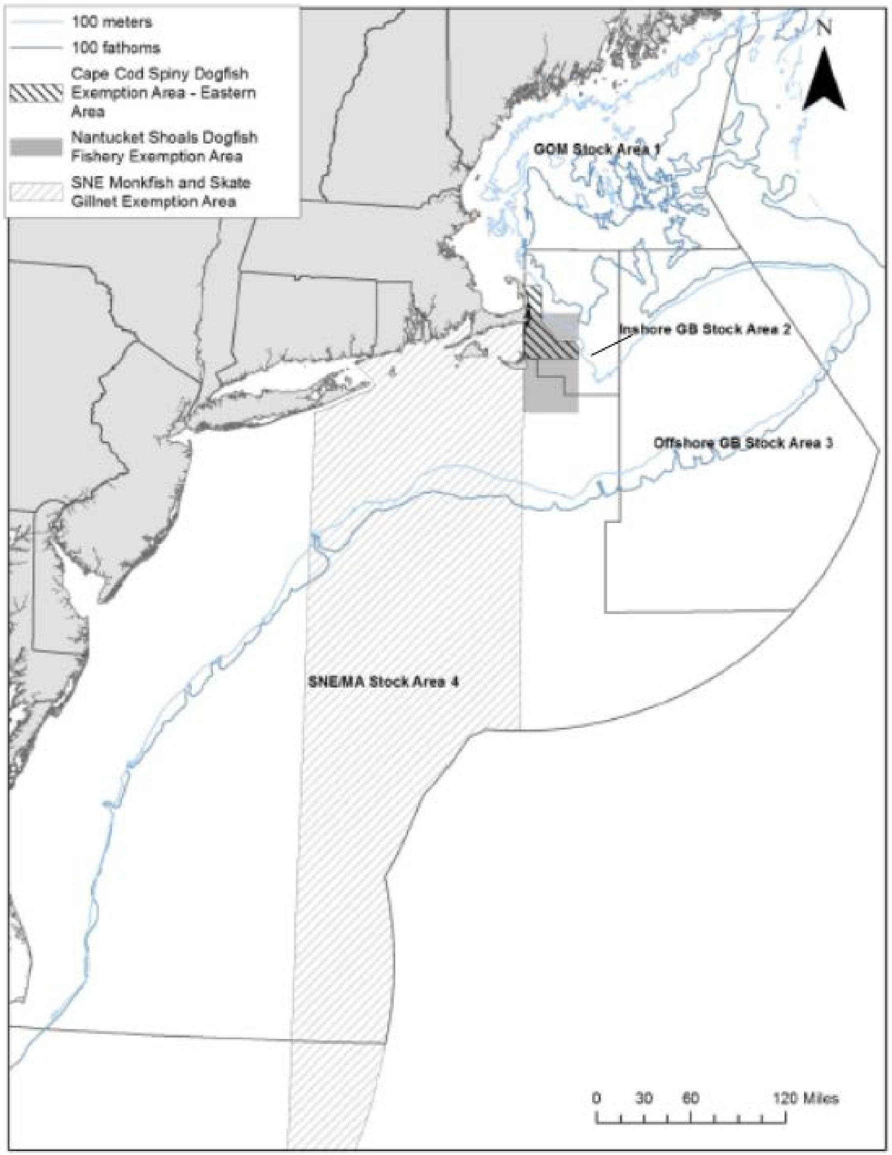
Option 1/No Action would maintain the existing measures for removal of groundfish monitoring program coverage requirements. Sector vessels fishing exclusively with extra-large mesh (ELM) gillnets of 10 inches (25.4 cm) or greater on a sector trip fishing exclusively in the SNE/MA and/or Inshore GB Broad Stock Areas would continue to be excluded from the at-sea monitoring coverage requirement. This alternative applies only to sector vessels.

FW55 removed the at-sea monitoring coverage requirement for sector vessels fishing exclusively with extra-large mesh (ELM) gillnets of 10 inches (25.4 cm) or greater on a sector trip fishing exclusively in the Southern New England/Mid-Atlantic (SNE/MA) Broad Stock Area (BSA) and Inshore Georges Bank (GB) BSA (Map 1). Vessels making an ELM declaration in the SNE/MA and/or Inshore GB Broad Stock Areas are not subject to at-sea monitoring coverage. The majority of catch on sector trips using ELM gear is of non-groundfish stocks, such as skates, monkfish, and dogfish, with minimal groundfish catch.

Sector vessels fishing on these non-ASM sector trips and fishing exclusively within the footprint and season of either the Nantucket Shoals Dogfish Exemption Area, the Eastern Area of the Cape Cod Spiny Dogfish Exemption Area, and SNE Dogfish Gillnet Fishery Exemption Area are currently excluded from the requirement to only use 10+ inch mesh on these excluded trips in order to target dogfish with 6.5 inch mesh on the same trip, and are thus also removed from the at-sea monitoring coverage requirement. Groundfish catch is very low within the area and season of dogfish exempted fisheries. However, these exemptions are handled through sector operations plans.

Rationale: The majority of catch on sector trips using ELM gear is of non-groundfish stocks, such as skates, monkfish, and dogfish, while the ASM program was designed, primarily, to ensure that sectors do not exceed their sector allocation and to verify area fished, catch, discards by species, and gear type used. Groundfish catch is known to be very low with the area and season of dogfish exempted fisheries, and groundfish catch on these trips is counted against the sector's ACE.

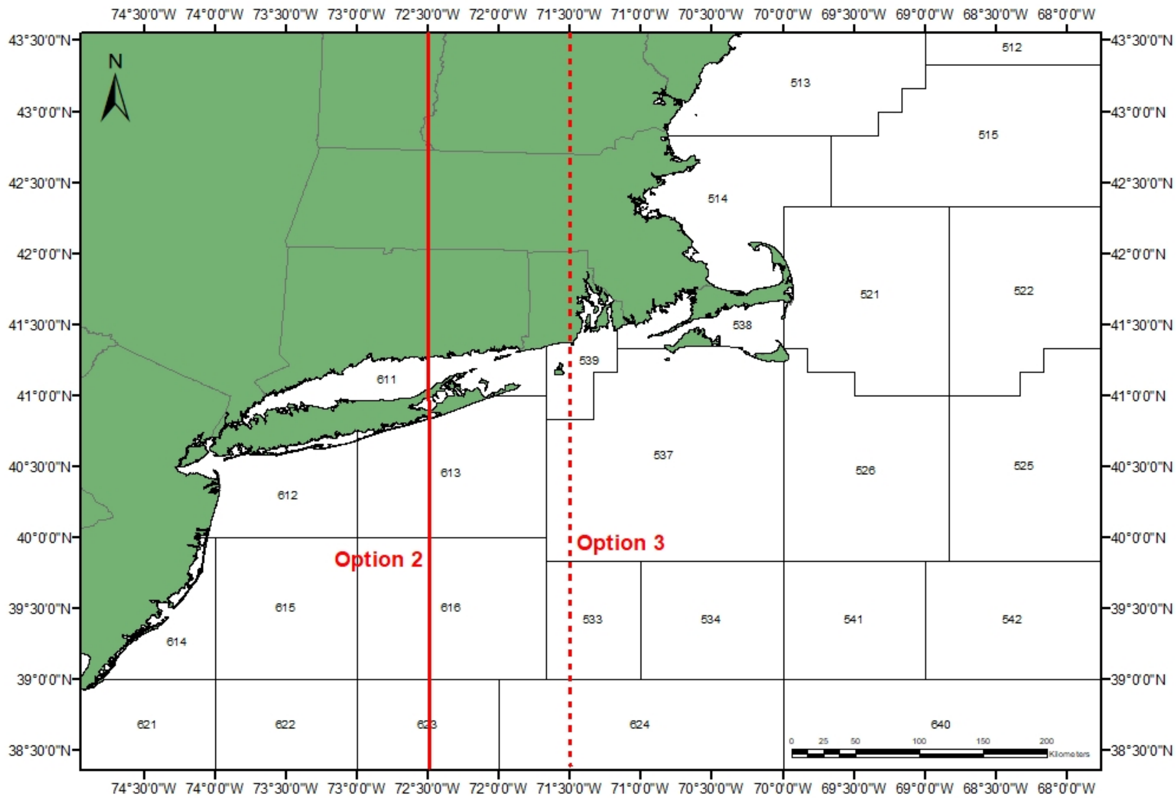
Map 1 - Groundfish Broad Stock Areas (BSAs) – sector trips fishing exclusively with extra-large mesh (ELM) gillnets fishing exclusively in the SNE/MA and/or Inshore GB BSA are exempt from the at-sea monitoring coverage requirement.



4.6.2 Removal of Monitoring Program Requirements Option 2 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 72 Degrees 30 Minutes West Longitude

If Option 2 is selected, the existing measures for removal of monitoring program coverage requirements described in the No Action would remain in place. The Council could select both sub-options.

Map 2 - 72 degrees 30 minutes west longitude boundary (Option 2) and 71 degrees 30 minutes west longitude boundary (Option 3).



4.6.2.1 Removal of Monitoring Program Requirements Sub-option 2A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only)

This alternative would remove the at-sea monitoring (ASM) coverage requirement for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a sector trip (Map 2– solid line). This alternative applies only to sector vessels. VMS declaration and application of transit rules east of the line would be required. A vessel declaring a trip fishing exclusively west of 72 degrees 30 minutes west longitude would still be prohibited from changing its declaration for that trip, and would be required to retain and land all groundfish of legal size on the trip. NMFS would need to revise the PTNS to allow a vessel to indicate a trip would be fishing exclusively west of 72 degrees 30 minutes west longitude while on either a groundfish DAS, a monkfish DAS, or both.

Rationale: For vessels fishing exclusively west of 72 degrees 30 minutes west longitude, the catch composition includes little to no groundfish species (see Table 67). The proportion of groundfish to total catches on trips west of 72 degrees 30 minutes west longitude have been less than five percent for all groundfish species in recent years (see Table 67).

4.6.2.2 Removal of Monitoring Program Requirements Sub-option 2B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool)

This alternative would remove the requirement for dockside monitoring coverage (if implemented) for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a trip (Map 2– solid line). This alternative applies to sector and common pool vessels. VMS declaration and application of transit rules east of the line would be required. A vessel declaring a trip fishing exclusively west of 72 degrees 30 minutes west longitude still would be prohibited from changing its declaration for that trip, and would be required to retain and land all groundfish of legal size on the trip. NMFS would need to revise the PTNS to allow a vessel to indicate a trip would be fishing exclusively west of 72 degrees 30 minutes west longitude while on r a groundfish DAS, a monkfish DAS, or both.

Rationale: For vessels fishing exclusively west of 72 degrees 30 minutes west longitude, the catch composition includes little to no groundfish species (see Table 67). Groundfish landings from trips west of 72 degrees 30 minutes west longitude have been low in recent years (see Table 65).

4.6.3 Removal of Monitoring Program Requirements Option 3 – Remove Monitoring Program Requirement for Vessels Fishing Exclusively West of 71 Degrees 30 Minutes West Longitude (*Preferred Alternative*)

If Option 3 is selected, the existing measures for removal of monitoring program coverage requirements described in the No Action would remain in place. The Council could select both sub-options.

4.6.3.1 Removal of Monitoring Program Requirements Sub-option 3A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only) (*Preferred Alternative)*

This alternative would remove the at-sea monitoring (ASM) coverage requirement for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a sector trip (Map 2– dashed line). This alternative applies only to sector vessels. VMS declaration and application of transit rules east of the line would be required. A vessel declaring a trip fishing exclusively west of 71 degrees 30 minutes west longitude would still be prohibited from changing its declaration for that trip, and would be required to retain and land all groundfish of legal size on the trip. NMFS would need to revise the PTNS to allow a vessel to indicate a trip would be fishing exclusively west of 71 degrees 30 minutes west longitude while on either a groundfish DAS, a monkfish DAS, or both.

Rationale: For vessels fishing exclusively west of 71 degrees 30 minutes west longitude, the catch composition includes little to no catch of many groundfish stocks, with substantial catch of a few groundfish stocks (see Table 70 - Proportion of groundfish catch west of 71 degrees 30 minutes west longitude.). While groundfish catches west of 71 degrees 30 minutes west longitude are low for many stocks, the proportion of catches for some stocks (SNE yellowtail flounder, SNE winter flounder, southern windowpane flounder, and ocean pout) caught west of 71 degrees 30 minutes west longitude has been over 25 percent in recent years (see Table 70). While there may be higher catches of some groundfish stocks in this area, the Council identified this alternative as preferred to minimize the costs of increased monitoring overall. The majority of total groundfish is caught in waters east of this boundary, so this measure is viewed as one that minimizes cost with limited potential impacts on total groundfish. The Council also identified that there should be a regular review of this measure to verify if the intent of the measures (e.g. that the catch composition has little to no groundfish) is still being met (Section 4.6.4.2).

4.6.3.2 Removal of Monitoring Program Requirements Sub-option 3B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool) (*Preferred Alternative)*

This alternative would remove the requirement for dockside monitoring coverage (if implemented) for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a trip (Map 2– dashed line). This alternative applies to sector and common pool vessels. VMS declaration and application of transit rules east of the line would be required. A vessel declaring a trip fishing exclusively west of 71 degrees 30 minutes west longitude would still be prohibited from changing its declaration for that trip, and would be required to retain and land all groundfish of legal size on the trip. NMFS would need to revise the PTNS to allow a vessel to indicate a trip would be fishing exclusively west of 71 degrees 30 minutes west longitude while on either a groundfish DAS, a monkfish DAS, or both.

Rationale: For vessels fishing exclusively west of 71 degrees 30 minutes west longitude, the catch composition includes little to no catch of many groundfish stocks, with substantial catch of a few groundfish stocks (see Table 70). While groundfish landings from trips west of 71 degrees 30 minutes west longitude are low for many stocks, landings for some stocks (SNE yellowtail flounder and SNE winter flounder) caught west of 71 degrees 30 minutes west longitude have been substantial (see Table 68). While there may be higher catches of some groundfish stocks in this area, the Council identified this alternative as preferred to minimize the costs of increased monitoring overall. The majority of total groundfish is caught in waters east of this boundary, so this measure is viewed as one that minimizes cost with limited potential impacts on total groundfish. The Council also identified that there should be a regular review of this measure to verify if the intent of the measures (e.g. that the catch composition has little to no groundfish) is still being met (Section 4.6.4.2).

4.6.4 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements

4.6.4.1 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 1: No Action

Currently, there is no formal review process to verify that the catch composition from vessels fishing on trips that are removed from monitoring program requirements have little to no groundfish.

4.6.4.2 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 2: Implement a Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements (*Preferred Alternative)*

This option, if selected, would establish a process for review of any measures that remove groundfish monitoring program requirements for certain vessels based on catch composition (Removal of Monitoring Program Requirements Option 1 (No Action), Option 2, and Option 3), should the Council select these options. This review would most likely be done by the Groundfish Plan Development Team (PDT) with substantial support by other relevant NEFSC and GARFO staff. The review would occur after two years of fishing data is available and every three years after that.

Rationale: Periodic review of measures that remove vessels from monitoring requirements that are based on catch composition will help to verify if the intent of the measures (e.g. that the catch composition has little to no groundfish) is still being met. The Council discussed that this measure is important to include if some vessels are removed from monitoring requirements to ensure that fishing behavior does not change and potential impacts on groundfish do not increase as a result of lower monitoring standards for vessels fishing in this area.

5.0 CONSIDERED BUT REJECTED ALTERNATIVES

5.1 FUNDING/OPERATIONAL PROVISIONS OF GROUNDFISH MONITORING (SECTORS AND COMMON POOL)

5.1.1 Additional Options for Industry-Funded Costs of Monitoring (Quota Auctions)

Under Amendment 16, sectors must develop and fund their own monitoring programs. Sectors are still expected to bear the costs of the monitoring program changes adopted in Amendment 23.[8]

Funding source ideas

The costs of additional monitoring can be considerable. This action will consider regulatory changes that will help offset the cost of monitoring for sectors. Ideas to offset monitoring costs include:

- Quota auctions and quota set-asides, where a portion of the ACL for key stocks could be auctioned off annually to fund monitoring. This is done in some Fishery Management Plans (FMPs), where a portion of the quota is reserved as a set-aside and auctioned off annually to provide additional catch opportunity and a source of funding for management priorities like research. Section 208 of the Magnuson-Stevens Act (MSA) established a Fisheries Conservation and Management Fund, which may be funded through quota set-asides, appropriations, states or other public sources, and private or nonprofit organizations. This fund may be used to expand the use of electronic monitoring.

This measure will establish the necessary infrastructure for a quota auction.

Rationale: Quota auctions may offset the cost of monitoring for sectors. This measure would consider regulatory changes to establish a quota auction.

Rationale for not including 5.1.1.1.1: After reviewing the work to date, the Council had concerns that an option to set up a quota auction or quota set-aside would further reduce available quota at a time when the groundfish fishery continues to operate under historically low annual catch limits. Therefore, the Council did not pursue this idea for further development.

[8] The Council recently adopted the IFM Amendment. The IFM Amendment discusses that the existing groundfish monitoring program is excluded from the newly adopted IFM approach. The Council is aware that there are provisions in the IFM Amendment that will need to be considered for determining how the adjusted groundfish monitoring program in Amendment 23 fits into the IFM approach, and plans to explore this concept further. At present, the Council does not expect that the IFM approach would apply to the adjusted groundfish monitoring program.

5.2 GROUNDFISH SECTOR AND COMMON POOL MONITORING PROGRAM REVISIONS

5.2.1 Dockside Monitoring Program

5.2.1.1 Dockside Monitoring as an Optional Program for Sectors

The following measures will consider changes to how landings are monitored in the groundfish fishery. The goal is to improve the reliability and accountability of landings.

This measure would develop an optional dockside monitoring (DSM) program for only the sector component of the groundfish fishery that sectors could choose to include in their sector operations plans. The goal of the optional DSM program is to verify landings (species and weights) by providing an independent landings data stream that may be compared to dealer-reported landings in order to ensure accurate accounting of landings.

Rationale: The goal is to establish an optional dockside monitoring program that allows for independent verification of landings for the sector component of the groundfish fishery, and to provide sectors with a tool that sectors could choose to include in their operations plans to monitor landings that ensures precise and accurate catch (landings and discards) estimation. Sectors currently have the ability to develop and implement a dockside monitoring program as part of their operations plans – this measure would establish the design and standards for an optional dockside monitoring program.

Rationale for not including 5.2.1.1.1: After reviewing the work to date, the Council noted that since sectors already have the ability to develop and implement a dockside monitoring program as part of their operations plans, that this alternative does not add anything new to the groundfish monitoring program. Therefore, the Council did not recommend this action for further development.

5.3 MANAGEMENT UNCERTAINTY BUFFERS FOR THE COMMERCIAL GROUNDFISH FISHERY (SECTORS AND COMMON POOL)

5.3.1 Revised Management Uncertainty Buffers for Allocated Groundfish Stocks

This measure would revise the management uncertainty buffer for all allocated groundfish stocks. Revised management uncertainty buffers would apply to both the sector and common pool sub-ACLs. This measure would not apply to other sub-ACLs or sub-components for any stocks.

This measure has three options for adjusting the management uncertainty buffer for each of the allocated groundfish stocks. The Council would select one of the following, to be applied to all allocated groundfish stocks:

Option A - Increase the management uncertainty buffer 2 times (multiplier of 2),

Option B - Increase the buffer 5 times (multiplier of 5), or

Option C - Increase 10 times (multiplier of 10)

For the allocated stocks, the range of potential increases in management uncertainty buffer would result in the revised management uncertainty buffers in Table 4.

Table 4 – Considered but Rejected: range of potential revised management uncertainty buffers under the options for an increase in management uncertainty buffer for allocated stocks.

Stock	Increase in Management Uncertainty Buffer	Revised Management Uncertainty Buffer
GB cod	2x	0.10
	5x	0.25
	10x	0.50
GOM cod	2x	0.10
	5x	0.25
	10x	0.50
GB haddock	2x	0.10
	5x	0.25
	10x	0.50
GOM haddock	2x	0.10
	5x	0.25
	10x	0.50
GB yellowtail flounder	2x	0.06
	5x	0.15
	10x	0.30
SNE/MA yellowtail flounder	2x	0.10
	5x	0.25
	10x	0.50
CC/GOM yellowtail flounder	2x	0.10
	5x	0.25
	10x	0.50
American plaice	2x	0.10
	5x	0.25
	10x	0.50
Witch flounder	2x	0.10
	5x	0.25
	10x	0.50

Stock	Increase in Management Uncertainty Buffer	Revised Management Uncertainty Buffer
GB winter flounder	2x	0.06
	5x	0.15
	10x	0.30
GOM winter flounder	2x	0.10
	5x	0.25
	10x	0.50
SNE/MA winter flounder	2x	0.10
	5x	0.25
	10x	0.50
Redfish	2x	0.10
	5x	0.25
	10x	0.50
White hake	2x	0.10
	5x	0.25
	10x	0.50
Pollock	2x	0.10
	5x	0.25
	10x	0.50

This measure would also include periodic reevaluation of the management uncertainty buffers. This measure would not change the elements that may be considered when evaluating management uncertainty buffers.

Rationale: While evidence of observer bias may warrant increased monitoring coverage, it will come at an increased cost that may reduce the economic viability of portions of the commercial groundfish fleet. An alternative method to high levels of monitoring coverage could be to increase the management uncertainty buffers for each allocated stock, which would attempt to minimize the potential effect of that bias and account for potential undocumented catch. This alternative could be combined with increased monitoring coverage rates as a potentially cost-effective solution to account for inaccurate catch in monitoring.

Rationale for not including 5.3.1: After reviewing the work to date[9], the Council shared concerns that increases in the management uncertainty buffer on a stock-by-stock basis are unlikely to be desirable

[9] See "Draft Memo from Groundfish PDT to Groundfish Committee re A23 draft alternatives – management uncertainty buffer", dated August 2, 2019: https://s3.amazonaws.com/nefmc.org/3b_190802-DRAFT-GF-PDT-memo-to-GF-Cte-re-A23-draft-alternatives_mgmt-uncertainty-buffers_v1_with-attachments.pdf

substitutes for increases in monitoring coverage, and could have unintended consequences as further constraining ACLs by increasing buffers is unlikely to reduce levels of unreported catch or address bias and may actually lead to increased levels of unreported catch and bias. The Council felt that this alternative would not meet the purpose and need of the amendment of improving accuracy of catch data. Therefore, the Council did not recommend this action for further development.

6.0 AFFECTED ENVIRONMENT

6.1 INTRODUCTION

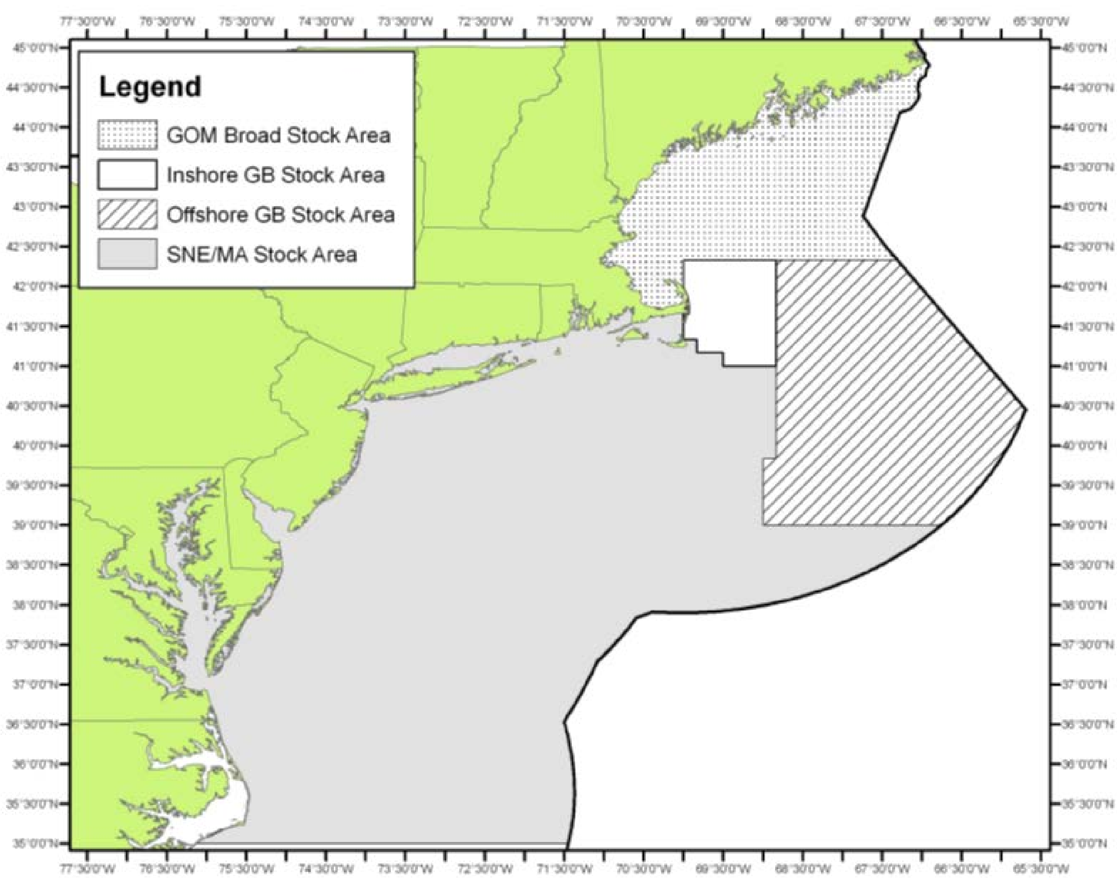
The Valued Ecosystem Components (VECs) affected by the Alternatives include regulated groundfish species, non-groundfish species/bycatch, the physical environment and Essential Fish Habitat (EFH), protected resources, and human communities, which are described below.

6.2 REGULATED GROUNDFISH SPECIES

This section describes the life history and stock population status for each allocated fish stock harvested under the Northeast Multispecies FMP. Map 3 identifies the four broad stock areas used in the fishery. Further information on life history and habitat characteristics of the stocks managed in this FMP can be found in the Essential Fish Habitat Source Documents at http://www.nefsc.noaa.gov/nefsc/habitat/efh/.

The allocated target stocks for the Northeast Multispecies FMP are: GOM Cod, GB Cod, GOM Haddock, GB Haddock, American Plaice, Witch Flounder, GOM Winter Flounder, GB Winter Flounder, SNE/MA Winter Flounder, Cape Cod/GOM Yellowtail Flounder, GB Yellowtail Flounder, SNE/MA Yellowtail Flounder, Redfish, Pollock and White Hake.

Map 3 - Northeast Multispecies Broad Stock Areas.



The Northeast Multispecies FMP also manages Atlantic halibut, ocean pout, windowpane flounder (GB/GOM- northern and SNE/MA- southern stocks), and wolffish. While OFLs, ABCs, and ACLs are specified for these stocks, they were not allocated to sectors through Amendment 16. These species are discussed in Sections 6.2.16 - 6.2.20.

The following discussions have been adapted from the most recent stock assessment reports (NEFSC 2017b and NEFSC 2020b). Table 5 summarizes the status of the northeast groundfish stocks as determined by NOAA Fisheries, noting which groundfish stocks are overfished or are experiencing overfishing.

Table 5 - Current status of groundfish stocks, determined by NOAA Fisheries.

	Status	
Stock	Overfishing?	Overfished?
Georges Bank Cod	Yes	Yes
Gulf of Maine Cod	Yes	Yes
Georges Bank Haddock	No	No
Gulf of Maine Haddock	No	No
Georges Bank Yellowtail Flounder	Yes	Yes
Southern New England/Mid-Atlantic Yellowtail Flounder	No	Yes
Cape Cod/Gulf of Maine Yellowtail Flounder	No	No
American Plaice	No	No
Witch Flounder	Unknown	Yes
Georges Bank Winter Flounder	No	Yes
Gulf of Maine Winter Flounder	No	Unknown
Southern New England/Mid-Atlantic Winter Flounder	No	Yes
Acadian Redfish	No	No
White Hake	No	Yes
Pollock	No	No
Northern Windowpane Flounder	No	Yes
Southern Windowpane Flounder	No	No
Ocean Pout	No	Yes
Atlantic Halibut	No	Yes
Atlantic Wolffish	No	Yes

Table 6 and Table 7 provide the updated numerical estimates of the status determination criteria for all groundfish stocks, based on the 2017 and 2019 operational assessments. The M-S Act requires that every fishery management plan specify “objective and measurable criteria for identifying when the fishery to which the plan applies is overfished.” Guidance on this requirement identifies two elements that must be specified: a maximum fishing mortality threshold (or reasonable proxy) and a minimum stock size threshold.

The M-S Act also requires that FMPs specify the maximum sustainable yield and optimum yield for the fishery. The NEFSC conducted assessments for 15 groundfish stocks in 2019. The peer review recommended updated numerical values are provided in Table 7, for information purposes only.

Table 6 - Status determination criteria.

Stock	Biomass Target (SSB_{MSY} or proxy)	Minimum Biomass Threshold	Maximum Fishing Mortality Threshold (F_{MSY} or proxy)
Georges Bank Cod	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Gulf of Maine Cod	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Georges Bank Haddock	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Gulf of Maine Haddock	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Georges Bank Yellowtail Flounder	Unknown	Unknown	Unknown
Southern New England/Mid-Atlantic Yellowtail Flounder	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Cape Cod/Gulf of Maine Yellowtail Flounder	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
American Plaice	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Witch Flounder	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Georges Bank Winter Flounder	SSBMSY	½ Btarget	F_{MSY}
Gulf of Maine Winter Flounder	Unknown	Unknown	F40% MSP
Southern New England/Mid-Atlantic Winter Flounder	SSBMSY	½ Btarget	F_{MSY}
Acadian Redfish	SSBMSY: SSB/R (50% MSP)	½ Btarget	F50% MSP
White Hake	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Pollock	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP
Northern Windowpane Flounder	External	½ Btarget	Rel F at replacement
Southern Windowpane Flounder	External	½ Btarget	Rel F at replacement
Ocean Pout	External	½ Btarget	Rel F at replacement
Atlantic Halibut	Internal	½ Btarget	$F_{0.1}$
Atlantic Wolffish	SSBMSY: SSB/R (40% MSP)	½ Btarget	F40% MSP

Table 7 - Current numerical estimates of SDCs.

Stock	Model/ Approach	B_{MSY} or Proxy (mt)	F_{MSY} or Proxy	MSY (mt)
Georges Bank Cod	empirical	NA	NA	NA
Gulf of Maine Cod	ASAP M=0.2	42,692	0.173	7,580
	ASAP M-ramp	63,867	0.175	11,420
Georges Bank Haddock	VPA	138,924	0.33	30,489
Gulf of Maine Haddock	ASAP	7,993	0.369	1,597
Georges Bank Yellowtail Flounder	empirical	NA	NA	NA
Southern New England/Mid-Atlantic Yellowtail Flounder	ASAP	1,779	0.355	492
Cape Cod/Gulf of Maine Yellowtail Flounder	VPA	3,439	0.32	1,138
American Plaice	VPA	15,293	0.258	3,301
Witch Flounder	empirical area swept	NA	NA	NA
Georges Bank Winter Flounder	VPA	8,910	0.519	4,260
Gulf of Maine Winter Flounder	empirical area swept	NA	0.23 (exploitation rate)	NA
Southern New England/Mid-Atlantic Winter Flounder	ASAP	24,687	0.34	7,532
Acadian Redfish	ASAP	247,918	0.038	9,318
White Hake	ASAP	31,828	0.1677	4,601
Pollock	ASAP	124,639	0.272	19,856
Northern Windowpane Flounder	AIM	3.489 kg/tow	0.185 c/i	647
Southern Windowpane Flounder	AIM	0.187 kg/tow	1.780 c/i	333
Ocean Pout	index	4.94 kg/tow	0.76 c/i	3,754
Atlantic Halibut	FSD	NA	NA	NA
Atlantic Wolffish	SCALE	1,612	0.222	232

6.2.1 Gulf of Maine Cod

Life History. The Atlantic cod, *Gadus morhua*, is a demersal gadoid species found on both sides of the North Atlantic. In the western North Atlantic, cod occur from Greenland to North Carolina. In U.S. waters, cod are assessed and managed as two stocks: Gulf of Maine (GOM) and Georges Bank (GB). GOM cod attain sexual maturity at a later age than GB cod due to different growth rates between the two stocks. The greatest concentrations of cod off the U.S. Northeast coast are on rough bottoms 33 - 492 ft (10 - 150 m) deep and at 32 - 50°F (0 - 10°C). Spawning occurs year-round near the ocean bottom, with a peak in winter and spring. Peak spawning corresponds to 41 - 45°F (5 - 7°C) water. It is delayed until spring when winters are severe, and peaks in the winter when winters are mild. Eggs are pelagic, buoyant, spherical, and transparent. They drift for 2 - 3 weeks before hatching. The larvae are pelagic for about three months until reaching 1.6 - 2.3 in (4 - 6 cm), when they descend to the seafloor. Most remain on the bottom, and there is no evidence of a subsequent diel, vertical migration. Adults tend to move in schools, usually near the bottom, but also occur in the water column (NEFSC 2011c).

Population Status. The inshore GOM stock appears to be relatively distinct from the offshore cod stocks on the banks of the Scotian Shelf and Georges Bank based on tagging studies. GOM cod spawning stock biomass is estimated to have been just over 22,000 mt in 1982. After a period of decline in the 1980's, SSB returned to roughly 20,000 mt in 1990 before decreasing again in the 1990's. The use of separate assessment models (M=0.2 and M-ramp) in the last three assessments yield two estimates for SSB in recent years, though both indicate a sharp decline in SSB since 2010, when SSB was estimated at 8,638 mt and 10,645 mt (respectively). The stock remains low relative to historic levels and is subject to a formal stock rebuilding plan. The 2018 SSB estimates (M=0.2 and M-ramp models) are 3,752 mt and 3,838 mt (respectively), which are 9% and 6% (respectively) of the biomass target. The 2018 fully selected fishing mortality was estimated to be 0.188 and 0.198, which is 109% and 113% of the F_{MSY} proxy (respectively) (NEFSC 2020b). Recreational catch estimates were re-estimated in this update by using the re-calibrated Marine Recreational Intercept Program (MRIP) data. In general, inclusion of the re-calibrated data resulted in an increase in SSB, F, and recruitment (NEFSC 2020b). Currently, the GOM cod stock is overfished and overfishing is occurring (NEFSC 2020b). The stock shows a truncated size and age structure, consistent with a population experiencing high mortality. Additionally, there are only limited signs of incoming recruitment, continued low survey indices, and the current spatial distribution of the stock is considerably less than its historical range within the Gulf of Maine (NEFSC 2020b).

6.2.2 Georges Bank Cod

Life History. Georges Bank cod, *Gadus morhua*, is the most southerly cod stock in the world. The greatest concentrations off the Northeast coast of the U.S. are on rough bottoms in waters between 33 and 492 ft (10 - 150 m) and at temperatures between 32 and 50° F (0 - 10°C). Spawning occurs year-round, near the ocean bottom, with a peak in winter and spring. Peak spawning corresponds to water temperatures between 41 and 45°F (5 - 7°C). It is delayed until spring when winters are severe, and peaks in the winter when winters are mild. Eggs are pelagic, buoyant, spherical, and transparent. They drift for 2 to 3 weeks before hatching. The larvae are pelagic for about 3 months until reaching 1.6 to 2.3 in (4 - 6 cm), at which point they descend to the seafloor. Afterwards, most remain on the bottom, and there is no evidence of a subsequent diel, vertical migration. Adults tend to move in schools, usually near the bottom, but also occur in the water column (NEFSC 2011c).

Population Status. GB cod is a transboundary stock co-managed by the U.S. and Canada. The GB cod stock underwent a benchmark assessment in 2012 (SAW55, NEFSC 2013a), which indicated that the stock is overfished and overfishing is occurring. The 2015 peer review concluded that the GB cod model was not acceptable as a scientific basis for catch advice, and that stock status and catch advice should be based an alternative approach, but did conclude that the stock was qualitatively determined to be overfished based on poor stock condition. The update to the ASAP model was rejected, not the underlying benchmark formulation from SAW 55. Because a stock assessment model framework is lacking, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. Status determination relative to reference points is not possible because reference points cannot be defined. Overfishing status is considered unknown and the peer review concluded that evidence suggests this stock should still be considered overfished due to poor stock condition (NEFSC 2017b). NMFS determined that the stock status for GB cod will remain overfished, with overfishing occurring, consistent with the determination from the 2013 GB cod benchmark assessment. Based on the 2019 assessment, overfishing status is considered unknown and stock status remains overfished based on a qualitative evaluation of poor stock condition (NEFSC 2020b). Recreational catch estimates were re-estimated in this update by using the re-calibrated MRIP data, which results in higher average total catch (NEFSC 2020b). The GB cod stock continues to show a truncated age structure. The most recent survey values remain below the mean of their time series. The 2013 year class was larger than recent year classes, but has not continued to be large as it ages and is below the average from the 1970s at every age in both surveys (NEFSC 2020b).

6.2.3 Gulf of Maine Haddock

Life History. Haddock, *Melanogrammus aeglefinus*, is a demersal gadoid species found in the North Atlantic Ocean, occurring from Cape May, New Jersey to the Strait of Belle Isle, Newfoundland. Six distinct haddock stocks have been identified, and the two which occur in U.S. waters are associated with Georges Bank and the Gulf of Maine. Haddock are highly fecund broadcast spawners, spawning over various substrates including rocks, gravel, smooth sand, and mud. In the Gulf of Maine, spawning occurs from early February to May, usually peaking in February to April. Haddock release their eggs near the ocean bottom in batches where a courting male then fertilizes them. Fertilized eggs become buoyant and rise to the surface water layer and remain in the water column to development. Larvae metamorphose into juveniles in roughly 30 to 42 days at lengths of 0.8 to 1.1 in (2 - 3 cm). Juveniles initially live in the epipelagic zone and remain in the upper water column for 3 - 5 months, but they visit the seafloor in search of food. They settle into a demersal existence once they locate suitable habitat. Haddock do not make extensive migrations, but prefer deeper waters in the winter and tend to move shoreward in summer. The GOM haddock have lower weights at age than the GB stock and the age at 50% maturity was also lower for GOM haddock than GB haddock (NEFSC 2011c).

Population Status. The GOM haddock underwent a benchmark assessment in 2014 at SAW 59, which indicated that the stock was not overfished and overfishing was not occurring. The 2013 SSB was estimated at 4,153 mt, above the <2,452 mt overfishing threshold, a change from the 2012 assessment update when the stock was experiencing overfishing (NEFSC 2014). As of the 2019 groundfish operational assessments, the stock is not overfished and overfishing is not occurring, with 2018 SSB estimated to be at 82,763 mt, which is 1,035% of the biomass target (NEFSC 2020b). Recreational catch estimates were re-estimated in this update by using the re-calibrated MRIP data. In general, inclusion of the re-calibrated data resulted in an increase in SSB, F, and recruitment. The GOM haddock stock has experienced several large recruitment events since 2010. The population biomass is currently at an all time high and overall, the population is experiencing low mortality (NEFSC 2017b).

6.2.4 Georges Bank Haddock

Life History. The life history of GB haddock, *Melanogrammus aeglefinus*, is comparable to the GOM haddock (Section 6.2.3). On Georges Bank, spawning occurs from January to June, usually peaking from February to early-April. This is the principal haddock spawning area in the Northeast U.S. Shelf Ecosystem, concentrating on the northeast peak of Georges Bank. Median age and size of maturity differ slightly between the GB and GOM haddock stocks (NEFSC 2011c).

Population Status. The GB haddock stock is a transboundary stock co-managed by the U.S. and Canada. The stock is not overfished and overfishing is not occurring (NEFSC 2020b). There has been a steady increase in SSB from ~15,000 mt in the early 1990s, to about 252,000 mt in 2007. The dramatic increase 2005 - 2007 is due to the exceptionally large 2003 year class reaching maturity. From 2007 - 2010, SSB decreased 35% as that 2003 year class decreased due to natural and fishing mortality. The fishing mortality rate for this stock has been low in recent years. The retrospective adjusted 2018 SSB was estimated to be at 507,130 mt, which is 365% of the biomass target (NEFSC 2020b). The GB haddock stock shows a broad age structure, and broad spatial distribution. This stock has produced several exceptionally strong year classes in the last 15 years, leading to record high SSB in recent years. Catches in recent years have been well below the total quota (US+Canada). While all survey indices support the finding that this stock is at an all-time high, weights at age have been declining since the large 2003 year class, and show further declines with the most recent data (NEFSC 2020b).

6.2.5 American Plaice

Life History. American plaice, *Hippoglossoides platessoides*, is an arctic-boreal to temperate-marine pleuronectid (righteye) flounder that inhabits the continental shelves of the North Atlantic. Off the U.S. coast, American plaice are managed as a single stock in the Gulf of Maine and Georges Bank regions. American plaice are batch spawners, releasing eggs in batches every few days over the spawning period. Adults spawn and fertilize their eggs at or near the bottom. Buoyant eggs lack oil globules and drift into the upper water column. Eggs hatch at the surface and the time between fertilization and hatching varies with water temperature. Transformation of the larvae and migration of the left eye begins when the larvae are ~0.8 in (20 mm). Dramatic physiological transformations occur during the juvenile stage; the body shape flattens and widens. As the migration of the left eye across the top of the head to the right side reaches completion, descent towards the seafloor begins. In U.S. and Canadian waters, adult American plaice are sedentary, migrating only for spawning and feeding (NEFSC 2011c).

Population Status. In the Gulf of Maine and Georges Bank, the American plaice is not overfished and overfishing is not occurring (NEFSC 2020b). The stock is in a rebuilding plan, but based on the 2019 assessment, the stock is now considered rebuilt (NEFMC 2020b). The retrospective adjusted spawning stock biomass in 2018 was estimated to be at 17,748 mt, which is 116% of the biomass target The 2018 fully selected fishing mortality was estimated to be 0.089, which is 34% of the FMSY proxy (NEFSC 2020b). The current fishing mortality rate is relatively low, and so recent above average recruitment has resulted in an increase in SSB. SSB is projected to decrease in the short term, however, even at current fishing rates (NEFSC 2020b).

6.2.6 Witch Flounder

Life History. Witch flounder, *Glyptocephalus cynoglossus*, is a demersal flatfish distributed on both sides of the North Atlantic. In the western North Atlantic, the species ranges from Labrador southward, and closely associates with mud or sand-mud bottom. In U.S. waters, witch flounder are common throughout the Gulf of Maine, in deeper areas on and adjacent to Georges Bank, and along the shelf edge as far south as Cape Hatteras, North Carolina. Witch flounder is managed as a unit stock. Spawning occurs at or near the bottom; however, the buoyant eggs rise into the water column where subsequent egg and larval development occurs. The pelagic stage of witch flounder is the longest among the species of the family *Pleuronectidae*. Descent to the bottom occurs when metamorphosis is complete, at 4 - 12 months of age. There has been a decrease in both the age and size of sexual maturity in recent years. Witch flounder spawn from March to November, with peak spawning occurring in summer. The general trend is for spawning to occur progressively later from south to north. In the Gulf of Maine-Georges Bank region, spawning occurs from April to November, and peaks from May to August. Spawning occurs in dense aggregations that are associated with areas of cold water. Witch flounder spawn at 32 - 50 °F (0 – 10 °C) (NEFSC 2011c).

Population Status. Witch flounder is overfished and overfishing status is unknown (NEFSC 2020b). The 2016 benchmark assessment (SARC 62) peer review panel did not accept the analytical assessment models for witch flounder (NEFSC 2017a). Because a stock assessment model framework is lacking, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. Status determination relative to reference points is not possible because reference points cannot be defined. An area-swept empirical approach indicates the stock condition remains poor (NEFSC 2020b). NMFS determined that the stock status for witch flounder will remain overfished, with overfishing unknown, consistent with the 2016 benchmark assessment for this stock. Based on the 2017 peer review, witch flounder was overfished and overfishing was unknown (NESFC 2017b). The 2019 assessment did not recommend a change to the stock status. The fishery landings and survey catch by age indicate a truncation of age structure and a reduction in the number of older fish in the population. NEFSC relative indices of abundance and biomass remain below their time series average (NEFSC 2020b).

6.2.7 Gulf of Maine Winter Flounder

Life History. Winter flounder, *Pseudopleuronectes americanus,* is a demersal flatfish distributed in the western North Atlantic from Labrador to Georgia. Important U.S. commercial and recreational fisheries exist from the Gulf of Maine to the Mid-Atlantic Bight. Winter flounder is managed and assessed in U.S. waters as three stocks: Gulf of Maine, southern New England/Mid-Atlantic, and Georges Bank. Adult GOM winter flounder migrate inshore in the fall and early winter and spawn in late winter and early spring. Peak spawning occurs in Massachusetts Bay and south of Cape Cod during February and March, and somewhat later along the coast of Maine, continuing into May. After spawning, adults typically leave inshore areas when water temperatures exceed 59°F (15°C), although some remain inshore year-round. Winter flounder eggs are demersal, adhesive, and cluster together. Larvae are initially planktonic, but 5 - 6 weeks after hatching become increasingly bottom-oriented with metamorphosis, as the left eye migrates to the right side of the body and the larvae become "flounder-like." This finishes by the time the larvae are 0.3 - 0.4 in (8 - 9 mm) long at ~8 weeks old. Newly metamorphosed young-of-the-year winter flounder reside in shallow water where individuals may grow to ~4 in (100 mm) within the first year (NEFSC 2011c).

Population Status. Gulf of Maine winter flounder overfished status is unknown, and overfishing is not occurring. The overfished status remains unknown because a biomass reference point or proxy cannot be determined without an assessment model, and an analytical assessment model has not been accepted since the last benchmark (NEFSC 2017b). In the absence of an assessment model, an area-swept empirical approach is used to estimate the abundance of 30+ cm biomass based on state and federal surveys, which was estimated at 2,585 mt for 2016 biomass (NEFSC 2017b). The GOM winter flounder stock has relatively flat survey indices with little change in the size structure over time. There have been large declines in the commercial and recreational removals since the 1980s. However, this large decline over the time series does not appear to have resulted in a response in the stock's size structure within the catch and surveys nor has it resulted in a change in the survey indices of abundance (NEFSC 2017b).

6.2.8 Georges Bank Winter Flounder

Life History: The life history of Georges Bank winter flounder, *Pseudopleuronectes americanus*, is comparable to the Gulf of Maine winter flounder life history, which is described in Section 6.2.7. GB winter flounder growth is different than either GOM or SNE winter flounder stocks, with winter flounder on Georges Bank growing larger in size than the inshore stocks of winter flounder.

Population Status: Georges Bank winter is overfished and overfishing is not occurring (NEFSC 2019). This is a change from the 2017 operational assessment, in which GB winter flounder was not overfished (NEFSC 2017b). The retrospective adjusted spawning stock biomass in 2018 was estimated to be 2,175 mt, which is 24% of SSB_{MSY}. The 2018 fully selected fishing mortality was estimated to be 0.223, which is 43% of the F_{MSY} proxy (NEFSC 2020b). Fishing mortality declined rapidly between 2013 and 2017 where it was at the lowest level of the time series, and was only slightly higher in 2018. Recruitment declined after 2008 and reached a time series low in 2018. Although fishing mortality rates were at the lowest levels of the time series during 2015-2018, SSB remained near the SSB_{MSY} threshold during 2004-2015 and then declined to the lowest level on record in 2018. Recruitment increased in 2019 and was similar to the 2017 value, but the 2019 estimate is uncertain (NEFSC 2020b).

6.2.9 Southern New England/Mid-Atlantic Winter Flounder

Life History: The life history of SNE/MA winter flounder, *Pseudopleuronectes americanus*, is comparable to the Gulf of Maine winter flounder life history, which is described in Section 6.2.7.

Population Status: Based on the 2017 operational assessment, the SNE/MA winter flounder stock is overfished but overfishing is not occurring. The 2016 spawning stock biomass was estimated to be 4,360 mt, which is 18% of SSB_{MSY} (NEFSC 2017b). The SNE/MA winter flounder stock shows an overall declining trend in SSB over the time series, with current estimates near the time series low. Estimates of fishing mortality have remained steady since 2012 and recruitment has steadily increased since an all time low in 2013. Current recruitment estimates are above the ten year average and are the highest since 2008 (NEFSC 2017b).

6.2.10 Cape Cod/Gulf of Maine Yellowtail Flounder

Life History: The yellowtail flounder, *Limanda ferruginea*, is a demersal flatfish that occurs from Labrador to Chesapeake Bay. It generally inhabits depths between 131 to 230 ft. (40 and 70 m). NMFS manages three stocks off the U.S. coast including the CC/GOM, GB, and SNE/MA stocks. Spawning occurs in the western North Atlantic from March through August at temperatures of 41 to 54 °F (5 to 12°C). Spawning takes place along continental shelf waters northwest of Cape Cod. Yellowtail flounder spawn buoyant, spherical, pelagic eggs that lack an oil globule. Pelagic larvae are brief residents in the water column with transformation to the juvenile stage occurring at 0.5 to 0.6 in (11.6 to 16 mm) standard length. There are high concentrations of adults around Cape Cod in both spring and autumn. The median age at maturity for females is 2.6 years off Cape Cod.

Population Status: Based on the 2019 operational assessment, the CC/GOM yellowtail flounder stock is not overfished and overfishing is not occurring. This is a change from the 2017 assessment update when the stock was overfished and was experiencing overfishing (NEFSC 2017b). The retrospective adjusted 2018 spawning stock biomass was estimated to be 2,125 mt, which is 62% of the biomass target. The 2018 fully selected fishing mortality was estimated to be 0.092, which is 29% of the F_{MSY} proxy (NEFSC 2020b). The change in status is supported by an above average estimated 2016 incoming year class coupled with very low exploitation of the fishery resource. The estimated 2018 catch was the lowest in the time series. There is an above average estimated 2016 incoming year class which has contributed to the increase in total biomass. The reductions in fishing mortality and above average 2016 year class has resulted in the stock biomass to increase. However, SSB is projected to decrease in the short-term if fished at $F_{40\%}$ (NEFSC 2020b).

6.2.11 Georges Bank Yellowtail Flounder

Life History: The general life history of the GB yellowtail flounder, *Limanda ferruginea*, is comparable to the CC/GOM yellowtail described in Section 6.2.10. The median age at maturity for females is 1.8 years on Georges Bank. Spawning takes place along continental shelf.

Population Status: The GB yellowtail flounder stock is a transboundary stock co-managed by the U.S. and Canada. The GB yellowtail flounder stock status is unknown due to a lack of biological reference points. Because a stock assessment model framework is lacking, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. Status determination relative to reference points is not possible because reference points cannot be defined. In the absence of an assessment model, an empirical approach based on survey catches indicates stock condition is poor, given a declining trend in survey biomass despite reductions in catch to historical low levels. Total catch has declined in recent years and is among the lowest values in the time series. The stock has been experiencing below average recruitment and a truncation of age structure. Stock biomass is low and productivity is poor (TRAC 2019). NMFS determined that the stock status for GB yellowtail flounder is overfished, with overfishing occurring.

6.2.12 Southern New England Yellowtail Flounder

Life History: The general life history of the SNE/MA yellowtail flounder, *Limanda ferruginea*, is comparable to the Cape Cod/GOM yellowtail described in Section 6.2.10. The median age at maturity for females is 1.6 years in southern New England.

Population: Based on the 2019 operational assessment, the SNE/MA yellowtail flounder stock is overfished and overfishing is not occurring (NEFSC 2020b). This is a change from the 2017 assessment update when the stock was experiencing overfishing (NEFSC 2017). The retrospective adjusted 2018 spawning stock biomass was estimated to be 90 mt, which is 5% of the biomass target. The 2018 fully selected fishing mortality was estimated to be 0.259, which is 73% of the F_{MSY} proxy (NEFSC 2020b). The 2018 total catch for SNE/MA yellowtail flounder was estimated to be the lowest on record. In 2017, the relatively strong incoming year class has resulted in a moderate increase in SSB in 2018, but remains well below SSB_{MSY}. In the short term, SSB is projected to increase due to another estimated incoming year class in 2018, but the projected increase is still below the biomass reference point (NEFSC 2020b).

6.2.13 Acadian Redfish

Life History: The Acadian redfish, *Sebastes fasciatus Storer*, and the deepwater redfish, *S. mentella Travin*, are virtually indistinguishable from each other based on external characteristics. Deepwater redfish are less prominent in the more southerly regions of the Scotian Shelf and appear to be virtually absent from the Gulf of Maine. Conversely, Acadian redfish appear to be the sole representative of the genus Sebastes. NMFS manages Acadian redfish inhabiting the U.S. waters of the Gulf of Maine and deeper portions of Georges Bank and the Great South Channel as a unit stock. The redfish are a slow growing, long-lived, ovoviviparous species with an extremely low natural mortality rate. Redfish fertilize their eggs internally. The eggs develop into larvae within the oviduct, and are released near the end of the yolk sac phase. The release of larvae lasts for 3 to 4 months with a peak in late May to early June. Newly spawned larvae occur in the upper 10 m of the water column; at 0.4 to 1.0 in (10 to 25 mm). The post-larvae descend below the thermocline when about 1 in (25 mm) in length. Young-of-the-year are pelagic until reaching 1.6 to 2.0 in (40 to 50 mm) at 4 to 5 months old. Therefore, young-of-the-year typically move to the bottom by early fall of their first year. Redfish of 9 in (22 cm) or greater are considered adults. In general, the size of landed redfish positively correlates with depth. This may be due to a combination of differential growth rates of stocks, confused species identification, size-specific migration, or gender-specific migration (females are larger). Redfish make diurnal vertical migrations linked to their primary euphausiid prey.

Population Status: Based on the 2017 operational assessment, the redfish stock is not overfished and overfishing is not occurring. The retrospective adjusted spawning stock biomass in 2016 was estimated to be 359,970 mt, which is 145% of the biomass target (NEFSC 2017b). Total removals of Acadian redfish generally have increased since the early 2000s. Fall survey data suggests the existence of relatively strong year classes in 2008 and 2009. Fall survey data suggests that older fish have begun to reappear in the stock since the 1990s (NEFSC 2017b).

6.2.14 Pollock

Life History: Pollock, *Pollachius virens*, occur on both sides of the North Atlantic. In the western North Atlantic, the species is most abundant on the western Scotian Shelf and in the Gulf of Maine. There is considerable movement of pollock between the Scotian Shelf, Georges Bank, and the Gulf of Maine. Although some differences in meristic and morphometric characters exist, there are no significant genetic differences among areas. As a result, pollock are assessed as a single unit. The principal pollock spawning sites in the western North Atlantic are in the western Gulf of Maine, Great South Channel, Georges Bank, and on the Scotian Shelf. Spawning takes place from September to April. Spawning time is more variable in northern sites than in southern sites. Spawning occurs over hard, stony, or rocky bottom. Spawning activity begins when the water column cools to near 46 °F (8°C) and peaks when temperatures are approximately 40 to 43 °F (4.5 to 6°C). Thus, most spawning occurs within a comparatively narrow range of temperatures. Pollock eggs are buoyant and rise into the water column after fertilization. The pelagic larval stage lasts for 3 to 4 months. At this time the small juveniles or "harbor pollock" migrate inshore to inhabit rocky subtidal and intertidal zones. Pollock then undergo a series of inshore-offshore movements linked to temperature until near the end of their second year. At this point, the juveniles move offshore where the pollock remain throughout the adult stage. Pollock are a schooling species and occur throughout the water column. With the exception of short migrations due to temperature changes and north-south movements for spawning, adult pollock are fairly stationary in the Gulf of Maine and along the Nova Scotian coast. Male pollock reach sexual maturity at a larger size and older age than females.

Population Status: Based on the 2019 operational assessment, the pollock stock is not overfished and overfishing is not occurring. There are two population assessment models brought forward from the 2017 operational assessment: the base model (dome-shaped survey selectivity), which is used to provide management advice; and the flat sel sensitivity model (flat-topped survey selectivity), which is included for the sole purpose of demonstrating the sensitivity of assessment results to survey selectivity assumptions. The retrospective adjusted spawning stock biomass in 2018 was estimated to be 212,416 mt under the base model and 71,322 under the flat sel sensitivity model (respectively), which are 170% and 101% (respectively) of the biomass target (NEFSC 2020b). Total removals of pollock have declined since 2008. Fishery and survey data suggests the existence of a relatively strong 2013 year class, which has just begun to enter the commercial fishery. Survey data suggests that older fish have begun to reappear in the stock since the 1990s (NEFSC 2020b).

6.2.15 White Hake

Life History: The white hake, *Urophycis tenuis*, occurs from Newfoundland to southern New England and is common on muddy bottom throughout the Gulf of Maine. The depth distribution of white hake varies by age and season. Juvenile white hake typically occupy shallower areas than adults, but individuals of all ages tend to move inshore or shoalward in summer and disperse to deeper areas in winter. The northern spawning group of white hake spawns in late summer (August-September) in the southern Gulf of St. Lawrence and on the Scotian Shelf. The timing and extent of spawning in the Georges Bank - Middle Atlantic spawning group has not been clearly determined. The eggs, larvae, and early juveniles are pelagic. Older juvenile and adult white hake are demersal. The eggs are buoyant. Pelagic juveniles become demersal at 2.0 to 2.4 in (50 - 60 mm) total length. The pelagic juvenile stage lasts about two months. White hake attain a maximum length of 53 in (135 cm) and weigh up to 49 lbs (22 kg). Female white hake are larger than males (NEFSC 2013b).

Population Status: Based on the 2019 operational assessment, the white hake stock is overfished and overfishing is not occurring. This is a change from the 2017 operational assessment, in which white hake was not overfished (NEFSC 2017b). The retrospective adjusted 2018 spawning stock biomass is estimated to be 15,891 mt, which is 50% of the biomass target. The 2018 fully selected fishing mortality was estimated to be 0.129, which is 77% of the F_{MSY} proxy (NEFSC 2020b). The stock shows no truncation of age structure. Estimates of commercial landings and discards have decreased over time. The rebuilding deadline for this stock was 2014, and the stock is not yet rebuilt and is now likely overfished. (NEFSC 2020b).

6.2.16 Gulf of Maine/Georges Bank Windowpane Flounder

Life History: Windowpane flounder or sand dab, *Scophthalmus aquosus*, is a left-eyed, flatfish species that occurs in the northwest Atlantic from the Gulf of St. Lawrence to Florida (Collette & Klein-MacPhee 2002). Windowpane prefer sandy bottom habitats and occur at depths from the high water mark to 656 ft (200 m), with the greatest abundance at depths < 180 ft (55 m), and at temperatures of 32º-80ºF (0º-26.8ºC) (Moore 1947). On Georges Bank, it is most abundant at depths < 60 m during late spring through autumn but overwintering occurs in deeper waters to 366 m (Chang et al. 1999). Windowpane flounders are assessed and managed as two stocks: Gulf of Maine-Georges Bank (GOM/GB or northern) and Southern New England-Mid-Atlantic Bight (SNE/MA or southern) due to differences in growth rates, size at maturity, and relative abundance trends. Windowpane generally reach sexual maturity between ages 3 and 4 (Moore 1947), though males can mature at age 2 (Grosslein & Azarovitz 1982). On Georges Bank, median length at maturity is nearly the same for males (8.7 in, 22.2 cm) and females (8.9 in, 22.5 cm) (O'Brien et al. 1993). Spawning occurs on Georges Bank during July and August and peaks again between October and November at temperatures of 55º- 61ºF (13º-16ºC) (Morse & Able 1995). Eggs incubate for 8 days at 50º-55ºF (10º-13ºC) and eye migration occurs approximately 17- 26 days after hatching (Collette & Klein-MacPhee 2002). During the first year of life, spring-spawned fish have significantly faster growth rates than autumn-spawned fish, which may result in differential natural mortality rates between the two cohorts (Neuman et al. 2001). Young windowpanes settle inshore and then move offshore to deeper waters as they grow. Windowpane on Georges Bank aggregate in shallow water during summer and early fall and move offshore in the winter and early spring (Grosslein & Azarovitz 1982).

Population Status: Initial results from the 2019 operational assessment indicated that the northern windowpane flounder stock is overfished and overfishing is occurring. This is a change from the 2017 assessment update when the stock was not experiencing overfishing (NEFSC 2017b). However, the peer review panel did not recommend accepting the F_{MSY} proxy produced for the 2019 assessment and recommended instead using the F_{MSY} proxy from the 2017 Operational Assessment for status determination. This changed the recommended status to overfished with no overfishing occurring, consistent with the 2017 assessment results. The stock was scheduled to be rebuilt by 2017, but the stock still remains below the biomass threshold despite recent catch estimates being the very lowest in the time series. Since the year 2000, the northern windowpane flounder stock has shown decreasing survey indices despite reductions in catch (NEFSC 2020b).

6.2.17 Southern New England/Mid-Atlantic Windowpane Flounder

Life History: The life history of Southern New-England/Mid-Atlantic Bight (southern) windowpane flounder, *Scophthalmus aquosus*, is comparable to Northern Windowpane Flounder (Section 6.2.16). In Southern New England, median length at maturity is nearly the same for males (8.5 in, 21.5 cm) and females (8.3 in, 21.2 cm) (O'Brien, et al. 1993). A split spawning season occurs between Virginia and Long Island with peaks in spring and fall (Chang, et al. 1999). Spawning occurs in the southern Mid-Atlantic during April and May and then peaks again in October or November (Morse & Able 1995).

Population Status: Based on the 2019 operational assessment, the southern windowpane flounder stock is not overfished and overfishing is not occurring. Since 2012, survey biomass indices have declined by half, however, the larger trend has been upward since the series low in 1993. Catch and relative F have been stable (NEFSC 2020b).

6.2.18 Ocean Pout

Life History: Ocean pout, *Zoarces americanus*, is a demersal eel-like species found in the northwest Atlantic from Labrador to Delaware. Ocean pout are most common on sand and gravel bottom (Orach-Meza 1975) at depths of 49-262 ft (15-80 m) and temperatures of 43º-48º F (6º-9º C) (Scott 1982). In US waters, ocean pout are assessed and managed as a unit stock from the Gulf of Maine to Delaware. In the Gulf of Maine, median length at maturity for males and females is 11.9 in (30.3 cm) and 10.3in (26.2 cm), respectively. Median length at maturity for males and females from Southern New England is 12.6 in (31.9 cm) and 12.3in (31.3 cm), respectively (O'Brien, et al. 1993). According to tagging studies conducted in Southern New England, ocean pout appear not to migrate, but do move between different substrates seasonally. In Southern New England-Georges Bank they occupy cooler rocky areas in summer, returning in late fall (Orach-Meza 1975). In the Gulf of Maine, they move out of inshore areas in the late summer and then return in the spring. Spawning occurs between September and October in Southern New England (Olsen & Merriman 1946) and in August and September in Newfoundland (Keats et al. 1985). Adults aggregate in rocky areas prior to spawning. Eggs are internally fertilized (Mercer et al. 1993; Yao & Crim 1995) and females lay egg masses encased in a gelatinous matrix that they then guard during the incubation period of 2.5-3 months (Keats, et al. 1985). Ocean pout hatch as juveniles on the bottom and are believed to remain there throughout their lives (Methven & Brown 1991; Yao & Crim 1995).

Population Status: Based on the 2017 operational assessment, ocean pout is overfished but overfishing is not occurring. The stock is not rebuilding as expected, despite low catch. Discards comprise most of the catch since the no possession regulation was implemented in May 2010. The NEFSC survey indices remain at near-record low levels; there are few large fish in the population. The ocean pout stock remains in poor condition. (NEFSC 2017b).

6.2.19 Atlantic Halibut

Life History: Atlantic halibut, *Hippoglossus hippoglossus*, is the largest species of flatfish in the northwest Atlantic Ocean. This long-lived, late-maturing flatfish is distributed from Labrador to southern New England (Collette & Klein-MacPhee 2002). They prefer sand, gravel, or clay substrates at depths up to 1000 m (Miller et al. 1991; Scott & Scott 1988). Along the coastal Gulf of Maine, halibut move to deeper water in winter and shallower water in summer (Collette & Klein-MacPhee 2002). Atlantic halibut reach sexual maturity between 5 to 15 years and the median female age of maturity in the Gulf of Maine-Georges Bank region is 7 years (Sigourney et al. 2006). In general, Atlantic halibut spawn once per year in synchronous groups during late winter through early spring (Neilson et al. 1993) and females can produce up to 7 million eggs per year depending on size (Haug & Gulliksen 1988). Spawning is believed to occur in waters of the upper continental slope at depths below 200 m (Scott & Scott 1988). Halibut eggs are buoyant but drift suspended at water depths of 54 - 90 m (Taning 1936). Incubation times are 13 - 20 days depending on temperature (Blaxter et al. 1983); how long halibut live in the plankton after hatching is not known.

Population Status: The stock assessment model framework for Atlantic halibut was not accepted as best scientific advice by the review panel at the 2015 operational assessments (NEFSC 2015). The 2010 benchmark assessment and 2012 assessment update concluded that the stock was overfished and that was overfishing was occurring (NEFSC 2012; NEFSC 2010). All information available in the 2015 assessment update, including the long-term exploitation history of the stock and survey trends, indicated that stock size had not increased, and that the condition of the stock was still poor. The 2015 peer review concluded that the Atlantic halibut stock status is unknown due to a lack of biological reference points. Because a stock assessment model framework is lacking, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. Status determination relative to reference points is not possible because reference points cannot be defined. The Council worked closely with the NEFSC to hire a contractor to explore data-limited assessment approaches for Atlantic halibut for 2017. The approach, known as the First Second Derivative (FSD) model, uses a combination of fishery dependent and fishery independent data sources to assess recent changes to the relative condition of the halibut resource. The peer review concluded that all information in the 2017 update indicates that while there have been recent increases in stock size, the condition of the stock is still poor. Overfishing status is considered unknown for halibut and the peer review concluded that evidence suggests that this stock should still be considered overfished (Rago 2017). NMFS determined that the stock status for Atlantic halibut will remain overfished, with overfishing not occurring, consistent with the 2012 assessment update for this stock. Based on the 2019 assessment update, stock status for Atlantic halibut cannot be determined analytically due to a lack of biological reference points associated with the FSD method (NEFSC 2020b). There are indications that abundance has increased significantly over the last decade (Rago 2017), which would support a hypothesis that the stock was not experiencing overfishing during that period. It should be noted however, that the FSD model has recently recommended reducing catch, which might be an indication that the stock no longer increasing.

6.2.20 Atlantic Wolffish

Life History: Atlantic wolffish, *Anarhichas lupus*, is a benthic fish distributed on both sides of the North Atlantic Ocean. In the northwest Atlantic, the species occurs from Davis Straits off of Greenland to Cape Cod and sometimes in southern New England and New Jersey waters (Collette & Klein-MacPhee 2002). In the Georges Bank-Gulf of Maine region, abundance is highest in the southwestern portion at depths of 263 - 394 ft (80 - 120 m), but wolffish are also found in waters from 131 - 787 ft (40 - 240 m) (Nelson & Ross 1992) and at temperatures of 29.7º - 50.4º F (-1.3º - 10.2º C) (Collette & Klein-MacPhee 2002). They prefer complex benthic habitats with large stones and rocks (Pavlov & Novikov 1993). Atlantic wolffish are mostly sedentary and solitary, except during mating season. There is some evidence of a weak seasonal shift in depth between shallow water in spring and deeper water in fall (Nelson & Ross 1992). Most individuals mature by age 5-6 when they reach ~18.5 in (47 cm) total length (Nelson & Ross 1992; Templeman 1986). Northern wolffish mature at smaller sizes than faster growing southern fish. Peak spawning is believed to occur from September to October for Gulf of Maine-Georges Bank wolffish (Collette & Klein-MacPhee 2002), though laboratory studies have shown that wolffish can spawn most of the year (Pavlov & Moksness 1994). Eggs are laid in masses, and males are thought to brood for several months. Incubation time is dependent on water temperature and may be 3 - 9 months. Larvae and early juveniles are pelagic between 20 - 40 mm TL, with settlement beginning by 50 mm TL (Falk-Petersen & Hansen 1991).

Population Status: Based on the 2017 operational assessment, Atlantic wolfish is overfished but overfishing is not occurring. The 2016 spawning stock biomass is estimated to be 652 mt, which is 40% of the biomass target (NEFSC 2017b). Catch has been limited almost exclusively to discards since the implementation of the no possession rule in May 2010. No age 1 recruits have been caught in the NEFSC spring survey since 2004 (NEFSC 2017b).

6.3 NON-GROUNDFISH SPECIES

The following are non-groundfish species routinely caught by the commercial groundfish fishery.

6.3.1 Spiny Dogfish

Life History. Spiny dogfish, *Squalus acanthias*, occurs in the northwest Atlantic from Labrador to Florida. Spiny dogfish is considered to be a unit stock in the northwest Atlantic. In summer, dogfish migrate northward to the Gulf of Maine-Georges Bank region and into Canadian waters. They return southward in autumn and winter. Recent research has suggested that migratory patterns may be more complex (Carlson et al 2014). Spiny dogfish tend to school by size and, when mature, by sex. The species bears live young, with a gestation period of 18 – 22 months, and produce 2 - 15 pups (average of 6). Size at maturity for females is ~31 in (80 cm), but can vary from 31 - 33 in (78 - 85 cm) depending on the abundance of females (NEFSC 2013h).

Population and Management Status. The NEFMC and MAFMC jointly manage spiny dogfish FMP for federal waters and the Atlantic States Marine Fisheries Commission (ASMFC) has a state waters plan. Spawning stock biomass of spiny dogfish declined rapidly in response to a directed fishery during the 1990's. NFMS initially implemented management measures adopted by the Councils for spiny dogfish in 2001. These measures have been effective in reducing landings and fishing mortality. At the 2010 TRAC, managers agreed to determine stock status using the model from SAW 43 (2006) and NEFSC spring survey data through 2009. NMFS declared the spiny dogfish stock rebuilt for the purposes of federal management in May 2010 (TRAC 2010). As of the 2018 update, the stock was not overfished, and overfishing was not occurring, but the population declined to 67% of the target (Sosebee and Rago 2018) so quotas were lowered from 2018 to 2019 but then are scheduled to increase somewhat in 2020 and 2021. A benchmark assessment is expected in 2022.

6.3.2 Skates

Life History. There are seven species in the Northeast Region skate complex: little skate (*Leucoraja erinacea*), winter skate (*L. ocellata*), barndoor skate (*Dipturus laevis*), thorny skate (*Amblyraja radiata*), smooth skate (*Malacoraja senta*), clearnose skate (*Raja eglanteria*), and rosette skate (*L. garmani*). Barndoor skate is the most common skate in the Gulf of Maine, on Georges Bank, and in southern New England. Georges Bank and southern New England is the center of distribution for little and winter skates in the Northeast Region. Thorny and smooth skates typically occur in the Gulf of Maine. Clearnose and rosette skates have a more southern distribution, and occur primarily in southern New England and the Chesapeake Bight. Skates are not known to undertake large-scale migrations, but move seasonally with changing water temperature; they move offshore in summer and early autumn and then return inshore during winter and spring. Skates lay eggs enclosed in a hard, leathery case commonly called a mermaid's purse. Incubation time is 6 - 12 months, with the young having the adult form at the time of hatching. Catches of these species are largely interrelated with the NE multispecies, monkfish, and scallop fisheries (NEFSC 2011c).

Population and Management Status. NMFS implemented the Northeast Skate Complex Fishery Management Plan (Skate FMP) in September 2003. The FMP required both dealers and vessels to report skate landings by species. Framework Adjustment 2 modified the VTR and dealer reporting codes to further improve species specific landing reports. Possession prohibitions of barndoor, thorny, and smooth skates in the Gulf of Maine were also provisions of the FMP. The FMP implemented a trip limit of 10,000 lbs (4,536 kg) for winter skate, and required fishermen to obtain a Letter of Authorization to exceed trip limits for the little skate bait fishery. In 2010, Amendment 3 to the Skate FMP implemented a rebuilding plan for smooth skate and established an ACL and annual catch target for the skate complex, total allowable landings for the skate wing and bait fisheries, and seasonal quotas for the bait fishery. Possession limits were reduced, in-season possession limit triggers were implemented, as well as other measures to improve management of the skate fisheries. Due to insufficient information about the population dynamics of skates, there remains considerable uncertainty about the status of skate stocks. Based on NEFSC bottom trawl survey data through autumn 2018/spring 2019, one skate species remains overfished (thorny) and overfishing is not occurring in any of the seven skate species. Barndoor skate is considered to be rebuilt for the purposes of federal management as of August 2016. Smooth skate is also considered rebuilt. Recent skate landings have fluctuated between approximately 30 and 40 million pounds. The landings and catch limits proposed by Amendment 3 have an acceptable probability of promoting biomass growth and achieving the rebuilding (biomass) targets for thorny skates. A stabilization of total catch below the median relative exploitation ratio should cause skate biomass and future yield to increase.

6.3.3 Monkfish

Life History. Monkfish, *Lophius americanus*, (i.e., "goosefish"), occur in the western North Atlantic from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina. Monkfish occur from inshore areas to depths of at least 2,953 ft (900 m). Monkfish undergo seasonal onshore-offshore migrations, which may relate to spawning or possibly to food availability. Female monkfish begin to mature at age 4 with 50% of females maturing by age 5 (~17 in [43 cm]). Males generally mature at slightly younger ages and smaller sizes (50% maturity at age 4.2 or 14 in [36 cm]). Spawning takes place from spring through early autumn. It progresses from south to north, with most spawning occurring during the spring and early summer. Females lay a buoyant egg raft or veil that can be as large as 39 ft (12 m) long and 5 ft (1.5 m) wide, and only a few mm thick. The larvae hatch after 1 - 3 weeks, depending on water temperature. The larvae and juveniles spend several months in a pelagic phase before settling to a benthic existence at a size of ~3 in (8 cm; NEFSC 2011c).

Population and Management Status. NMFS implemented the Monkfish FMP in 1999 (NEFMC 1998) and the fishery is jointly managed by the NEFMC and MAFMC. The FMP included measures to stop overfishing and rebuild the stocks through a number of measures. These measures included:

- Limiting the number of vessels with access to the fishery and allocating DAS to those vessels;
- Setting trip limits for vessels fishing for monkfish; minimum fish size limits;
- Gear restrictions;
- Mandatory time out of the fishery during the spawning season; and
- A framework adjustment process.

The Monkfish FMP defines two management areas for monkfish (northern and southern), divided roughly by an east-west line bisecting Georges Bank. As of 2013 data, monkfish in both management areas are not overfished and overfishing is not occurring (NEFSC 2013c). Operational assessments for monkfish were conducted in 2016 and 2019, but it was recommended that stock status not be updated during these data updates due to a lack of biological reference points (Richards 2016, NEFSC 2020a). According to the 2019 assessment, strong recruitment in 2015 fueled an increase in stock biomass in 2016-2018, though abundance has since declined as recruitment returned to average levels. Biomass increases were greater in the northern area than in the southern area, and biomass has declined somewhat in the south, as abundance of the 2015 year class declined. In the north, landings and catch have fluctuated around a steady level since 2009, but increased after 2015, with discards increasing only slightly. In the south, landings and catch had been declining since around 2000, but catch increased after 2015 due to discarding of a strong 2015 year class, with almost a doubling of the discard rate.

6.3.4 Summer Flounder

Life History. Summer flounder, *Paralichthys dentatus*, occur in the western North Atlantic from the southern Gulf of Maine to South Carolina. Summer flounder are concentrated in bays and estuaries from late spring though early autumn, when an offshore migration to the outer continental shelf is undertaken. Spawning occurs during autumn and early winter, and the larvae are transported toward coastal areas by prevailing water currents. Development of post larvae and juveniles occurs primarily within bays and estuarine areas. Most fish are sexually mature by age 2. The largest fish are females, which can attain lengths over 90 cm (36 in) and weights up to 11.8 kg (26 lbs.; NEFSC 2011c). Recent NEFSC trawl survey data indicate that while female summer flounder grow faster (reaching a larger size at the same age), the sexes attain about the same maximum age (currently age 15 at 56 cm for males, and age 14 at 76 cm for females). Unsexed commercial fishery samples currently indicate a maximum age of 20 for a 57 cm fish (NEFSC 2019b).

Population and Management Status. The FMP was developed by the MAFMC in 1988, and scup and black sea bass were later incorporated into the FMP. Amendment 2, implemented in 1993, established a commercial quota allocated to the states, a recreational harvest limit, minimum size limits, gear restrictions, permit and reporting requirements, and an annual review process to establish specifications for the coming fishing year. In 1999, Amendment 12 revised the overfishing definitions for all three species, established rebuilding programs, addressed bycatch and habitat issues and established a framework adjustment procedure for the FMP to allow for a streamlined process for relatively minor changes to management measures. Results from the 2018 benchmark assessment indicate that the summer flounder stock was not overfished, and overfishing was not occurring in 2017 relative to the biological reference points as revised through the SAW 66 benchmark assessment (NEFSC 2019a). The estimated SSB in 2017 was 44,552 mt, which is 78% of the target biomass. Fully selected fishing mortality was estimated to be 0.334 in 2017, which is 75% of the F_{MSY} proxy (NEFSC 2019a).

6.3.5 American Lobster

Life History. American lobster, *Homarus americanus*, occurs in continental shelf waters from Maine to North Carolina. There are two biological stock units: the Gulf of Maine/Georges Bank stock, and Southern New England stock. The American lobster is long-lived and known to reach more than 40 pounds in body weight (Wolff 1978). Lobsters are encased in a hard exoskeleton that is periodically cast off (molted) for growth and mating to occur. Eggs are carried under the female's abdomen during a 9 - 11 month incubation period. Larger lobsters produce eggs with greater energy content and thus, may produce larvae with higher survival rates (Attard & Hudon 1987). Seasonal timing of egg extrusion and larval hatching is somewhat variable among areas and may also vary due to seasonal weather patterns. Hatching tends to occur over a five month period from May – September, occurring earlier and over a longer period in the southern part of the range. The pelagic larvae molt four times before they resemble adults and settle to the bottom. Lobsters molt more than 20 times over 5 - 8 years before they reach the minimum legal harvest size.

Population and Management Status. The states, in cooperation with NMFS, manage the American lobster resource through the ASMFC under the provisions of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). States have jurisdiction for implementing measures in state waters, while NMFS implements complementary regulations in federal waters. Over the last four decades, landings in the lobster fishery have exponentially increased, with 39.1 million pounds landed in 1981 and 159.36 million pounds landed in 2016. Preliminary landings in 2017 were 137.0 million pounds. Most of this increase in landings can be attributed to the Gulf of Maine, which has accounted for over 90% of coastwide landings since 2006. In contrast, landings in the Southern New England stock have declined in conjunction with a decrease in stock health. Results of the 2015 Benchmark Stock Assessment showed a mixed picture, with increasing abundance in the Gulf of Maine/Georges Bank (GOM/GBK) stock and a sharp decline in abundance for the Southern New England (SNE) stock. In particular, the Stock Assessment concluded that the SNE stock is experiencing recruitment failure with estimates of recent recruitment near zero (ASMFC, 2015). Overall, the SNE stock is considered depleted but overfishing is not occurring; the GOM/GBK unit is not overfished and overfishing is not occurring, though consistent declines in the young-of-year surveys have been observed in the GOM/GBK stock since 2012. (ASMFC 2015).

6.3.6 Whiting (Silver Hake)

Life History. Silver hake, also known as whiting, *Merluccius bilinearis*, range primarily from Newfoundland to South Carolina. Silver hake are fast swimmers with sharp teeth, and are important fish predators that also feed heavily on crustaceans and squid (Lock & Packer 2004). In U.S. waters, two stocks have been identified based on differences of head and fin lengths (Almeida 1987), otolith morphometrics (Bolles & Begg 2000), otolith growth differences, and seasonal distribution patterns (Lock & Packer 2004). The northern silver hake stock inhabits Gulf of Maine - Northern Georges Bank waters, and the southern silver hake stock inhabits Southern Georges Bank - Middle Atlantic Bight waters. Silver hake migrate in response to seasonal changes in water temperatures, moving toward shallow, warmer waters in the spring. They spawn in these shallow waters during late spring and early summer and then return to deeper waters in the autumn (Brodziak et al. 2001). The older, larger silver hake especially prefer deeper waters. During the summer, portions of both stocks can be found on Georges Bank, whereas during the winter fish in the northern stock move to deep basins in the Gulf of Maine, while fish in the southern stock move to outer continental shelf and slope waters. Silver hake are widely distributed, and have been observed at temperature ranges of 2-17° C (36-63° F) and depth ranges of 11-500 m (36-1,640 ft). However, they are most commonly found between 7-10º C (45-50º F) (Lock & Packer 2004).

Population and Management Status. Due to their abundance and availability, silver hake have supported important U.S. and Canadian fisheries as well as distant-water fleets. Landings increased to 137,000 mt in 1973 and then declined sharply with increased restrictions on distant-water fleet effort and implementation of the Magnuson Fishery Conservation and Management Act (MFCMA) in 1977. U.S. landings during 1987-1996 were relatively stable, averaging 16,000 mt per year, but have gradually declined to a historic low of 6,035 mt in fishing year 2017. The small-mesh otter trawl remains the principal gear used in the U.S. fishery, and recreational catches have been low since 1985. Fishing in the Gulf of Maine and Georges Bank regulated mesh areas are managed via six exemption areas, each having specific specifications for gear, possession limits for incidental species, and boundaries (see NEFMC 2017 for details). In the northern management area, all but the Cultivator Shoals Area require vessels to use a more selective raised footrope trawl when using small-mesh trawls.

Silver hake are managed under the NEFMC's Northeast Multispecies FMP ("non-regulated multispecies" category). In 2000, the NEFMC implemented Amendment 12 to this FMP, and placed silver hake into the “small mesh multispecies” management unit, along with red hake and offshore hake. This amendment established retention limits based on net mesh size, adopted overfishing definitions for northern and southern stocks, identified essential fish habitat for all life stages, and set requirements for fishing gear (NEFMC 2000). As of the last assessment in 2017, silver hake is not overfished and overfishing is not occurring in the northern or southern management area (NEFMC 2018). Biomass in the northern management area has increased, but biomass in the southern management area has been declining. As a result, the Council adjusted the annual catch specifications for 2018-2020, increasing by 27% in the northern area and decreasing by 35% in the southern area (NEFMC 2017), reflecting changes in the three-year average survey biomass estimate which is a major component of the specification-setting procedures.

6.3.7 Loligo Squid

Life History. Longfin inshore squid (*Doryteuthis (Amerigo) pealeii*) are distributed primarily in continental shelf waters located between Newfoundland and the Gulf of Venezuela (Cohen 1976; Roper et al. 1984). In the northwest Atlantic Ocean, longfin squid are most abundant in the waters between Georges Bank and Cape Hatteras where the species is commercially exploited. The management unit is all longfin squid under U.S. jurisdiction (i.e. U.S. east coast). Distribution varies seasonally. North of Cape Hatteras, squid migrate offshore during autumn to overwinter in warmer waters along the shelf edge and slope, and then return inshore during the spring where they remain until late autumn (Jacobson 2005). The species lives for 6-8 months, grows rapidly, and spawns year-round with peaks during late spring and autumn. Individuals hatched in summer grow more rapidly than those hatched in winter and males grow faster and attain larger sizes than females (Brodziak & Macy III 1996).

Population and Management Status. Based on a new biomass reference point from a 2010 SAW-SARC assessment, the longfin squid stock was not overfished in 2009, but overfishing status was not determined because no overfishing threshold was recommended (though the assessment did describe the stock as "lightly exploited"). The assessment was updated in 2017 with 2016 data and the findings were the same (stock was 174% of the target biomass in 2016). The domestic fishery occurs primarily in Southern New England and Mid-Atlantic waters, but some fishing also occurs along the edge of Georges Bank. Fishing patterns reflect seasonal distribution patterns and effort is generally directed offshore during October through April and inshore during May through September. The fishery is dominated by small-mesh otter trawlers, but some near-shore pound net and fish trap fisheries occur during spring and summer. Summer or winter landings may dominate in any given year. The stock is managed by the MAFMC under the Atlantic Mackerel, Squid, and Butterfish FMP. Management measures include annual TACs, which have been partitioned into 3 four-month seasonal trimesters since 2007. There is a moratorium on directed and incidental fishery permits (an open access permit with a low trip limit may still be acquired for free). A minimum codend mesh size of 2 1/8 inches applies from September-April and 1 7/8 inches from May-August. The fishery can also be closed if butterfish discards exceed a discard cap (via in-season monitoring).

6.3.8 Atlantic Sea Scallops

Life History. Sea scallops, *Placopecten magellanicus*, are distributed in the northwest Atlantic Ocean from Newfoundland to North Carolina, mainly on sand and gravel sediments where bottom temperatures remain below 20º C (68º F). North of Cape Cod, concentrations generally occur in shallow water <40 m (22 fathoms) deep. South of Cape Cod and on Georges Bank, sea scallops typically occur at depths 25 - 200 m (14 - 110 fathoms), with commercial concentrations generally 35 - 100 m (19 - 55 fathoms). Sea scallops are filter feeders, feeding primarily on phytoplankton, but also on microzooplankton and detritus (Hart & Chute 2004). Sea scallops grow rapidly during the first several years of life. Between ages 3 and 5, they commonly increase 50 - 80% in shell height and quadruple their meat weight. Sea scallops have been known to live more than 20 years. They usually become sexually mature at age 2, but individuals younger than age 4 probably contribute little to total egg production. Sexes are separate and fertilization is external. Spawning usually occurs in late summer and early autumn; spring spawning may also occur, especially in the Mid-Atlantic Bight. Sea scallops are highly fecund; a single large female can release hundreds of millions of eggs annually. Larvae remain in the water column for four to seven weeks before settling to the bottom. Sea scallops attain commercial size at about four to five years old, though historically, three year olds were often exploited. Sea scallops have a somewhat uncommon combination of life-history attributes: low mobility, rapid growth, and low natural mortality (NEFSC 2011c).

Population and Management Status. The commercial fishery for sea scallops is conducted year round, primarily using New Bedford style and turtle deflector scallop dredges. A small percentage of the fishery employs otter trawls, mostly in the Mid-Atlantic. The principal U.S. commercial fisheries are in the Mid-Atlantic (from Virginia to Long Island, New York) and on Georges Bank and neighboring areas, such as the Great South Channel and Nantucket Shoals. There is also a small, primarily inshore fishery for sea scallops in the Gulf of Maine. The NEFMC established the Scallop FMP in 1982. The scallop resource was last assessed through a benchmark assessment in 2018, and it was not overfished, and overfishing was not occurring (NEFSC 2018).

6.3.9 Scup

Life History. Scup are found in a variety of habitats in the Mid-Atlantic. Essential fish habitat (EFH) for scup includes demersal waters, areas with sandy or muddy bottoms, mussel beds, and sea grass beds from the Gulf of Maine through Cape Hatteras, North Carolina. Scup undertake extensive seasonal migrations between coastal and offshore waters. They are mostly found in estuaries and coastal waters during the spring and summer. In the fall and winter, they move offshore and to the south, to outer continental shelf waters south of New Jersey. Scup spawn once annually over weedy or sandy areas, mostly off of southern New England. Spawning takes place from May through August and usually peaks in June and July (Steimle et al. 1999). About 50% of scup are sexually mature at two years of age and about 17 cm (about 7 inches) total length. Nearly all scup older than three years of age are sexually mature. Scup reach a maximum age of at least 14 years. They may live as long as 20 years; however few scup older than age 7 are caught in the Mid-Atlantic (DPSWG 2009, NEFSC 2015).

Population and Management Status. The scup fishery is cooperatively managed by the MAFMC and the ASMFC under the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP). The primary commercial fishery management measure is a quota that is distributed to three trimester periods and to individual states. Other federal regulations include minimum mesh size, gear restricted areas, and a minimum fish size. States typically restrict harvest to their quota using seasons and trip limits. Scup were under a formal rebuilding plan from 2005 through 2009. NMFS declared the scup stock rebuilt in 2009 based on the findings of the Data Poor Stocks Working Group (DPSWG 2009). The most recent stock assessment update indicates that scup was not overfished and overfishing was not occurring in 2016, relative to the biological reference points from the 2015 benchmark assessment. SSB has declined since its peak in 2011 but remains very high and increased slightly in 2016. Estimated SSB in 2016 was 396.60 million pounds (179,898 mt), 2.1 times SSB at maximum sustainable yield (SSB_{MSY} = 192.47 million pounds, or 87,302 mt). The fishing mortality rate in 2016 was 0.139, which is 37% below the fishing mortality threshold reference point ($F_{MSY\ PROXY}$ = F40%) of 0.220. Fishing mortality has been below the $F_{MSY\ PROXY}$ reference point for the last 17 years. The average recruitment from 1984 to 2016 is 121 million fish at age 0. The 2015 year class is estimated to be 252 million fish, the largest on record, while the 2016 year class is estimated to be below average at 65 million fish (NEFSC 2017).

6.3.10 Atlantic Herring

Life History. Atlantic herring is widely distributed in continental shelf waters of the Northeast Atlantic, from Labrador to Cape Hatteras. Herring is in every major estuary from the northern Gulf of Maine to the Chesapeake Bay. They are most abundant north of Cape Cod and become increasingly scarce south of New Jersey (Kelly & Moring 1986). Spawning occurs in the summer and fall, starting earlier along the eastern Maine coast and southwest Nova Scotia (August – September) than in the southwestern GOM (early to mid-October in the Jeffreys Ledge area) and GB (as late as November - December; Reid et al. 1999). In general, GOM herring migrate from summer feeding grounds along the Maine coast and on GB to SNE/MA areas during winter, with larger individuals tending to migrate farther distances. Atlantic herring play an important role as forage in the Northeast U.S. shelf ecosystem. They are eaten by a wide variety of fish, marine mammals, birds, and (historically) by humans in the region.

Population and Management Status. The Atlantic herring fishery is cooperatively managed by both the NEFMC and ASMFC. Presently, herring from the GOM (inshore) and GB (offshore) stock components are combined for assessment purposes into a single coastal stock complex. The fishery uses quotas by area and season. Prosecuted primarily by mid water trawls (single and paired), purse seines, and a lesser degree bottom trawls, management measures include restrictions on the incidental catch of haddock and other regulated groundfish. Mid-water trawls are allowed access to the groundfish closed areas as an exempted fishery but their use of the areas is subject to numerous regulatory restrictions. The Atlantic herring stock was last assessed in 2018 and was not overfished and overfishing was not occurring through 2017 (NEFSC, 2018). However, recruitment has been below average and four of the six lowest annual recruitment estimates have occurred in recent years. Therefore, future projections of biomass are relatively low in the near term, putting the stock at relatively high risk of becoming overfished. According to the 2018 Stock Assessment, SSB in 2017 is estimated to be 141,473 mt. Catch limits are expected to be much lower in 2019-2021 compared to current levels set in the last specification package (2016-2018) and earlier. For example, catch limits proposed for 2020 are well under 20,000 mt compared to catch limits over 100,000 mt that were in place for the handful of years before.

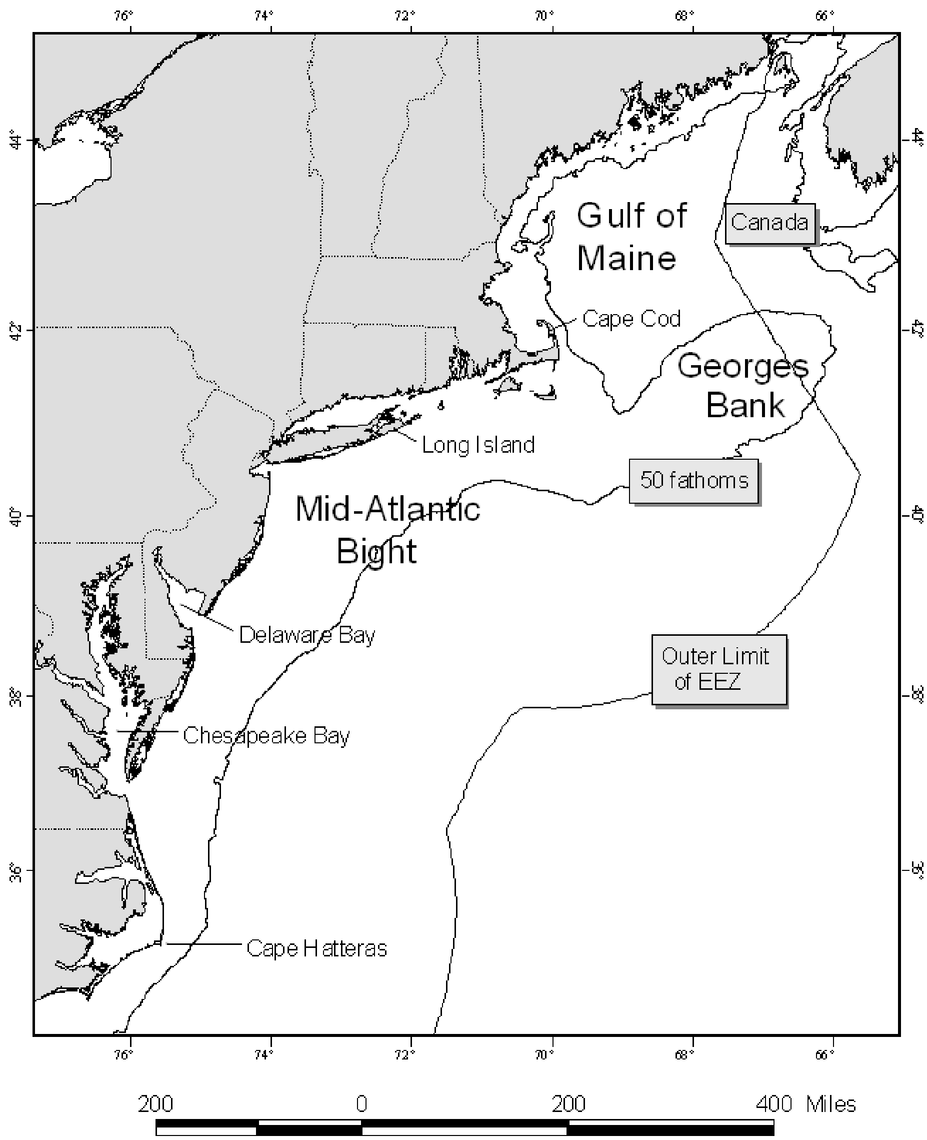
6.3.11 Bycatch

The MSA defines bycatch as fish which are harvested in a fishery, but which are not sold or kept for personal use, including economic discards and regulatory discards. Fish released alive under a recreational catch and release fishery management program are not included. The MSA requires that, to the extent practicable, bycatch and the mortality of bycatch that cannot be avoided should both be minimized. To consider whether these objectives are being met, bycatch must be reported and assessed. To this end, the MSA requires that a standardized reporting methodology assess the amount and type of bycatch occurring in a fishery. The primary tools used to report bycatch in the multispecies fishery are the Vessel Trip Report system (VTR), the NEFSC Observer Program (NEFOP), and the groundfish sector At-Sea Monitoring Program (ASM). Each federally permitted groundfish vessel is required to report discards and landings on every trip from each statistical area they fish in. The sea sampling/observer program places personnel on boats to observe and estimate the amount of discards on a haul-by-haul basis. More information on bycatch may be found at: http://www.greateratlantic.fisheries.noaa.gov/

6.4 Physical Environment/EFH

The Northeast U.S. Shelf Ecosystem (Map 4) includes the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream (Sherman et al. 1996). The continental slope includes the area east of the shelf, out to a depth of 6,562 ft (2,000 m). Four distinct sub-regions are identified, including the Gulf of Maine, Georges Bank, the Mid-Atlantic Bight, and the continental slope. The groundfish fishery primarily occurs in the inshore and offshore waters of the Gulf of Maine, Georges Bank, and the Southern New England/Mid-Atlantic areas. Therefore, the description of the physical environment focuses on these sub-regions. The distinctive features of Southern New England are included in the sections describing Georges Bank and the Mid-Atlantic Bight.

Map 4 - Northeast U.S. Shelf Ecosystem.

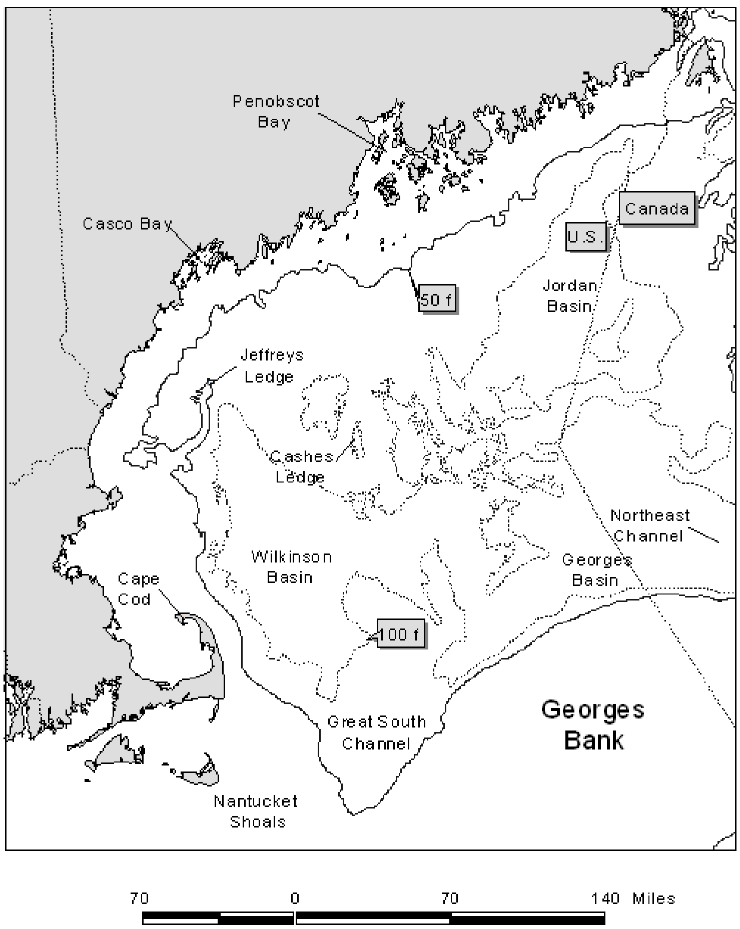


Source: Stevenson et al. (2004).

6.4.1 Gulf of Maine

The Gulf of Maine is an enclosed coastal sea, glacially derived, bounded on the east by Browns Bank, on the north by the Nova Scotia (Scotian) Shelf, on the west by the New England states, and on the south by Cape Cod and Georges Bank (Map 5). The Gulf of Maine is a boreal environment characterized by relatively cold waters and deep basins, with a patchwork of various sediment types, topographically diverse from the rest of the continental border along the U.S. Atlantic coast. There are 21 distinct basins separated by ridges, banks, and swells. Depths in the basins exceed 820 ft. (250 m), with a maximum depth of 1,148 ft (350 m) in Georges Basin, just north of Georges Bank. High points within the Gulf of Maine include irregular ridges, such as Cashes Ledge, which peaks at 30 ft (9 m) below the surface.

Map 5 - Gulf of Maine.



Source: Stevenson et al. (2004).

Very fine sediment particles created and eroded by the glaciers have collected in thick deposits over much of the seafloor of the Gulf of Maine, particularly in its deep basins. In the basins, these mud deposits blanket and obscure the irregularities of the underlying bedrock, forming topographically smooth terrains, although localized rocky features are present, for example in Jordan Basin (see the Council's Draft Deep-Sea Coral Amendment). In the rises between the basins, other materials are usually at the surface.

Unsorted glacial till covers some morainal areas, sand predominates on some high areas, and gravel,[10] sometimes with boulders, predominates others. Bedrock is the predominant substrate along the western edge of the Gulf of Maine, north of Cape Cod in a narrow band out to a water depth of about 197 ft. (60 m). Mud predominates in coastal valleys and basins that often abruptly border rocky substrates. Gravel, often mixed with shell, is common adjacent to bedrock outcrops and in fractures in the rock. Gravel is most abundant at depths of 66 - 131 ft. (20 - 40 m), except off eastern Maine where a gravel-covered plain exists to depths of at least 328 ft. (100 m). Sandy areas are relatively rare along the inner shelf of the western Gulf of Maine, but are more common south of Casco Bay, especially offshore of sandy beaches (Stevenson, et al. 2004). Stellwagen Bank offshore Massachusetts includes large areas of sand sediment, in addition to gravel sediments and boulder ridges (Valentine et al. 2005, Valentine and Gallea 2015).

The geologic features of the Gulf of Maine, coupled with the vertical variation in water properties (e.g., salinity, depth, temperature), provide a great diversity of habitat types that support a rich biological community. A brief description of benthic invertebrates and demersal (i.e., bottom-dwelling) fish that occupy the Gulf of Maine is provided below. Additional information is provided in Stevenson et al. (2004), which is incorporated by reference.

The most common groups of benthic invertebrates in the Gulf of Maine reported by Theroux and Wigley (1998) in terms of numbers collected were annelid worms, bivalve mollusks, and amphipod crustaceans. Bivalves, sea cucumbers, sand dollars, annelids, and sea anemones dominated biomass. Watling (1998) identified seven different bottom assemblages that occur on the following habitat types:

1. Sandy offshore banks: fauna are characteristically sand dwellers with an abundant interstitial component;
2. Rocky offshore ledges: fauna are predominantly sponges, tunicates, bryozoans, hydroids, and other hard bottom dwellers;
3. Shallow [<197 ft. (60 m)] temperate bottoms with mixed substrate: fauna population is rich and diverse, primarily comprised of polychaetes and crustaceans;
4. Primarily fine muds at depths of 197 - 459 ft. (60 - 140 m) within cold Gulf of Maine Intermediate Water:[11] fauna are dominated by polychaetes, shrimp, and cerianthid anemones;
5. Cold deep water, muddy bottom: fauna include species with wide temperature tolerances which are sparsely distributed, diversity low, dominated by a few polychaetes, with brittle stars, sea pens, shrimp, and cerianthids also present;
6. Deep basin, muddy bottom, overlaying water usually 45 - 46°F (7 - 8°C): fauna densities are not high, dominated by brittle stars and sea pens, and sporadically by tube-making amphipods; and
7. Upper slope, mixed sediment of either fine muds or mixture of mud and gravel, water temperatures always >46°F (8°C): upper slope fauna extending into the Northeast Channel.

Two studies (Gabriel 1992; Overholtz & Tyler 1985) reported common[12] demersal fish species by assemblages in the Gulf of Maine and Georges Bank:

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[10] The term "gravel," as used in this analysis, is a collective term that includes granules, pebbles, cobbles, and boulders in order of increasing size. Therefore, the term "gravel" refers to particles larger than sand and generally denotes a variety of "hard bottom" substrates.

[11] Maine Intermediate Water is described as a mid-depth layer of water that preserves winter salinity and temperatures, and is located between more saline Maine bottom water and the warmer, stratified Maine surface water. The stratified surface layer is most pronounced in the deep portions of the western GOM.

[12] Other species were listed as found in these assemblages, but only the species common to both studies are listed.

- Deepwater/Slope and Canyon: offshore hake, blackbelly rosefish, Gulf stream flounder;
- Intermediate/Combination of Deepwater Gulf of Maine-Georges Bank and Gulf of Maine-Georges Bank Transition: silver hake, red hake, goosefish (monkfish);
- Shallow/Gulf of Maine-Georges Bank Transition Zone: Atlantic cod, haddock, pollock;
- Shallow water Georges Bank-southern New England: yellowtail flounder, windowpane flounder, winter flounder, winter skate, little skate, longhorn sculpin;
- Deepwater Gulf of Maine-Georges Bank: white hake, American plaice, witch flounder, thorny skate; and
- Northeast Peak/Gulf of Maine-Georges Bank Transition: Atlantic cod, haddock, pollock.

6.4.2 Georges Bank

Georges Bank is a shallow (10 - 492 ft. [3 - 150 m depth]), elongated (100 mi.(161 km) wide by 20 mi (322 km) long) extension of the continental shelf that was formed during the Wisconsinian glacial episode (Map 4). It has a steep slope on its northern edge, a broad, flat, gently sloping southern flank, and steep submarine canyons on its eastern and southeastern edges. It has highly productive, well-mixed waters and strong currents. The Great South Channel lies to the west. Natural processes continue to erode and rework the sediments on Georges Bank. Erosion and reworking of sediments by the action of rising sea level as well as tidal and storm currents may reduce the amount of sand and cause an overall coarsening of the bottom sediments (Valentine & Lough 1991).

Bottom topography on eastern Georges Bank consists of linear ridges in the western shoal areas; a relatively smooth, gently dipping seafloor on the deeper, easternmost part; a highly energetic peak in the north with sand ridges up to 30 m high and extensive gravel pavement; and steeper and smoother topography incised by submarine canyons on the southeastern margin. The central region of Georges Bank is shallow, and the bottom has shoals and troughs, with sand dunes superimposed within. The area west of the Great South Channel, known as Nantucket Shoals, is similar in nature to the central region of Georges Bank. Currents in these areas are strongest where water depth is shallower than 164 ft. (50 m). Sediments in this region include gravel pavement and mounds, some scattered boulders, sand with storm-generated ripples, and scattered shell and mussel beds. Tidal and storm currents range from moderate to strong, depending upon location and storm activity.

Oceanographic frontal systems separate the water masses of the Gulf of Maine and Georges Bank from oceanic waters south of Georges Bank. These water masses differ in temperature, salinity, nutrient concentration, and planktonic communities. These differences influence productivity and may influence fish abundance and distribution.

Georges Bank has historically had high levels of both phytoplankton and fish production. Common demersal fish species in Georges Bank are offshore hake, blackbelly rosefish, Gulf Stream flounder, silver hake, red hake, goosefish (monkfish), Atlantic cod, haddock, pollock, yellowtail flounder, windowpane flounder, winter flounder, winter skate, little skate, longhorn sculpin, white hake, American plaice, witch flounder, and thorny skate. In terms of benthic invertebrates, the most common groups in terms of numbers collected were amphipod crustaceans and annelid worms, while sand dollars and bivalves dominated the overall biomass (Theroux & Wigley 1998). Using Theroux and Wigley database, Theroux and Grosslein (1987) identified four macrobenthic invertebrate assemblages that occur on similar habitat type:

1. The Western Basin assemblage is found in comparatively deep water (492 - 656 ft. [150 - 200 m]) with relatively slow currents and fine bottom sediments of silt, clay, and muddy sand. Fauna are comprised mainly of small burrowing detritivores and deposit feeders, and carnivorous scavengers.
2. The Northeast Peak assemblage is found in variable depths and current strength and includes coarse sediments, consisting mainly of gravel and coarse sand with interspersed boulders, cobbles, and pebbles. Fauna tend to be sessile (coelenterates, brachiopods, barnacles, and tubiferous annelids) or free-living (brittle stars, crustaceans, and polychaetes), with a characteristic absence of burrowing forms.
3. The Central Georges Bank assemblage occupies the greatest area, including the central and northern portions of Georges Bank in depths <328 ft. (100 m). Medium-grained shifting sands predominate this dynamic area of strong currents. Organisms tend to be small to moderately large with burrowing or motile habits. Sand dollars are most characteristic of this assemblage.
4. The Southern Georges Bank assemblage is found on the southern and southwestern flanks at depths from 262 - 656 ft. (80 - 200 m), where fine-grained sands and moderate currents predominate. Many southern species exist here at the northern limits of their range. Dominant fauna include amphipods, copepods, euphausiids, and starfish.

6.4.3 Southern New England/Mid-Atlantic Bight

The Mid-Atlantic Bight includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream (Map 4). The northern portion of the Mid-Atlantic Bight is sometimes referred to as southern New England. It generally includes the area of the continental shelf south of Cape Cod from the Great South Channel to Hudson Canyon. The Mid-Atlantic Bight consists of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, North Carolina. The shelf slopes gently from shore out to 62 - 124 ft (100 - 200 km) offshore, where it transforms to the slope (328 - 656 ft. [100 - 200 m water depth]) at the shelf break. In both the Mid-Atlantic Bight and on Georges Bank, numerous canyons incise the slope, and some cut up onto the shelf itself (Stevenson, et al. 2004). Like the rest of the continental shelf, sea level fluctuations during past ice ages largely shaped the topography of the Mid-Atlantic Bight. Since that time, currents and waves have modified this basic structure.

The sediment type covering most of the shelf in the Mid-Atlantic Bight is sand, with some relatively small, localized areas of sand-shell and sand-gravel. Silty sand, silt, and clay predominate on the slope. Permanent sand ridges occur in groups with heights of about 33 ft. (10 m), lengths of 6 - 31 mi (10 - 50 km), and spacing of 1 mi (2 km). The sand ridges are usually oriented at a slight angle towards shore, running in length from northeast to southwest. Sand ridges are often covered with smaller similar forms such as sand waves, megaripples, and ripples. Sand waves are usually found in patches of 5 - 10 with heights of about 7 ft. (2 m), lengths of 164 - 328 ft. (50 - 100 m), and 0.6 - 1 mi (1 - 2 km) between patches. Sand waves are temporary features that form and re-form in different locations. They usually occur on the inner shelf. Because tidal currents southwest of Nantucket Shoals and southeast of Long Island and Rhode Island slow significantly, there is a large mud patch on the seafloor where silts and clays settle out.

Artificial reefs are another important Mid-Atlantic Bight habitat. These localized areas of hard structure have been formed more recently than other seabed types by shipwrecks, lost cargoes, disposed solid materials, shoreline jetties and groins, submerged pipelines, cables, and other materials (Steimle & Zetlin 2000). In general, reefs are important for attachment sites, shelter, and food for many species. In addition, fish predators, such as tunas, may be drawn by prey aggregations or may be behaviorally attracted to the reef structure. Estuarine reefs, such as blue mussel beds or oyster reefs, are dominated by epibenthic organisms, as well as crabs, lobsters, and sea stars. These reefs are hosts to a multitude of fish, including gobies, spot, bass (black sea and striped), perch, toadfish, and croaker. Coastal reefs consist of exposed rock, wrecks, kelp, or other hard material. Boring mollusks, algae, sponges, anemones, hydroids, and coral generally dominate these coastal reefs. These reef types also host lobsters, crabs, sea stars, and urchins, as well as a multitude of fish, including; black sea bass, pinfish, scup, cunner, red hake, gray triggerfish, black grouper, smooth dogfish, and summer flounder. These epibenthic organisms and fish assemblages are similar to the reefs farther offshore, which generally consist of rocks and boulders, wrecks, and other types of artificial reefs. There is less information available for reefs on the outer shelf, but the fish species associated with these reefs include tilefish, white hake, and conger eel.

While substrate is the primary factor influencing demersal species distribution in the Gulf of Maine and Georges Bank, latitude and water depth are the primary influence in the Mid-Atlantic Bight area.
In terms of numbers, amphipod crustaceans and bivalve mollusks dominate the benthic fauna of this primarily sandy environment. Mollusks (70%) dominate the biomass (Stevenson, et al. 2004). Pratt (1973) identified three broad faunal zones related to water depth and sediment type:

1. The “sand fauna” zone is dominated by polychaetes and was defined for sandy sediments (≤1% silt) that are at least occasionally disturbed by waves, from shore out to a depth of about 164 ft. (50 m).
2. The “silty sand fauna” zone is dominated by amphipods and polychaetes and occurs immediately offshore from the sand fauna zone, in stable sands containing a small amount of silt and organic material.
3. Silts and clays become predominant at the shelf break and line the Hudson Shelf Valley supporting the “silt-clay fauna.”

Colvocoresses and Musick (1984) identified the following assemblages in the Mid-Atlantic sub region during spring and fall.[13]

- Northern (boreal) portions: hake (white, silver, red), goosefish (monkfish), longhorn sculpin, winter flounder, little skate, and spiny dogfish;
- Warm temperate portions: black sea bass, summer flounder, butterfish, scup, spotted hake, and northern sea robin;
- Water of the inner shelf: windowpane flounder;
- Water of the outer shelf: fourspot flounder; and
- Water of the continental slope: shortnose greeneye, offshore hake, blackbelly rosefish, and white hake.

6.4.4 Essential Fish Habitat Designations

The Sustainable Fisheries Act defines EFH as “[t]hose waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” The proposed action could potentially affect EFH for benthic life stages of species that are managed under the Northeast Multispecies FMP; as well as EFH for species managed under the Atlantic Sea Scallop; Monkfish; Northeast Skate Complex; Atlantic

[13] Other species were listed as found in these assemblages, but only the species common to both spring and fall seasons are listed.

Herring; Summer Flounder, Scup, and Black Sea Bass; Golden Tilefish; Atlantic Mackerel, Squid, and Butterfish; and Atlantic Surfclam and Ocean Quahog FMPs. EFH for deep-sea red crab is designated beyond the operating depths of the multispecies fishery. EFH for the species managed under these FMPs includes a wide variety of benthic habitats in state and federal waters throughout the Northeast U.S. shelf ecosystem.

Table 8 - Summary of Geographic distributions and habitat characteristics of Essential Fish Habitat designations for benthic fish and shellfish species managed by the New England and Mid-Atlantic fishery management councils in the Greater Atlantic region, as of October 2019.

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Acadian redfish	Juveniles	Gulf of Maine and the continental slope north of 37°38'N	50-200 in Gulf of Maine, to 600 on slope	Sub-tidal coastal and offshore rocky reef substrates with associated structure-forming epifauna (e.g., sponges, corals), and soft sediments with cerianthid anemones
	Adults	Gulf of Maine and the continental slope north of 37°38'N	140-300 in Gulf of Maine, to 600 on slope	Offshore benthic habitats on finer grained sediments and on variable deposits of gravel, silt, clay, and boulders
American plaice	Juveniles	Gulf of Maine and bays and estuaries from Passamaquoddy Bay to Saco Bay, Maine and from Massachusetts Bay to Cape Cod Bay, Massachusetts Bay	40-180	Sub-tidal benthic habitats on mud and sand, also found on gravel and sandy substrates bordering bedrock
	Adults	Gulf of Maine, Georges Bank and bays and estuaries from Passamaquoddy Bay to Saco Bay, Maine and from Massachusetts Bay to Cape Cod Bay, Massachusetts Bay	40-300	Sub-tidal benthic habitats on mud and sand, also gravel and sandy substrates bordering bedrock
Atlantic cod	Juveniles	Gulf of Maine, Georges Bank, and Southern New England, including nearshore waters from eastern Maine to Rhode Island and the following estuaries: Passamaquoddy Bay to Saco Bay; Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	Mean high water-120	Structurally-complex intertidal and sub-tidal habitats, including eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulder) with and without attached macroalgae and emergent epifauna
	Adults	Gulf of Maine, Georges Bank, Southern New England, and the Mid-Atlantic to Delaware Bay, including the following estuaries: Passamaquoddy Bay to Saco Bay; Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	30-160	Structurally complex sub-tidal hard bottom habitats with gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae, also sandy substrates and along deeper slopes of ledges
Atlantic halibut	Juveniles & Adults	Gulf of Maine, Georges Bank, and continental slope south of Georges Bank	60-140 and 400-700 on slope	Benthic habitats on sand, gravel, or clay substrates
Atlantic wolffish	Eggs	U.S. waters north of 41˚N latitude and east of 71˚W longitude	<100	Sub-tidal benthic habitats under rocks and boulders in nests
	Juveniles	U.S. waters north of 41˚N latitude and east of 71˚W longitude	70-184	Sub-tidal benthic habitats
	Adults	U.S. waters north of 41˚N latitude and east of 71˚W longitude	<173	A wide variety of sub-tidal sand and gravel substrates once they leave rocky spawning habitats, but not on muddy bottom

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Haddock	Juveniles	Inshore and offshore waters in the Gulf of Maine, on Georges Bank, and on the continental shelf in the Mid-Atlantic region	40-140 and as shallow as 20 in coastal Gulf of Maine	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel
	Adults	Offshore waters in the Gulf of Maine, on Georges Bank, and on the continental shelf in Southern New England	50-160	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel and adjacent to boulders and cobbles along the margins of rocky reefs
Ocean pout	Eggs	Georges Bank, Gulf of Maine, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	<100	Sub-tidal hard bottom habitats in sheltered nests, holes, or rocky crevices
	Juveniles	Gulf of Maine, on the continental shelf north of Cape May, New Jersey, on the southern portion of Georges Bank, and including certain bays and estuaries in the Gulf of Maine	Mean high water-120	Intertidal and sub-tidal benthic habitats on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel
	Adults	Gulf of Maine, Georges Bank, on the continental shelf north of Cape May, New Jersey, and including certain bays and estuaries in the Gulf of Maine	20-140	Sub-tidal benthic habitats on mud and sand, particularly in association with structure forming habitat types; i.e. shells, gravel, or boulders
Pollock	Juveniles	Inshore and offshore waters in the Gulf of Maine (including bays and estuaries in the Gulf of Maine), the Great South Channel, Long Island Sound, and Narragansett Bay, Rhode Island	Mean high water-180 in Gulf of Maine, Long Island Sound, and Narragansett Bay; 40-180 on Georges Bank	Intertidal and sub-tidal pelagic and benthic rocky bottom habitats with attached macroalgae, small juveniles in eelgrass beds, older juveniles move into deeper water habitats also occupied by adults
	Adults	Offshore Gulf of Maine waters, Massachusetts Bay and Cape Cod Bay, on the southern edge of Georges Bank, and in Long Island Sound	80-300 in Gulf of Maine and on Georges Bank; <80 in Long Island Sound, Cape Cod Bay, and Narragansett Bay	Pelagic and benthic habitats on the tops and edges of offshore banks and shoals with mixed rocky substrates, often with attached macro algae
White hake	Juveniles	Gulf of Maine, Georges Bank, and Southern New England, including bays and estuaries in the Gulf of Maine	Mean high water - 300	Intertidal and sub-tidal estuarine and marine habitats on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats
	Adults	Gulf of Maine, including coastal bays and estuaries, and the outer continental shelf and slope	100-400 offshore Gulf of Maine, >25 inshore Gulf of Maine, to 900 on slope	Sub-tidal benthic habitats on fine-grained, muddy substrates and in mixed soft and rocky habitats
Windowpane flounder	Juveniles	Estuarine, coastal, and continental shelf waters from the Gulf of Maine to	Mean high water - 60	Intertidal and sub-tidal benthic habitats on mud and sand substrates

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
		northern Florida, including bays and estuaries from Maine to Maryland		
	Adults	Estuarine, coastal, and continental shelf waters from the Gulf of Maine to Cape Hatteras, North Carolina, including bays and estuaries from Maine to Maryland	Mean high water - 70	Intertidal and sub-tidal benthic habitats on mud and sand substrates
Winter flounder	Eggs	Eastern Maine to Absecon Inlet, New Jersey (39° 22´N) and Georges Bank	0-5 south of Cape Cod, 0-70 Gulf of Maine and Georges Bank	Sub-tidal estuarine and coastal benthic habitats on mud, muddy sand, sand, gravel, submerged aquatic vegetation, and macroalgae
	Juveniles	Coastal Gulf of Maine, Georges Bank, and continental shelf in Southern New England and Mid-Atlantic to Absecon Inlet, New Jersey, including bays and estuaries from eastern Maine to northern New Jersey	Mean high water - 60	Intertidal and sub-tidal benthic habitats on a variety of bottom types, such as mud, sand, rocky substrates with attached macro algae, tidal wetlands, and eelgrass; young-of-the-year juveniles on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks
	Adults	Coastal Gulf of Maine, Georges Bank, and continental shelf in Southern New England and Mid-Atlantic to Absecon Inlet, New Jersey, including bays and estuaries from eastern Maine to northern New Jersey	Mean high water - 70	Intertidal and sub-tidal benthic habitats on muddy and sandy substrates, and on hard bottom on offshore banks; for spawning adults, also see eggs
Witch flounder	Juveniles	Gulf of Maine and outer continental shelf and slope	50-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
	Adults	Gulf of Maine and outer continental shelf and slope	35-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
Yellowtail flounder	Juveniles	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	20-80	Sub-tidal benthic habitats on sand and muddy sand
	Adults	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including certain bays and estuaries in the Gulf of Maine	25-90	Sub-tidal benthic habitats on sand and sand with mud, shell hash, gravel, and rocks
Silver hake	Juveniles	Gulf of Maine, including certain bays and estuaries, and on the continental shelf as far south as Cape May, New Jersey	40-400 in Gulf of Maine, >10 in Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats in association with sand-waves, flat sand with amphipod tubes, shells, and in biogenic depressions
	Adults	Gulf of Maine, including certain bays and estuaries, the southern portion of Georges Bank, and the outer continental shelf and some shallower coastal locations in the Mid-Atlantic	>35 in Gulf of Maine, 70-400 on Georges Bank and in the Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats, often in bottom depressions or in association with sand waves and shell fragments, also in mud habitats bordering deep boulder reefs, on over deep boulder reefs in the southwest Gulf of Maine
Offshore hake	Juveniles	Outer continental shelf and slope from Georges Bank to 34° 40’N	160-750	Pelagic and benthic habitats
	Adults	Outer continental shelf and slope from Georges Bank to 34° 40’N	200-750	Pelagic and benthic habitats

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
Red hake	Juveniles	Gulf of Maine, Georges Bank, and the Mid-Atlantic, including Passamaquoddy Bay to Cape Cod Bay in the Gulf of Maine, Buzzards Bay and Narragansett Bay, Long Island Sound, Raritan Bay and the Hudson River, and lower Chesapeake Bay	Mean high water-80	Intertidal and sub-tidal soft bottom habitats, especially those that that provide shelter, such as depressions in muddy substrates, eelgrass, macroalgae, shells, anemone and polychaete tubes, on artificial reefs, and in live bivalves (e.g., scallops)
	Adults	In the Gulf of Maine, the Great South Channel, and on the outer continental shelf and slope from Georges Bank to North Carolina, including inshore bays and estuaries as far south as Chesapeake Bay	50-750 on shelf and slope, as shallow as 20 inshore	Sub-tidal benthic habitats in shell beds, on soft sediments (usually in depressions), also found on gravel and hard bottom and artificial reefs
Monkfish	Juveniles	Gulf of Maine, outer continental shelf in the Mid-Atlantic, and the continental slope	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Sub-tidal benthic habitats on a variety of habitats, including hard sand, pebbles, gravel, broken shells, and soft mud, also seek shelter among rocks with attached algae
	Adults	Gulf of Maine, outer continental shelf in the Mid-Atlantic, and the continental slope	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Sub-tidal benthic habitats on hard sand, pebbles, gravel, broken shells, and soft mud, but seem to prefer soft sediments, and, like juveniles, utilize the edges of rocky areas for feeding
Smooth skate	Juveniles	Offshore Gulf of Maine, some coastal bays in Maine and New Hampshire, and on the continental slope from Georges Bank to North Carolina	100-400 offshore Gulf of Maine, <100 inshore Gulf of Maine, to 900 on slope	Benthic habitats, mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks in the Gulf of Maine
	Adults	Offshore Gulf of Maine and the continental slope from Georges Bank to North Carolina	100-400 offshore Gulf of Maine, to 900 on slope	Benthic habitats, mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks in the Gulf of Maine
Thorny skate	Juveniles	Offshore Gulf of Maine, some coastal bays in the Gulf of Maine, and on the continental slope from Georges Bank to North Carolina	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 on the slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
	Adults	Offshore Gulf of Maine and on the continental slope from Georges Bank to North Carolina	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 on the slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
Little skate	Juveniles	Coastal waters in the Gulf of Maine, Georges Bank, and the continental shelf in the Mid-Atlantic region as far south as Delaware Bay, including certain bays and estuaries in the Gulf of Maine	Mean high water-80	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud
	Adults	Coastal waters in the Gulf of Maine, Georges Bank, and the continental shelf in the Mid-Atlantic region as far	Mean high water-100	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
		south as Delaware Bay, including certain bays and estuaries in the Gulf of Maine		
Winter skate	Juveniles	Coastal waters from eastern Maine to Delaware Bay, including certain bays and estuaries from eastern Maine to Chincoteague Bay, Virginia, and on Georges Bank and the continental shelf in Southern New England and the Mid-Atlantic	0-90	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud
	Adults	Coastal waters from eastern Maine to Delaware Bay, including certain bays and estuaries in Maine and New Hampshire, and on Georges Bank and the continental shelf in Southern New England and the Mid-Atlantic	0-80	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud
Barndoor skate	Juveniles and adults	Primarily on Georges Bank and in Southern New England and on the continental slope	40-400 on shelf and to 750 on slope	Sub-tidal benthic habitats on mud, sand, and gravel substrates
Clearnose skate	Juveniles	Inner continental shelf from New Jersey to the St. Johns River in Florida and certain bays and certain estuaries including Raritan Bay, inland New Jersey bays, Chesapeake Bay, and Delaware Bays	0-30	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
	Adults	Inner continental shelf from New Jersey to the St. Johns River in Florida and certain bays and certain estuaries including Raritan Bay, inland New Jersey bays, Chesapeake Bay, and Delaware Bays	0-40	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
Rosette skate	Juveniles and adults	Outer continental shelf from approximately 40˚N to Cape Hatteras, North Carolina	80-400	Benthic habitats with mud and sand substrates
Atlantic herring	Eggs	Coastal Gulf of Maine, Georges Bank, and Southern New England	5-90	Sub-tidal benthic habitats on coarse sand, pebbles, cobbles, and boulders and/or macroalgae
Atlantic sea scallop	Eggs	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Inshore and offshore benthic habitats (see adults)
	Larvae	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Massachusetts Bay, and Cape Cod Bay	No information	Inshore and offshore pelagic and benthic habitats: pelagic larvae ("spat"), settle on variety of hard surfaces, including shells, pebbles, and gravel and to macroalgae and other benthic organisms such as hydroids
	Juveniles	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to	18-110	Benthic habitats initially attached to shells, gravel, and small rocks (pebble, cobble), later free-swimming juveniles found in same habitats as adults

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
		Sheepscot River; Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay		
	Adults	Gulf of Maine coastal waters and offshore banks, Georges Bank, and the Mid-Atlantic, including the following estuaries: Passamaquoddy Bay to Sheepscot River; Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay	18-110	Benthic habitats with sand and gravel substrates
Deep-sea red crab	Eggs	Outer continental shelf and slope throughout the region, including two seamounts	320-640	Benthic habitats attached to female crabs
	Juveniles	Outer continental shelf and slope throughout the region, including two seamounts	320-1300 on slope and to 2000 on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments
	Adults	Outer continental shelf and slope throughout the region, including two seamounts	320-900 on slope and up to 2000 m on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments
Summer flounder	Juveniles	Continental shelf and estuaries from Cape Cod, Massachusetts, to Cape Canaveral, Florida	To maximum 152	Benthic habitats, including inshore estuaries, salt marsh creeks, seagrass beds, mudflats, and open bay areas
	Adults	Continental shelf from Cape Cod, Massachusetts, to Cape Canaveral, Florida, including shallow coastal and estuarine waters during warmer months	To maximum 152 in colder months	Benthic habitats
Scup	Juveniles	Continental shelf between southwestern Gulf of Maine and Cape Hatteras, North Carolina and in nearshore and estuarine waters between Massachusetts and Virginia	No information	Benthic habitats, in association with inshore sand and mud substrates, mussel and eelgrass beds
	Adults	Continental shelf and nearshore and estuarine waters between southwestern Gulf of Maine and Cape Hatteras, North Carolina	No information, generally overwinter offshore	Benthic habitats
Black sea bass	Juveniles and adults	Continental shelf and estuarine waters from the southwestern Gulf of Maine and Cape Hatteras, North Carolina	Inshore in summer and spring	Benthic habitats with rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, also offshore clam beds and shell patches in winter
Golden tilefish	Juveniles and adults	Outer continental shelf and slope from U.S.-Canada boundary to the Virginia-North Carolina boundary	100-300	Burrows in semi-lithified clay substrate, may also utilize rocks, boulders, scour depressions beneath boulders, and exposed rock ledges as shelter
Longfin inshore squid	Eggs	Inshore and offshore waters from Georges Bank southward to Cape Hatteras	Generally <50	Bottom habitats attached to variety of hard bottom types, macroalgae, sand, and mud
Spiny dogfish	Juveniles	Primarily the outer continental shelf and slope between Cape Hatteras and Georges Bank and in the Gulf of Maine	Deep water	Pelagic and epibenthic habitats

Species	Life Stage	Geographic Area	Depth (meters)	Habitat Type and Description
	Female sub-adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
	Male sub-adults	Primarily in the Gulf of Maine and on the outer continental shelf from Georges Bank to Cape Hatteras	Wide depth range	Pelagic and epibenthic habitats
	Female adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
	Male adults	Throughout the region	Wide depth range	Pelagic and epibenthic habitats
Atlantic surfclam	Juveniles and adults	Continental shelf from southwestern Gulf of Maine to Cape Hatteras, North Carolina	Surf zone to about 61, abundance low >38	In substrate to depth of 3 ft
Ocean quahog	Juveniles and adults	Continental shelf from southern New England and Georges Bank to Virginia	9-244	In substrate to depth of 3 ft

6.4.5 Gear Types and Interaction with Habitat

A variety of gears are used in the multispecies fishery (Table 9). Groundfish vessels fish for target species with: trawl, gillnet, and hook and line gear (including jigs, handline, and non-automated demersal longlines). This section discusses the characteristics of each of the gear types, as well as the typical impacts to the physical habitat associated with each of these gear types. In general, EFH for species and life stages that rely on the seafloor for shelter (e.g., from predators), reproduction, or food is vulnerable to disturbance by bottom tending gear. The most vulnerable habitat is more likely to be hard or rough bottom with attached epifauna. The Council's recently published Omnibus Habitat Amendment 2 includes an assessment of relative habitat vulnerability to the gear types used in the northeast region. This analysis was recently updated (NEFMC 2019).

Table 9 - Description of the gear types used by the multispecies fishery.

	Trawl	Sink/Anchor Gillnets	Bottom Longlines	Hook and Line
Total Length	Varies	295 ft. (90 m) long per net	~1,476 ft. (451 m)	Varies by target species
Lines	N/A	Leadline and floatline with webbing (mesh) connecting	Mainline is parachute cord. Gangions (lines from mainline to hooks) are 15 in (38 cm) long, 3 - 6 in (8 to 15 cm) apart, and made of shrimp twine	One to several with mechanical line fishing
Nets	Rope or large-mesh size, depends upon target species	Monofilament, mesh size depends on the target species (groundfish nets minimum mesh size of 6.5 in [16.5 cm])	No nets, but 12/0 or larger circle hooks are required	No nets, but single to multiple hooks, "umbrella rigs"
Anchoring	N/A	22 lbs (10 kg) Danforth-style anchors are required at each end of the net string	20-24 lbs (9-11 kg) anchors, anchored at each end, using pieces of railroad track, sash weights, or Danforth anchors, depending on currents	No anchoring, but sinkers used (stones, lead)
Frequency/ Use Duration	Tows last for several hours	Frequency of tending changes from daily (when targeting groundfish) to semi-weekly (when targeting monkfish and skate)	Usually set for a few hours at a time	Depends upon cast/target species

6.4.5.1 Trawl Gear

Trawls are classified by their function, bag construction, or method of maintaining the mouth opening. Function may be defined by the part of the water column where the trawl operates (e.g., bottom) or by the species that it targets (Hayes 1983). Mid-water trawls are designed to catch pelagic species in the water column and do not normally contact the bottom; however, mid-water trawls are prohibited in the Northeast multispecies fishery. Bottom trawls are designed to be towed along the seafloor and to catch a variety of demersal fish and invertebrate species.

Bottom otter trawls account for nearly all commercial bottom trawling activity. A wide range of otter trawls are used in the northeast due to the diversity of fisheries and bottom types encountered in the region (NEFSC 2002c). The specific gear design is often a result of the target species (whether found on or off the bottom) as well as the composition of the bottom (smooth versus rough and soft versus hard). Fishermen tow bottom trawls at a variety of speeds, but average about 5.6 km/hour (3 knots). Several federal FMPs manage the use of this gear. Bottom trawling is also subject to a variety of state regulations throughout the region.

A flatfish trawl is a type of bottom otter trawl designed with a low net opening between the headrope and the footrope and more ground rigging on the sweep. This type of trawl is designed so that the sweep follows the contours of the bottom. As flounders lie in contact with the seafloor, these animals respond to the bottom-tending sweep by swimming up off the bottom where they can be entrained into net. Flatfish trawls are used on smooth mud and sand bottoms. In contrast, a high-rise or fly net with larger mesh has a wide net opening and is used to catch demersal fish that tend to rise higher off the bottom than flatfish (NEFSC 2002).

Bottom otter trawls are rigged with rockhopper gear for use on "hard" bottom (i.e., gravel or rocky bottom), or on mud or sand bottom with occasional boulders. This type of gear seeks to sweep over irregularities in the bottom without damaging the net. The sweep in trawls rigged for fishing on smooth bottoms looks to herd fish into the path of the net (Mirarchi 1998).

The raised-footrope trawl was designed to provide vessels with a means of continuing to fish for small-mesh species without catching groundfish. Raised-footrope trawls fish about 1.6 - 2.0 ft. (0.5 - 0.6 m) above the bottom. Although the doors of the trawl still ride on the bottom, underwater video and observations in flume tanks have confirmed that the sweep in the raised-footrope trawl has much less contact with the seafloor than the traditional cookie sweep (Carr & Milliken 1998).

The haddock separator trawl and Ruhle trawl (bottom trawls) are used to minimize the catch of cod. The design of these gears considers the behavior of fish in response to gear. A haddock separator trawl is a groundfish trawl modified to a vertically oriented trouser trawl configuration. It has two extensions arranged one over the other. A codend is attached to the upper extension and the bottom extension is left open with no codend attached. A horizontal large mesh separating panel constructed with a minimum of 6-inch diamond mesh must be installed between the selvedges joining the upper and lower panels [648.85(a)(3)(iii)(A)]. Haddock generally swim to the upper part of a net and cod swim to the lower part of the net. By inserting a mesh panel in the net, and using two codends, the net effectively divides the catch. The cod can escape if the codend on the lower part of the net is left open (NEFMC 2003). Overall, the haddock separator trawl has had mixed results in commercial fishing operations. The expected ratios of haddock to cod have not been realized. Catches of other demersal species, such as flounders, skates, and monkfish, have also been higher than expected. However, the separator trawl has reduced catches of these species compared to normal fishing practices (NEFMC 2009b).

The Ruhle trawl (previously known as the haddock rope trawl or eliminator trawl) is a four-seam bottom groundfish trawl with a rockhopper. It is designed to reduce the bycatch of cod while retaining or increasing the catch of haddock and other healthy stocks [648.85(b)(6)(iv)(J)(3)]. NMFS approved the Ruhle trawl for use in the DAS program and in the Eastern U.S./Canada Haddock SAP on July 14, 2008 (73 FR 40186) after nearly two years of testing to determine efficacy. Experiments comparing traditional and the new trawl gear showed that the Ruhle trawl reduced bycatch of cod and flounders, while simultaneously retaining the catch of healthier stocks, primarily haddock. The large, 8-foot mesh in the forward end (the wings) of the Ruhle trawl net allows cod and other fish to escape because of their body shapes and unique behavior around the netting.

6.4.5.2 Gillnet Gear

In addition to trawl gear, the fishery is also prosecuted using gillnets. A bottom gillnet is a large wall of netting equipped with floats at the top and lead weights along the bottom. Bottom gillnets are anchored or staked in position. Fish are caught while trying to pass through the net mesh. The meshes of individual gillnets are uniform in size and shape, and therefore are highly selective for a particular size of fish (Jennings et al. 2001). Bottom gillnets are fished in two different ways, as "standup" and "tiedown" nets (Williamson 1998). Standup nets typically catch Atlantic cod, haddock, pollock, and hake and are soaked (duration of time the gear is set) for 12 - 24 hours. Tiedown nets are set with the floatline tied to the leadline at 6-ft (1.8 m) intervals, so that the floatline is close to the bottom and the net forms a limp bag between each tie. They are left in the water for 3-4 days, and are used to catch flounders and monkfish.

Individual sink/anchor gillnets are about 295 ft. (90 m) long. They are usually fished as a series of 5 - 15 nets attached end-to-end. A vast majority of “strings” consist of 10 gillnets. Gillnets typically have three components: the leadline, webbing, and floatline. In New England, leadlines are approximately 66 lbs/net (30 kg/net). Webs are monofilament, with the mesh size depending on the species of interest. Nets are anchored at each end using materials such as pieces of railroad track, sash weights, or Danforth anchors, depending on currents. Anchors and leadlines have the most contact with the bottom. For Northeast groundfish, gillnets are tended daily to semiweekly (NEFSC 2002c).

6.4.5.3 Fish Traps and Pots

Fish traps, pots, and lobster pots are similar. A non-lobster trap could be a trap that is configured with small mesh or small entrances that effectively exclude lobsters, or a floating trap that is fished off the bottom. If a fish pot or trap is configured in such a way that it is not capable of catching lobster, then NMFS would not consider it to be a lobster trap, and the vessel would not be subject to the lobster trap gear specifications. NMFS has determined that the floating Norwegian fish pots are not lobster traps.

The Norwegian-design pots are collapsible two-chamber rectangular pots made of netting, with a single bridle with anchor along the short end of the pot, allowing it to float and to turn with the current, adapted from Furevik et al. (2008). They have one entrance at the opposite end as the bridle, and are made of 50 mm black poly mesh for the trap body and 50 mm white poly for the entrances (into the pot and between chambers). Three frames per pot are constructed of 2 cm diam. PVC electrical conduit, with 13 cm radius corners, glued with cement. The frame sizes are approx. 1.5 m x 1 m (4.79 ft x 3.28 ft), hung 0.7 m (2.3 ft) apart forming two chambers with a widemouth entrance in between. The bridles are anchored with >5 kg links of chain. The PVC pipes are then perforated and 11 deep-water gillnet floats are added along the upper frame to achieve proper orientation. During a tank study (Furevik et al. 2008), the top of the Norwegian pot was measured to be 3 m off bottom; the bottom of the pot was 1.5 m off-bottom.

6.4.5.4 Hook and Line Gear

6.4.5.4.1 Hand Lines/Rod and Reel

Fishermen use hand lines as well as rods and reels in the Northeast Region to catch a variety of demersal species. Handlines are the simplest form of hook and line fishing. It may be fished using a rod and reel or simply “by hand.” The gear consists of a line, sinker (weight), gangion, and at least one hook. The line is typically stored on a small spool and rack and varies in length. The sinkers vary from stones to cast lead. The hooks can vary from single to multiple arrangements in “umbrella” rigs. Fishermen use an attraction device such as natural bait or an artificial lure with the hook. Handlines can be carried by currents until retrieved or fished in such a manner as to hit bottom and bounce (Stevenson, et al. 2004).

6.4.5.4.2 Mechanized Line Fishing

Mechanized line-hauling systems use electrical or hydraulic power to work the lines on the spools. They allow smaller fishing crews to work more lines. Fishermen mount the reels, also called “bandits,” on the vessel bulwarks with the mainline wound around a spool. They take the line from the spool over a block at the end of a flexible arm. Each line may have a number of branches and baited hooks.

Fishermen use jigging machines to jerk a line with several unbaited hooks up in the water to attract a fish. Fishermen generally use fish jigging machine lines in waters up to 1,970 ft. (600 m) deep. Hooks and sinkers can contact the bottom. Depending upon the way the gear is used, it may catch a variety of demersal species.

6.4.5.4.3 Bottom Long Lines

This gear consists of a long length of line to which gangions carrying baited hooks are attached. Longlining is undertaken for a wide range of bottom species. Bottom longlines typically have up to six individual longlines strung together for a total length of more than 1,476 ft. (450 m) and are deployed with 20 - 24 lbs (9 - 11 kg) anchors. The mainline is a parachute cord. Gangions are typically 16 in (40 cm) long and 3 - 6 in (1 - 1.8 m) apart and are made of shrimp twine. These bottom longlines are usually set for a few hours at a time (NEFSC 2002c).

All hooks must be 12/0, or larger, circle hooks. A circle hook is a hook with the point turned back towards the shank. The barbed end of the hook may be displaced (offset) relative to the parallel plane of the eyed-end or shank of the hook when laid on its side or may be in-line. Habitat impacts from bottom long lines are negligible.

6.4.5.5 Gear Interaction with Habitat

The Council has included habitat impacts assessments in its fishery management plans since the early 2000s. Amendment 13 (NEFMC 2003) included a comprehensive evaluation of gear effects on habitat. The amendment described the general effects of bottom trawls on benthic marine habitats. This analysis primarily used an advisory report prepared for the International Council for the Exploration of the Seas (ICES 2000). The report generally concluded that: (1) low-energy environments are more affected by bottom trawling; and (2) bottom trawling affects the potential for habitat recovery (i.e., after trawling ceases, benthic communities and habitats may not always return to their original pre- impacted state).

The Committee on Ecosystem Effects of Fishing for the National Research Council's Ocean Studies Board (NRC 2002) prepared an evaluation of the habitat effects of trawling and dredging that was also evaluated during Amendment 13. This report identified four general conclusions regarding the types of habitat modifications caused by bottom trawls:

- Trawling reduces habitat complexity;
- Repeated trawling results in discernible changes in benthic communities;
- Bottom trawling reduces the productivity of benthic habitats; and
- Fauna that live in low natural disturbance regimes are generally more vulnerable to fishing gear disturbance.

In 2002, NEFMC and MAMFC convened a regional workshop to evaluate the existing scientific research on the effects of fishing gear on benthic habitats; determine the degree of impact from various Northeast gear types; specify the type of evidence that is available to support the conclusions made about the degree of impact; rank the relative importance of gear impacts to various habitat types; and provide recommendations on measures to minimize those adverse impacts. The panel was provided with a summary of available research studies relating to the effects of bottom otter trawls, bottom gillnets, and bottom longlines. Relying on this information plus professional judgment, the panel identified the effects and the degree of impact of these gears on mud, sand, and gravel/rock habitats.

In general, the panel determined that impacts from trawling are greater in gravel/rock habitats with attached epifauna. The panel ranked impacts to biological structure higher than impacts to physical structure. Effects of trawls on major physical features in mud (deep water clay-bottom habitats) and gravel bottom were described as permanent. Impacts to biological and physical structure were given recovery times of months to years in mud and gravel. Impacts of trawling on physical structure in sand were estimated to be of shorter duration (days to months) given the exposure of most continental shelf sand habitats to strong bottom currents and/or frequent storms. Impacts of sink gillnets and bottom longlines on sand and gravel habitats were estimated to be less than bottom trawl impacts. The duration of impacts to physical structures from these gear types would be expected to last days to months on soft mud, but could be permanent on hard bottom clay structures along the continental slope. Impacts to mud would be caused by gillnet lead lines and anchors. Physical habitat impacts from sink gillnets and bottom longlines on sand would not be expected. The workshop report (NEFSC 2002c) noted that factors such as frequency of disturbance from fishing and from natural events are important when evaluating impacts.

The Council's Omnibus Essential Fish Habitat Amendment 2 (OHA2) evaluated existing habitat management areas and developed new habitat management areas. To assist with this effort, the Council developed an analytical approach to characterize and map habitats and to assess the extent to which different habitat types are vulnerable to different types of fishing activities. This body of work, termed the Swept Area Seabed Impact approach, includes a quantitative, spatially-referenced model that overlays fishing activities on habitat through time to estimate both potential and realized adverse effects to EFH. The approach is summarized in Volume 1 of the FEIS and detailed in Appendix D. Both documents are available at http://www.nefmc.org/library/omnibus-habitat-amendment-2. The SASI approach builds on previous fishing impacts assessments including the 2002 workshop, and reached similar conclusions, but made the assessment more explicitly spatial. This spatial approach facilitated the use of the assessment when developing management areas. In 2018-2019, the Council updated SASI with additional years of fishing effort data and sediment data, and some changes to the structure of the model. The updated analysis is referred to the Fishing Effects Model, or FE Model. A version of the FE Model was previously developed for the North Pacific region of the U.S. (Smeltz et al. 2019). The FE model includes many elements of SASI as well as elements from another model developed for the North Pacific region (Fujioka 2006). The FE Model report is available at https://www.nefmc.org/library/fishing-effects-model. The discussion below summarizes both the SASI and FE models.

The spatial domain of the models is U.S. waters from Cape Hatteras to the U.S.-Canada border. SASI included federal waters (3-200 miles) only, but FE includes state waters as well. Within this region, habitats were defined based on natural disturbance regime and dominant substrate, given previous assessments that natural disturbance may mask or interact with human-caused disturbance. Energy at the seabed was inferred from an oceanography model (flow) and a coastal relief model (depth) and was binned into two categories, either high or low energy. Substrate type is an important determinant of habitat because it influences the distribution of managed species, structure-forming epifauna, and prey species by providing spatially discrete resources such as media for burrowing organisms, attachment points for vertical epifauna, etc. The dominant substrate map used in SASI/FE was composed of thousands of visual and grab-sample observations, with grid size based on the spacing of the observations. The underlying spatial resolution of the substrate grid is much higher on Georges Bank and on the tops of banks and ledges in the Gulf of Maine than it is in deeper waters. Habitat definitions for both SASI and FE are based on five sediment grain sizes, mud, sand, pebble, cobble, and boulder. The FE model adds a steep and deep habitat category to account for areas of high relief where deep-sea coral ecosystems occur.

One of the outputs of the model is habitat vulnerability, which is related in part to the characteristics of the habitat itself, and part to the quality of the impact. Because of a general need for attachment sites, epifauna that provided a sheltering function for managed species tend to be more diverse and abundant in habitats containing larger grain sized substrates. Consistent with previous findings, the literature review completed to support the SASI and FE models found that structurally complex and/or long-lived epifaunal species are more susceptible to gear damage and slower to recover to impacts from mobile gears, including trawls and dredges. Recovery rates were assumed to be slower in low energy areas, such that overall vulnerability (susceptibility + recovery) of low energy areas is greater than high energy areas, other factors being equal. Of the mobile gears, hydraulic dredges were estimated to have the greatest per unit area impact, with lower and similar per unit area impacts associated with bottom otter trawls and scallop dredges. Although the literature on fixed gear impacts is relatively sparse, it was estimated that mobile gears have a greater per-unit area swept impact than fixed gears. Again, this was consistent with previous findings. Combining the SASI/FE vulnerability assessment and spatial model, gravel habitats on Georges Bank and in the Gulf of Maine were identified as vulnerability hotspots for all gear types, with moderate vulnerability in deeper, low energy habitats in the Gulf of Maine and along the continental margin, and lower vulnerability in sand habitats on Georges Bank, in Southern New England, and in the Mid-Atlantic Bight. Steep and deep habitats are also more vulnerable to impact.

The FE model in particular emphasizes the realized impacts of fishing by modeling how the magnitude of fishing in different locations across the model domain influences patterns of habitat disturbance. Habitat impacts are expressed as percent disturbance in 5 km by 5 km grid cells. The model is run continuously over time, with monthly changes in fishing effort by gear type. As time progresses and habitats begin to recover from previous impacts, new fishing impacts can continue to affect the condition of the seabed. Thus, the percent disturbance at a given time and location represents a combination of current and prior habitat impacts.

6.5 PROTECTED SPECIES

6.5.1 Species Present in the Area

Numerous protected species inhabit the environment within the Northeast multispecies FMP management unit (Table 10) and have the potential to be impacted by the proposed action (i.e., there have been observed/documented interactions in the fishery or with gear type(s) similar to those used in the fishery (bottom trawl or gillnet gear)). These species are under NMFS jurisdiction and are afforded protection under the Endangered Species Act (ESA) of 1973 and/or the Marine Mammal Protection Act (MMPA) of 1972.

Table 10 - Species protected under the ESA and/or MMPA that may occur in the affected environment of the Northeast multispecies fishery. Marine mammal species (cetaceans and pinnipeds) italicized and in bold are considered MMPA strategic stocks.[1]

Species	Status[2]	Potentially impacted by this action?
Cetaceans		
North Atlantic right whale (Eubalaena glacialis)	***Endangered***	***Yes***
Humpback whale, West Indies DPS (*Megaptera novaeangliae*)[3]	Protected (MMPA)	Yes
Fin whale (Balaenoptera physalus)	***Endangered***	***Yes***
Sei whale (Balaenoptera borealis)	***Endangered***	***Yes***
Blue whale (Balaenoptera musculus)	***Endangered***	***No***
Sperm whale (Physeter microcephalus)	***Endangered***	***No***
Minke whale (*Balaenoptera acutorostrata*)	Protected (MMPA)	Yes
Pilot whale (Globicephala spp.)[3]	Protected (MMPA)	Yes
Risso's dolphin (*Grampus griseus*)	Protected (MMPA)	Yes
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Protected (MMPA)	Yes
Short Beaked Common dolphin (*Delphinus delphis*)	Protected (MMPA)	Yes
Spotted dolphin (*Stenella frontalis*)	Protected (MMPA)	No
Bottlenose dolphin (Tursiops truncatus)[4]	***Protected (MMPA)***	***Yes***
Harbor porpoise (*Phocoena phocoena*)	Protected (MMPA)	Yes
Sea Turtles		
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Yes
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Yes
Green sea turtle, North Atlantic DPS (*Chelonia mydas*)	Threatened	Yes

Loggerhead sea turtle (*Caretta caretta*), Northwest Atlantic Ocean DPS	Threatened	Yes
Hawksbill sea turtle (*Eretmochelys imbricate*)	Endangered	No
Fish		
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered	No
Atlantic salmon (*Salmo salar*)	Endangered	Yes
Atlantic sturgeon *(Acipenser oxyrinchus)*		
Gulf of Maine DPS	Threatened	Yes
New York Bight DPS, Chesapeake Bay DPS,	Endangered	Yes
Carolina DPS & South Atlantic DPS		
Cusk (*Brosme brosme)*	Candidate	Yes
Pinnipeds		
Harbor seal (*Phoca vitulina*)	Protected (MMPA)	Yes
Gray seal (*Halichoerus grypus*)	Protected (MMPA)	Yes
Harp seal (*Phoca groenlandicus*)	Protected (MMPA)	Yes
Hooded seal (*Cystophora cristata*)	Protected (MMPA)	Yes
Critical Habitat		
North Atlantic Right Whale	ESA (Protected)	No
Northwest Atlantic DPS of Loggerhead Sea Turtle	ESA (Protected)	No

Notes:

[1] A strategic stock is defined under the MMPA as a marine mammal stock for which: (1) the level of direct human-caused mortality exceeds the potential biological removal level; (2) based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; and/or (3) is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA (Section 3, 1972).

[2] The status of the species is defined by whether the species is listed under the ESA as endangered (species are at risk of extinction) or threatened (species at risk of endangerment), or protected under the MMPA. Note, marine mammals listed under the ESA are also protected under the MMPA. Candidate species are those species in which ESA listing may be warranted.

[3] There are two species of pilot whales: short finned (*G. melas melas*) and long finned (*G. macrorhynchus*). Due to the difficulties in identifying the species at sea, they are often just referred to as *Globicephala spp*.

[4] This includes the following Stocks of Bottlenose Dolphins: Western North Atlantic Offshore, Northern Migratory Coastal (strategic stock), and Southern Migratory Coastal (strategic stock).

Cusk are NMFS "candidate species" under the ESA. Candidate species are those petitioned species for which NMFS has determined that listing may be warranted under the ESA and those species for which NMFS has initiated an ESA status review through an announcement in the Federal Register. If a species is proposed for listing the conference provisions under Section 7 of the ESA apply (see 50 CFR 402.10); however, candidate species receive no substantive or procedural protection under the ESA. Thus, this species will not be discussed further in this action; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on candidate species from any proposed action. Additional information on cusk is at: https://www.fisheries.noaa.gov/endangered-species-conservation/candidate-species-under-endangered-species-act.

6.5.2 Species and Critical Habitat Not Likely Impacted by the Proposed Action

Based on available information, it has been determined that this action is not likely to impact multiple ESA listed and/or marine mammal protected species or any designated critical habitat (Table 10). This determination has been made because either the occurrence of the species is not known to overlap with the area primarily impacted by the action and/or there have never been documented interactions between the species and the primary gear type (i.e., gillnet and bottom trawl) used to prosecute the multispecies fishery (see https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; NMFS NEFSC FSB 2019; http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html). In the case of critical habitat, this determination has been made, because the action will not impact the essential physical and biological features of North Atlantic right whale or loggerhead (NWA DPS) critical habitat and therefore, will not result in the destruction or adverse modification of any species critical habitat (NMFS 2014a).

6.5.3 Species Potentially Impacted by the Proposed Action

Table 10 has a list of protected species of sea turtle, marine mammal, and fish species present in the affected environment of the multispecies fishery, and that may also be impacted by the operation of this fishery; that is, have the potential to become entangled or bycaught in the fishing gear used to prosecute the fishery. To aid in the identification of MMPA protected species potentially impaccted by the action, the MMPA List of Fisheries and marine mammal stock assessment reports for the Atlantic Region were referenced (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region ; https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries). To help identify ESA listed species potentially impacted by the action, the 2013 Biological Opinion issued by NMFS on the operation of seven commercial fisheries, including the multispecies) FMP, and its impact on ESA listed species was referenced (NMFS 2013). The 2013 Opinion, which considered the best available information on ESA listed species and observed or documented ESA listed species interactions with gear types used to prosecute the 7 FMPs (e.g., gillnet, bottom trawl, and pot/trap), concluded that the seven fisheries may adversely affect, but was not likely to jeopardize the continued existence of any ESA listed species. The Opinion included an incidental take statement (ITS) authorizing the take of specific numbers of ESA listed species of sea turtles, Atlantic salmon, and Atlantic sturgeon.[14] Reasonable and prudent measures and terms and conditions were also issued with the ITS to minimize impacts of any incidental take.

[14] The 2013 Opinion did not authorize take of ESA listed species of whales because (1) an incidental take statement cannot be lawfully issued under the ESA for a marine mammal unless incidental take authorization exists for that marine mammal under the MMPA (see 16 U.S.C. § 1536(b)(4)(C)), and (2) the incidental take of ESA- listed whales by the black seabass fishery has not been authorized under MMAP Section 101(a)(5). However, the 2013 BiOp assessed interaction risks to these species and concluded that 7 FMPs assessed, may affect but would not jeopardize the continued existence of any ESA listed species of whales (NMFS 2013).

Up until recently, the 2013 Opinion remained in effect; however, new information indicates that North Atlantic right whale abundance has been in decline since 2010 (Pace et al. 2017). This new information is different from that considered and analyzed in the 2013 Opinion and; therefore, may reveal effects from this fishery that were not previously considered. As a result, per an October 17, 2017, ESA 7(a)(2)/7(d) memorandum issued by NMFS, the 2013 Opinion, as well as several other fishery Opinions, has been reinitiated. However, the October 17, 2017, ESA 7(a)(2)/7(d) memo issued by NMFS, determined ".....For the consultations being reinitiated..…. Allowing these fisheries to continue during the reinitiation period will not increase the likelihood of interactions with these species above the amount that would otherwise occur if consultation had not been reinitiated, because allowing these fisheries to continue does not entail making any changes to any fishery during the reinitiation period that would cause an increase in interactions with whales, sea turtles, sturgeon, or Atlantic salmon. Because of this, the continuation of these fisheries during the reinitiation period would not be likely to jeopardize the continued existence of any whale, sea turtle, Atlantic salmon, or sturgeon species." Until replaced, the multispecies FMP is currently covered by the October 17, 2017, memo.

As the primary concern for both MMPA protected and ESA listed species is the potential for the fishery to interact (e.g., bycatch, entanglement) with these species it is necessary to consider (1) species occurrence in the affected environment of the fishery and how the fishery will overlap in time and space with this occurrence; and (2) data and observed records of protected species interaction with particular fishing gear types, to understand the potential risk of an interaction. Information on species occurrence in the affected environment of the multispecies fishery is below, information on protected species interactions with specific fishery gear is in Section 6.5.4.

6.5.3.1 Sea Turtles

This section contains a brief summary of the occurrence and distribution of leatherback and hard-shelled sea turtles (i.e., green (North Atlantic DPS), loggerhead (Northwest Atlantic Ocean DPS), Kemp's ridley) in the affected environment of the Northeast multispecies fishery. Three of the four species are considered hard-shelled turtles (i.e., green, loggerhead, and Kemp's ridley). Additional background information on the range-wide status of the other four species, as well as a description and life history of the species, is in several published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; Conant *et al*. 2009; NMFS and USFWS 2013; NMFS and USFWS 2015; Seminoff *et al*. 2015), and recovery plans for the loggerhead sea turtle (Northwest Atlantic DPS; NMFS and USFWS 2008), leatherback sea turtle (NMFS and USFWS 1992), Kemp's ridley sea turtle (NMFS *et al.* 2011), and green sea turtle (NMFS and USFWS 1991).

Hard-shelled sea turtles

In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, Massachusetts, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Mitchell *et al.* 2003; Braun-McNeill *et al.* 2008; TEWG 2009). While hard-shelled turtles are most common south of Cape Cod, MA, they are known to occur in the Gulf of Maine. Loggerheads, the most common hard-shelled sea turtle in the Greater Atlantic Region, feed as far north as southern Canada. Loggerheads have been observed in waters with surface temperatures of 7 °C to 30 °C, but water temperatures ≥11 °C are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). Sea turtle presence in U.S. Atlantic waters is also influenced by water depth. While hard-shelled turtles occur in waters from the beach to beyond the continental shelf, they are most commonly found in neritic waters of the inner continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009; Hawkes *et al.* 2011; Griffin *et al.* 2013).

Hard-shelled sea turtles occur year-round in waters off Cape Hatteras, North Carolina and south. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States and also move up the Atlantic Coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Griffin *et al.* 2013), occurring in Virginia foraging areas as early as late April and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by September, but some remain in Mid-Atlantic and Northeast areas until late fall. By December, sea turtles have migrated south to waters offshore of NC, particularly south of Cape Hatteras, and further south (Shoop and Kenney 1992; Epperly *et al.* 1995b; Hawkes *et al.* 2011; Griffin *et al.* 2013).

Leatherback sea turtles

Leatherbacks, a pelagic species, are known to use coastal waters of the U.S. continental shelf and to have a greater tolerance for colder water than hard-shelled sea turtles (James *et al.* 2005; Eckert *et al.* 2006; Murphy *et al.* 2006; NMFS and USFWS 2013b; Dodge *et al.* 2014). Leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992; James *et al.* 2005; James *et al*. 2006; Dodge *et al*. 2014). They are found in more northern waters (i.e., Gulf of Maine) later in the year (i.e., similar time frame as hard-shelled sea turtles), with most leaving the Northwest Atlantic shelves by mid-November (James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014). Leatherback sea turtles also engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992; James *et al*. 2005; James *et al*. 2006; Dodge *et al*. 2014).

6.5.3.2 Marine Mammals

6.5.3.2.1 Large Whales

North Atlantic right, humpback, fin, sei, and minke whales are found throughout the waters of the Northwest Atlantic Ocean. In general, these species follow an annual pattern of migration between low latitude (south of 35ºN) wintering/calving grounds and high latitude spring/summer foraging grounds (primarily north of 41ºN; Hayes *et al.* 2019; NMFS 1991, 2005, 2010, 2011, 2012). This, however, is a simplification of whale movements, particularly as it relates to winter movements. It remains unknown if all individuals of a population migrate to low latitudes in the winter, although, increasing evidence suggests that for some species (e.g., right and humpback whales), some portion of the population remains in higher latitudes throughout the winter (Hayes *et al.* 2019; Khan *et al*. 2009, 2010, 2011, 2012; Brown *et al*. 2002; NOAA 2008; Cole *et al*. 2013; Clapham *et al*. 1993; Swingle *et al*. 1993; Vu *et al*. 2012).Although further research is needed to provide a clearer understanding of large whale movements and distribution in the winter, the distribution and movements of large whales to foraging grounds in the spring/summer is well understood. Movements of whales into higher latitudes coincide with peak productivity in these waters. As a result, the distribution of large whales in higher latitudes is strongly governed by prey availability and distribution, with large numbers of whales coinciding with dense patches of preferred forage (Mayo and Marx 1990; Kenney *et al*. 1986, 1995; Baumgartner *et al*. 2003; Baumgartner and Mate 2003; Payne *et al*.1986, 1990; Brown *et al.* 2002; Kenney and Hartley 2001;

Schilling *et al.* 1992). For additional information on the biology, status, and range wide distribution of each whale species refer to: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.

To further assist in understanding how the multispecies fishery may overlaps in time and space with the occurrence of large whales, a general overview on species occurrence and distribution in the area of operation for the multispecies fishery is in Table 11.

Table 11 - Large whale occurrence, distribution, and habitat use in the affected environment of the multispecies fishery (SNE=Southern New England; GOM=Gulf of Maine; GB=Georges Bank).

Species	Occurrence/Distribution/Habitat Use in the Affected Environment
North Atlantic Right Whale	• Occur and are distributed throughout all continental shelf waters along the U.S. eastern seaboard throughout the year. Although whales can be found consistently in particular locations throughout their range, there is a high interannual variability in right whale use of some habitats. • Starting in 2010, acoustic and visual surveys indicate an apparent shift in habitat use patterns (e.g., shift from previously prevalent northern grounds (greater GOM) to spending more time in the Mid-Atlantic regions (waters off south of Martha's Vineyard and Nantucket Islands, New Jersey, and Virginia); increased use of Cape Cod Bay and decreased use of Great South Channel). • New England waters = **Foraging Grounds.** Seasonally important aggregating/foraging grounds include, but not limited to: › Massachusetts and Cape Cod Bays; › Great South Channel; › Jordan Basins; and, › Georges Basin (along the northeastern edge of GB). • Mid-Atlantic waters: Migratory corridor to/from northern (high latitude) foraging and southern calving grounds. • Passive acoustic and telemetry data shows excursions into deeper water off the continental shelf (e.g., shelf edge along southern Georges Bank and Mid-Atlantic) • Location of much of the population unknown in winter; however, increasing evidence of wintering areas (~November – January) in: › Cape Cod Bay; › Jeffreys and Cashes Ledges; › Jordan Basin; and › Massachusetts Bay (e.g., Stellwagen Bank).
Humpback Whale	• Distributed throughout all continental shelf waters of the Mid-Atlantic (SNE included), GOM, and GB throughout the year.

Species	Occurrence/Distribution/Habitat Use in the Affected Environment
	• New England waters (GOM and GB regions) = **Foraging Grounds** (~March-November). • Mid-Atlantic waters: Migratory pathway to/from northern (high latitude) foraging and southern (West Indies) calving grounds. • Increasing visual and acoustic evidence of whales remaining in mid- and high-latitudes throughout the winter. (e.g., *Mid-Atlantic*: waters near Chesapeake and Delaware Bays, peak presence about January through March; *Massachusetts Bay*: peak presence about March-May and September-December).
Fin	• Distributed throughout all continental shelf waters of the Mid-Atlantic (SNE included), GOM, and GB throughout the year. • Mid-Atlantic waters: › Migratory pathway to/from northern (high latitude) foraging and southern (low latitude) calving grounds; and › Possible offshore calving area (October-January). • New England (GOM and GB)/SNE waters = **Foraging Grounds** (greatest densities March-August; lower densities September-November). Important foraging grounds include: › Massachusetts Bay (esp. Stellwagen Bank); › Great South Channel; › Waters off Cape Cod (~40-50 meter contour); › GOM; › Perimeter (primarily eastern) of GB; and › Mid-shelf area off the east end of Long Island. • Evidence of wintering areas in mid-shelf areas east of New Jersey (NJ), Stellwagen Bank; and eastern perimeter of GB.
Sei	• Uncommon in shallow, inshore waters of the Mid-Atlantic (SNE included), GB, and GOM; however, occasional incursions during peak prey availability and abundance. • Primarily found in deep waters along the shelf edge, shelf break, and ocean basins between banks. • Spring through summer, found in greatest densities in offshore waters of the GOM and GB; sightings concentrated along the northern, eastern (into Northeast Channel) and southwestern (in the area of Hydrographer Canyon) edge of GB.
Minke	• Widely distributed within the U.S. EEZ. • Spring to Fall: widespread (acoustic) occurrence on the continental shelf; however, most abundant in New England waters during this period of time. • September to April: high (acoustic) occurrence in deep-ocean waters.

Species	Occurrence/Distribution/Habitat Use in the Affected Environment
***Sources*:** Baumgartner et al. 2007; Baumgartner *et al*. 2011; Baumgartner and Mate 2005; Bort et al. 2015; Brown *et al*. 2002; CETAP 1982; Clapham *et al*. 1993; Cole *et al*. 2013; Davis et al. 2017; Good 2008; Hain *et al*. 1992; Hamilton and Mayo 1990; Hayes et al. 2017, 2018, 2019; Kenney et al. 1986, 1995; Khan *et al*. 2009, 2010, 2011, 2012; Leiter et al. 2017; Mate et al. 1997; McLellan *et al*. 2004; NMFS 1991, 2005, 2010, 2011, 2012; 2015; NOAA 2008; Pace and Merrick 2008; Payne *et al*. 1984; Payne *et al*.1990; Pendleton et al. 2009; Record et al. 2019; Risch *et al*. 2013; Schevill *et al*. 1986; Swingle *et al*. 1993; Vu *et al*. 2012; Watkins and Schevill 1982; Winn *et al*. 1986; 50 CFR 224.105; 81 FR 4837 (January 27, 2016).	

6.5.3.2.2 Small Cetaceans

Atlantic white sided dolphins, short and long finned pilot whales, Risso's dolphins, short beaked common dolphins, harbor porpoise, and several stocks of bottlenose dolphins are found throughout the year in the Northwest Atlantic Ocean (Hayes *et al*. 2017; Hayes *et al*. 2018; Hayes *et al*. 2019). Within this range, however, there are seasonal shifts in species distribution and abundance. To further assist in understanding how fisheries may overlap in time and space with the occurrence of small cetaceans, a general overview of species occurrence and distribution in the area of operation for the multispecies fishery is in Table 12. For additional information on the biology, status, and range wide distribution of each species refer to: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region

Table 12 - Small cetacean occurrence in the area of operation of the multispecies fishery.

Species	Prevalence and Month of Occurrence
Atlantic White Sided Dolphin	• Distributed throughout the continental shelf waters (primarily to 100 m) of the Mid-Atlantic (north of 35ºN), SNE, GB, and GOM; however, most common in continental shelf waters from Hudson Canyon (~ 39ºN) to GB, and into the GOM. • **January-May**: low densities found from GB to Jeffreys Ledge. • **June-September**: Large densities found from GB, through the GOM. • **October-December**: intermediate densities found from southern GB to southern GOM. • South of GB (SNE and Mid-Atlantic), particularly around Hudson Canyon, low densities found year-round, • Virginia (VA) and North Carolina (NC) waters represent southern extent of species range during winter months.
Short Beaked Common Dolphin	• Regularly found throughout the continental shelf-edge-slope waters (primarily between the 100-2,000 m) of the Mid-Atlantic, SNE, and GB (esp. in Oceanographer, Hydrographer, Block, and Hudson Canyons). • Less common south of Cape Hatteras, NC, although schools have been reported as far south as the Georgia/South Carolina border.

Species	Prevalence and Month of Occurrence
	• **January-May**: occur from waters off Cape Hatteras, NC, to GB (35º to 42ºN). • **Mid-summer-autumn**: Occur in the GOM and on GB; *Peak abundance* found on GB in the autumn.
Risso's Dolphin	• **Spring through fall**: Distributed along the continental shelf edge from Cape Hatteras, NC, to GB. • **Winter**: distributed in the Mid-Atlantic Bight, extending into oceanic waters. • Rarely seen in the GOM; primarily a Mid-Atlantic continental shelf edge species (can be found year-round).
Harbor Porpoise	• Distributed throughout the continental shelf waters of the Mid-Atlantic, SNE, GB, and GOM. • **July-September**: Concentrated in the northern GOM (waters <150 meters); low numbers can be found on GB. • **October-December**: widely dispersed in waters from New Jersey (NJ) to Maine (ME); seen from the coastline to deep waters (>1,800 meters). • **January-March**: intermediate densities in waters off NJ to NC; low densities found in waters off New York (NY) to GOM. • **April-June**: widely dispersed from NJ to ME; seen from the coastline to deep waters (>1,800 meters).
Bottlenose Dolphin	**<u>Western North Atlantic Offshore Stock</u>** • Distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic from GB to Florida (FL). • Depths of occurrence: ≥40 meters **<u>Western North Atlantic Northern Migratory Coastal Stock</u>** • Most common in coastal waters <20 m deep. • Warm water months (e.g., July-August): distributed from the coastal waters from the shoreline to about the 20 m depth between the Assateague, VA, to Long Island, NY. • Late summer and fall, and during cold water months (e.g., January-March): stock occupies coastal waters from Cape Lookout, NC, to the NC/VA border. **<u>Western North Atlantic Southern Migratory Coastal Stock</u>** • Most common in coastal waters <20 m deep. • **October-December**: appears stock occupies waters of southern NC (south of Cape Lookout) • **January-March**: appears stock moves as far south as northern FL.

Species	Prevalence and Month of Occurrence
	• **April-June**: stock moves north to waters of NC. • **July-August**: stock is presumed to occupy coastal waters north of Cape Lookout, NC, to the eastern shore of VA (as far north as Assateague).
Pilot Whales: *Short- and Long-Finned*	**<u>Short- Finned Pilot Whales</u>** • Except for area of overlap (see below), primarily occur south of 40°N (Mid-Atlantic and SNE waters); although low numbers have been found along the southern flank of GB, but no further than 41°N. • May through December (about): distributed primarily near the continental shelf break of the Mid-Atlantic and SNE; individuals begin shifting to southern waters (i.e., 35°N and south) beginning in the fall. **<u>Long-Finned Pilot Whales</u>** • Except for area of overlap (see below), primarily occur north of 42°N. • Winter to early spring (November - April): primarily distributed along the continental shelf edge-slope of the Mid-Atlantic, SNE, and GB. • Late spring through fall (May - October): movements and distribution shift onto/within GB, the Great South Channel, and the GOM. **<u>Area of Species Overlap:</u>** between approximately 38°N and 40°N.
Notes: Information is representative of small cetacean occurrence in the Northwest Atlantic continental shelf waters out to 2,000 m depth ***Sources*:** Hayes *et al*. 2017; Hayes *et al.* 2018; Hayes *et al.* 2019; Payne and Heinemann 1993; Payne *et al.* 1984; Jefferson *et al*. 2009.	

6.5.3.2.3 Pinnipeds

Harbor, gray, harp, and hooded seals will occur in the affected environment of the multispecies fishery (Table 13). Specifically, pinnipeds are found in the nearshore, coastal waters of the Northwest Atlantic Ocean. They are primarily found throughout the year or seasonally from New Jersey to Maine; however, increasing evidence indicates that some species (e.g., harbor seals) may be extending their range seasonally into waters as far south as Cape Hatteras, North Carolina (35°N) (Waring *et al*. 2007; Hayes *et al*. 2019). To help understand how the multispecies fishery may overlap in time and space with the occurrence of pinnipeds, a general overview of species occurrence and distribution in the area of operation of the multispecies fishery is provided in the following table (Table 13). Waring *et al*. (2007), and Hayes *et al.* (2019) have additional information on the biology, status, and range wide distribution of each species.

Table 13 - Pinniped occurrence in the area of operation of the multispecies fishery.

Species	Prevalence
Harbor Seal	• Primarily distributed in waters from New Jersey to Maine; however, increasing evidence indicates that their range is extending into waters as far south as Cape Hatteras, NC (35ºN). • **Year Round**: Waters of Maine • **September-May**: Waters from MA to NJ.
Gray Seal	• **Year Round**: Waters from Maine to just south of Cape Cod, MA. • **September-May**: Waters from southern MA to NJ. • Stranding records: Southern NJ to Cape Hatteras, NC
Harp Seal	• Winter-Spring (approx.. January-May): Waters from New Jersey to Maine.
Hooded Seal	• Winter-Spring (approx. January-May): Waters of New England.
***Sources*: Waring *et al*. 2007 (for hooded seals); Hayes *et al.* 2019.**	

6.5.3.3 Atlantic Sturgeon

Table 10 lists the 5 DPSs of Atlantic sturgeon that occur in the affected environment of the multispecies fishery and that may be affected by the operation of this fishery. The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. All five DPSs of Atlantic sturgeon have the potential to be located anywhere in this marine range; in fact, results from genetic studies show that, regardless of location, multiple DPSs can be found at any one location along the Northwest Atlantic coast (ASSRT 2007; Dovel and Berggren 1983; Dadswell *et al*. 1984; Kynard *et al*. 2000; Stein *et al*. 2004a; Dadswell 2006; Laney *et al*. 2007; Dunton *et al*. 2010; Dunton *et al*. 2012; Dunton *et al*. 2015; Erickson *et al*. 2011; Wirgin *et al*. 2012; O'Leary *et al*. 2014; Waldman *et al.* 2013; Wirgin *et al*. 2015a,b; ASMFC 2017).

Based on fishery-independent and -dependent data, as well as data collected from tracking and tagging studies, in the marine environment, Atlantic sturgeon appear to primarily occur inshore of the 50 meter depth contour (Stein *et al*. 2004 a,b; Erickson *et al*. 2011; Dunton *et al.* 2010); however, Atlantic sturgeon are not restricted to these depths, as excursions into deeper continental shelf waters have been documented (Timoshkin 1968; Collins and Smith 1997; Stein *et al*. 2004a,b; Dunton *et al*. 2010; Erickson *et al*. 2011). Data from fishery-independent surveys and tagging and tracking studies also indicate that some Atlantic sturgeon may undertake seasonal movements along the coast (Erickson *et al.* 2011; Dunton *et al*. 2010; Wipplehauser 2012). For instance, tagging and tracking studies found that satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight, at depths greater than 20 m, during winter and spring, while in the summer and fall, Atlantic sturgeon concentrations shifted to the northern portion of the Mid-Atlantic Bight at depths less than 20 meters (Erickson *et al.* 2011).

Within the marine range of Atlantic sturgeon, several marine aggregation areas have been identified adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard (i.e., waters off North Carolina, Chesapeake Bay; Delaware Bay; New York Bight; Massachusetts Bay; Long Island Sound; and Connecticut and Kennebec River Estuaries); depths in these areas are generally no greater than 25 meters (Bain *et al.* 2000; Savoy and Pacileo 2003; Stein *et al*. 2004a; Laney *et al*. 2007; Dunton *et al*. 2010; Erickson *et al*. 2011; Oliver *et al*. 2013; Waldman *et al.* 2013; O'Leary *et al*. 2014; Wipplehauser 2012; Wipplehauser and Squiers 2015). Although additional studies are still needed to clarify why these sites are chosen by Atlantic sturgeon, there is some indication that they may serve as thermal refuge, wintering sites, or marine foraging areas (Stein *et al*. 2004a; Dunton *et al*. 2010; Erickson *et al*. 2011).

6.5.3.4 Atlantic Salmon (Gulf of Maine DPS)

The wild populations of Atlantic salmon are listed as endangered under the ESA. Their freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, while the marine range of the GOM DPS extends from the GOM (primarily northern portion of the GOM), to the coast of Greenland (Fay *et al.* 2006; NMFS & USFWS 2005, 2016). In general, smolts, post- smolts, and adult Atlantic salmon may be present in the GOM and coastal waters of Maine in the spring (beginning in April), and adults may be present throughout the summer and fall months (Baum 1997; Fay *et al.* 2006; Hyvarinen *et al.* 2006; Lacroix & Knox 2005; Lacroix & McCurdy 1996; Lacroix *et al.* 2004; NMFS & USFWS 2005; Reddin 1985; Reddin & Friedland 1993; Reddin & Short 1991). For additional information on the on the biology, status, and range wide distribution of the GOM DPS of Atlantic salmon, refer to NMFS and USFWS (2005, 2016); and Fay et al. (2006). Thus, as the multispecies fishery operates throughout the year, and operates in the GOM, the fishery could overlap in time and space with Atlantic salmon migrating northeasterly between U.S. and Canadian waters.

6.5.4 Interactions Between Gear and Protected Species

Protected species are vulnerable to interactions with various types of fishing gear, with interaction risks associated with gear type, quantity, and soak or tow time. Available information on gear interactions with a given species (or species group) is in the sections below. These sections are not a comprehensive review of all fishing gear types known to interact with a given species; emphasis is only being placed on the primary gear types used to prosecute the multispecies fishery (i.e., sink gillnet and bottom trawl gear).

6.5.4.1 Marine Mammals

Depending on species, marine mammals have been observed seriously injured or killed in bottom trawl and/or sink gillnet gear. Pursuant to the MMPA, NMFS publishes a List of Fisheries (LOF) annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injuries and/or mortalities of marine mammals in each fishery (i.e., Category I=frequent; Category II=occasional; Category III=remote likelihood or no known interactions). In the Northwest Atlantic, the 2019 LOF (83 FR 5349 (May 16, 2019)) categorizes commercial gillnet fisheries (Northeast or Mid-Atlantic) as Category I fisheries and commercial bottom trawl fisheries (Northeast or Mid-Atlantic) as Category II fisheries.

6.5.4.1.1 Large Whales

Bottom Trawl Gear

With the exception of minke whales, there have been no observed interactions with large whales and bottom trawl gear (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; https://www.nefsc.noaa.gov/fsb/take_reports/nefop.html; https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries; https://www.nefsc.noaa.gov/publications/crd/). Since 2008, serious injury and mortality records for minke whales in U.S. waters have shown zero interactions with bottom trawl (northeast or Mid-Atlantic) gear (Henry et al. 2016; Henry et al. 2017; Hayes et al. 2019; Waring et al. 2015; 84 Federal Register 22051). Based on this information, large whale interactions with bottom trawl gear are expected to rare to nonexistent. For further information on bottom trawl interactions with minke whales, see Framework 58.

Fixed Fishing Gear (e.g., Sink Gillnet Gear)

The greatest entanglement risk to large whales is posed by fixed fishing gear (e.g., trap/pot gear, sink gillnet gear) with vertical or ground lines that rise into the water column (Kenney and Hartley 2001; Knowlton and Kraus 2001; Hartley *et al*. 2003; Johnson *et al*. 2005;Whittingham *et al*. 2005a,b; Cassoff et al. 2011; Knowlton et al. 2012; NMFS 2014; Henry et al. 2015; Henry et al. 2016; Henry et al. 2017; Henry et al. 2019; see Marine Mammal Stock Assessment Reports: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). Any line can become entangled in the mouth (baleen), flippers, and/or tail of the whale when the animal is transiting or foraging through the water column (Johnson *et al*. 2005; NMFS 2014; Kenney and Hartley 2001; Hartley *et al*. 2003; Whittingham *et al*. 2005a, b; Henry et al. 2015; Henry et al. 2016; Henry et al. 2017; Henry et al. 2019). The effects of entanglement to large whales range from no injury to death. The risk of injury or death in the event of an entanglement may depend on such things as the characteristics of the whale involved (species, size, age, health, etc.), the nature of the gear (e.g., whether the gear incorporates weak links designed to help a whale free itself), human intervention (i.e., the feasibility or success of disentanglement efforts), or other variables (Angliss and Demaster 1998; Johnson *et al*. 2005; Cassoff et al. 2011; Moore and Van der Hoop 2012; NMFS 2014; van der Hoop et al. 2016; Pettis et al. 2017; van der Hoop et al. 2017). Although the interrelationships among these factors are not fully understood, and the data needed to provide a more complete characterization of risk are not available, to date, available data indicate that entanglement in fishing gear is a significant source of serious injury or mortality for Atlantic large whales (Cassoff et al. 2011; NMFS 2014; Henry et al. 2015; van der Hoop et al. 2016; Henry et al. 2016; Henry et al. 2017; Pettis et al. 2017; van der Hoop et al. 2017; Henry et al. 2019; Sharp et al. 2019; see Marine Mammal Stock Assessment Reports: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). For further information on injury and mortality to large whales due to entanglement in fishing gear, see Framework 58.

In response to its obligations under the MMPA (section 118(f)(1)), in 1996, NMFS established the Atlantic Large Whale Take Reduction Team (ALWTRT) to develop a plan (Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan)) to reduce serious injury to, or mortality of large whales, specifically, humpback, fin, and North Atlantic right whales, due to incidental entanglement in U.S. commercial fishing gear.[15] In 1997, the ALWTRP was implemented; however, since 1997, the Plan has been modified; recent adjustments include the Sinking Groundline Rule and Vertical Line Rules (72 FR 57104, October 5, 2007; 79 FR 36586, June 27, 2014; 79 FR 73848, December 12, 2014; 80 FR 14345, March

[15] The measures identified in the ALWTRP are also beneficial to the survival of the minke whale, which are also known to be incidentally taken in commercial fishing gear.

19, 2015; 80 FR 30367, May 28, 2015). The Plan consists of regulatory (e.g., universal gear requirements, modifications, and requirements; area- and season- specific gear modification requirements and restrictions; time/area closures) and non- regulatory measures (e.g., gear research and development, disentanglement, education and outreach) that, in combination, seek to assist in the recovery of North Atlantic right, humpback, and fin whales by addressing and mitigating the risk of entanglement in gear employed by commercial fisheries, specifically trap/pot and gillnet fisheries (http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/; 73 FR 51228; 79 FR 36586; 79 FR 73848; 80 FR 14345; 80 FR 30367). The Plan recognizes trap/pot and gillnet Management Areas in Northeast, Mid-Atlantic, and Southeast regions of the U.S, and identifies gear modification requirements and restrictions for Category I and II gillnet and trap/pot fisheries in these regions; these Category I and II fisheries must comply with all regulations of the Plan.[16] For further details on the ALWTRP, see: http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/.

6.5.4.1.2 Small Cetaceans and Pinnipeds

Sink Gillnet and Bottom Trawl Gear

Small cetaceans and pinnipeds are vulnerable to interactions with sink gillnet and bottom trawl gear (Read *et al*. 2006; Lyssikatos 2015; Chavez-Rosales et al. 2017; Hayes *et al*. 2017; Hayes et al. 2018; Hayes et al. 2019; 84 FR 22051 (May 16, 2019)). Based on the most recent Marine Mammal List of Fisheries (LOF) issued on May 16, 2019 (84 FR 22051), Table 14 provides a list of species that have been observed (incidentally) seriously injured and/or killed by MMPA LOF Category I (frequent interactions) gillnet and/or Category II (occasional interactions) bottom trawl fisheries that operate in the affected environment of the multispecies fishery. Of the species provided in Table 14, gray seals, followed by harbor seals, harbor porpoises, short beaked common dolphins, and harp seals are the most frequently bycaught small cetacean and pinnipeds in sink gillnet gear in the Greater Atlantic Region (GAR; Hatch and Orphanides 2014, 2015, 2016, 2019). In terms of bottom trawl gear, short-beaked common dolphins and Atlantic white-sided dolphins are the most frequently observed bycaught marine mammal species in the GAR, followed by gray seals, long-finned pilot whales, Risso's dolphins, bottlenose dolphin (offshore), harbor porpoise, harbor seals, and harp seals (Lyssikatos 2015; Chavez-Rosales et al. 2017).

Table 14 - Small cetacean and pinniped species observed seriously injured and/or killed by Category I and II sink gillnet or bottom trawl fisheries in the affected environment of the multispecies fisheries.

Fishery	Category	Species Observed or reported Injured/Killed
Northeast Sink Gillnet	I	Bottlenose dolphin (offshore)
		Harbor porpoise
		Atlantic white sided dolphin
		Short-beaked common dolphin
		Risso's dolphin
		Long-finned pilot whales
		Harbor seal
		Hooded seal

[16] The fisheries currently regulated under the ALWTRP include: Northeast/Mid-Atlantic American lobster trap/pot; Atlantic blue crab trap/pot; Atlantic mixed species trap/pot; Northeast sink gillnet; Northeast anchored float gillnet; Northeast drift gillnet; Mid-Atlantic gillnet; Southeastern U.S. Atlantic shark gillnet; and Southeast Atlantic gillnet (NMFS 2014c).

		Gray seal
		Harp seal
Mid-Atlantic Gillnet	I	Bottlenose dolphin (Northern Migratory coastal)
		Bottlenose dolphin (Southern Migratory coastal)
		Bottlenose dolphin (offshore)
		Harbor porpoise
		Short-beaked common dolphin
		Risso's dolphin
		Harbor seal
		Harp seal
		Gray seal
Northeast Bottom Trawl	II	Harp seal
		Harbor seal
		Gray seal
		Long-finned pilot whales
		Short-beaked common dolphin
		White-sided dolphin
		Harbor porpoise
		Bottlenose dolphin (offshore)
		Risso's dolphin
Mid-Atlantic Bottom Trawl	II	White-sided dolphin
		Short-beaked common dolphin
		Risso's dolphin
		Bottlenose dolphin (offshore)
		Gray seal
		Harbor seal
Source: MMPA LOF 84 FR 22051 (May 16, 2019).		

As noted above, numerous species of small cetaceans and pinnipeds interact with Category I and II fisheries in the GAR; however, several species (Table 14) have experienced such great losses to their populations due to interactions with Category I and/or II fisheries that they are now considered strategic stocks under the MMPA (Table 10). These include several stocks of bottlenose dolphins, pilot whales, and until recently, the harbor porpoise.[17] MMPA Section 118(f)(1) requires the preparation and implementation of a TRP for any strategic marine mammal stock that interacts with Category I or II fisheries. Thus, the Harbor Porpoise TRP (HPTRP) and the Bottlenose Dolphin TRP (BDTRP) were developed and implemented for these species.[18] Also, due to the incidental mortality and serious injury of small cetaceans, incidental to bottom and midwater trawl fisheries operating in

[17] In a recent U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment (Hayes et al. 2018); harbor porpoise is no longer designated as a strategic stock.

[18] Although a recent U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment (Hayes et al. 2018) no longer designates harbor porpoise as a strategic stock, HPTRP regulations are still in place per the mandates provided in Section 118(f)(1).

both the Northeast and Mid- Atlantic regions, the Atlantic Trawl Gear Take Reduction Strategy (ATGTRS) was implemented. Additional information on each TRP or Strategy is at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-take-reduction-plans-and-teams.

6.5.4.2 Sea Turtles

Bottom Trawl Gear

Although sea turtle interactions with trawl gear have been observed in the Gulf of Maine, Georges Bank, and the Mid-Atlantic, most observed interactions have occurred in the Mid-Atlantic (see Murray 2011; Warden 2011a, b; Murray 2015a, Murray 2015b). As few sea turtle interactions have been observed in the Gulf of Maine and Georges Bank, there is insufficient data available to conduct a robust model-based analysis on sea turtle interactions with trawl gear in these regions or produce a bycatch estimate for these regions. As a result, the bottom trawl bycatch estimates are based on interactions observed in the Mid-Atlantic.

Green, Kemp's ridley, leatherback, loggerhead, and unidentified sea turtles have been documented interacting with bottom trawl gear. However, estimates are available only for loggerhead sea turtles. Most recently, Murray (2015) estimated that from 2009-2013, the total average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic was 231 (CV=0.13, 95% CI=182-298); this equates to about 33 adult equivalents (Murray 2015). Bycatch estimates by Warden (2011a) and Murray (2015b) are a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, which Murray (2008) estimated at 616 sea turtles (CV=0.23, 95% CI over the nine-year period: 367-890). For more information on bottom trawl interactions with sea turtles, see Framework 58.

Sink Gillnet Gear

Murray (2018) conducted an assessment of loggerhead, Kemp's ridley, leatherback, and unidentified hard-shell sea turtle interactions in Mid-Atlantic and Georges Bank gillnet gear during 2012-2016. Based on Northeast Fisheries Observer Program, At-Sea Monitoring Program, and Vessel Trip Report data from 2012-2016, total estimated bycatch of sea turtles in commercial sink gillnet gear in the Mid-Atlantic and Georges Bank regions was 705 loggerheads (equivalent to 19 adults), 145 Kemp's ridleys, 27 leatherbacks, and 112 unidentified hard-shelled sea turtles (Murray 2018). Depending on species, sea turtles were observed captured in nets with mesh sizes ranging from 3.25 inches to 12 inches.

6.5.4.3 Atlantic Sturgeon

Sink Gillnet and Bottom Trawl Gear

Atlantic sturgeon interactions (i.e., bycatch) with sink gillnet and bottom trawl gear have been observed since 1989; these interactions have the potential to result in the injury or mortality of Atlantic sturgeon (NMFS NEFSC FSB 2019). Although Atlantic sturgeon were observed to interact with trawl and gillnet gear with various mesh sizes, Miller and Shepard (2011) concluded that, based on NEFOP observed sturgeon mortalities, gillnet gear, in general, posed a greater risk of mortality to Atlantic sturgeon than did trawl gear. Estimated mortality rates in gillnet gear were 20.0%, while those in otter trawl gear were 5.0% (Miller and Shepard 2011; NMFS 2013). Similar conclusions were reached in Stein et al. (2004b) and ASMFC (2007) reports; after review of observer data from 1989-2000 and 2001-2006, both studies concluded that observed mortality is much higher in gillnet gear than in trawl gear. However, an important consideration to these findings is that observed mortality is considered a minimum of what occurs and therefore, the conclusions reached by Stein et al. (2004b), ASMFC (2007), and Miller and Shepard (2011) are not reflective of the total mortality associated with either gear type. To date, total

Atlantic sturgeon mortality associated with gillnet or trawl gear remains uncertain. For further information on sink gillnet and bottom trawl gear interactions with Atlantic sturgeon, see Framework 58.

6.5.4.4 Atlantic Salmon

Sink Gillnet and Bottom Trawl Gear

Atlantic salmon interactions (i.e., bycatch) with gillnet and bottom trawl have been observed since 1989; in many instances, these interactions have resulted in the injury and mortality of Atlantic salmon (NMFS NEFSC FSB 2019). According to the Biological Opinion issued by NMFS Greater Atlantic Regional Fisheries Office (GARFO) on December 16, 2013 and Northeast Fisheries Science Center's (NEFSC) Northeast Fisheries Observer and At-Sea Monitoring Programs documented a total of 15 individual salmon incidentally caught on more than 60,000 observed commercial fishing trips from 1989 through August 2013 (NMFS 2013; Kocik *et al*. 2014). Since 2013, no additional Atlantic salmon have been observed in gillnet or bottom trawl gear (NMFS NEFSC FSB 2019). Based on the above information, specifically the very low number of observed Atlantic salmon interactions in gillnet and trawl gear reported in the Northeast Fisheries Observer Program's database (which includes At-Sea Monitoring data), interactions with Atlantic salmon are likely rare events (Kocik *et al*. 2014; NMFS NEFSC FSB 2019). For further information on sink gillnet and bottom trawl gear interactions with Atlantic salmon, see Framework 58.

6.6 HUMAN COMMUNITIES

This EA considers and evaluates the effect management alternatives may have on people's way of life, traditions, and community. These economic and social impacts may be driven by changes in fishery flexibility, opportunity, stability, certainty, safety, and/or other factors. While it is possible that these impacts could be solely experienced by individual fishermen, it is more likely that impacts would be experienced across communities, gear types, and/or vessel size classes.

This section reviews the Northeast multispecies fishery and describes the human communities potentially impacted by the Proposed Action. This includes a description of the sector, common pool, and recreational participants' groundfish fishing and the important port communities in the fishery. Table 15 contains a summary of major trends in the groundfish fishery, reproduced in figures as well (Figure 1 - Figure 5). This section focuses on the groundfish component of fishery participants activities and generally does not report out revenue or landed pounds landed on trips other than groundfish trips. An exception is in Section 6.6.4.1, Reliance on Groundfish Fishery Revenue. Additional information may be found in the FY2010, FY2011, FY2012, FY2013, and FY2015 performance reports for this fishery by the NEFSC (Kitts et al. 2011; Murphy et al. 2012; Murphy et al. 2014; Murphy et al. 2015; Murphy et al. 2018).

Table 15 - Summary of major trends in the Northeast multispecies fishery by fishing year and group ($2018). Pounds and revenue reflect landings on groundfish trips.

		Groundfish Pounds landed	Non-groundfish pounds landed	Groundfish gross revenue ($)	Non-groundfish gross revenue ($)	Total gross revenue ($)	Groundfish average price	Non-groundfish average price	Number of active vessels*	Number of groundfish trips	Number of days absent on groundfish trips
2010	Common Pool	1,229,389	3,878,253	2,231,897	4,801,899	7,033,796	1.82	1.24	129	2,081	1,488
	Sector Vessels	56,186,534	17,804,994	91,647,335	21,070,317	112,717,652	1.63	1.18	299	10,779	16,455
	Total	**57,415,923**	**21,683,247**	**93,879,232**	**25,872,216**	**119,751,449**	**1.64**	**1.19**	**428**	**12,860**	**17,943**
2011	Common Pool	444,881	4,691,894	814,888	6,241,572	7,056,460	1.83	1.33	117	2,191	1,432
	Sector Vessels	60,928,002	23,013,923	99,552,448	29,555,458	129,107,906	1.63	1.28	299	13,504	19,801
	Total	**61,372,883**	**27,705,817**	**100,367,336**	**35,797,030**	**136,164,365**	**1.64**	**1.29**	**414**	**15,695**	**21,233**
2012	Common Pool	233,598	3,714,441	503,035	4,475,987	4,979,022	2.15	1.21	97	1,582	982
	Sector Vessels	46,860,313	23,744,265	76,500,828	24,809,352	101,310,180	1.63	1.04	302	12,884	18,898
	Total	**47,093,911**	**27,458,707**	**77,003,863**	**29,285,339**	**106,289,203**	**1.64**	**1.07**	**398**	**14,466**	**19,881**
2013	Common Pool	594,735	2,944,385	1,075,712	3,471,186	4,546,898	1.81	1.18	97	1,472	1,016
	Sector Vessels	41,477,942	17,042,770	61,829,659	21,605,909	83,435,568	1.49	1.27	245	9,110	16,348
	Total	**42,072,677**	**19,987,155**	**62,905,370**	**25,077,095**	**87,982,465**	**1.5**	**1.25**	**342**	**10,582**	**17,364**
2014	Common Pool	489,851	2,487,653	923,100	2,659,978	3,583,079	1.88	1.07	76	1,094	806
	Sector Vessels	42,508,531	22,429,142	62,061,088	26,451,472	88,512,561	1.46	1.18	228	8,672	15,902
	Total	**42,998,382**	**24,916,795**	**62,984,189**	**29,111,451**	**92,095,639**	**1.46**	**1.17**	**304**	**9,766**	**16,709**
2015	Comon Pool	669,002	3,565,794	1,337,144	1,294,451	2,631,595	2	0.36	64	934	657
	Sector Vessels	40,771,574	19,309,159	57,335,587	22,212,568	79,548,156	1.41	1.15	213	7,392	14,381
	Total	**41,440,576**	**22,874,953**	**58,672,731**	**23,507,020**	**82,179,751**	**1.42**	**1.03**	**277**	**8,326**	**15,038**
2016	Common Pool	327,598	2,552,724	842,692	1,051,616	1,894,309	2.57	0.41	59	816	536
	Sector Vessels	33,499,549	21,126,203	50,923,669	24,131,178	75,054,847	1.52	1.14	209	6,507	12,083
	Total	**33,827,147**	**23,678,927**	**51,766,362**	**25,182,794**	**76,949,156**	**1.53**	**1.06**	**268**	**7,323**	**12,620**
2017	Common Pool	185,881	1,962,866	447,448	764,856	1,212,304	2.41	0.39	54	594	377
	Sector Vessels	37,051,935	22,102,456	46,559,703	21,930,341	68,490,044	1.26	0.99	198	6,757	11,269
	Total	**37,237,816**	**24,065,322**	**47,007,151**	**22,695,197**	**69,702,348**	**1.26**	**0.94**	**252**	**7,351**	**11,646**
2018	Common Pool	149,761	1,914,364	293,839	824,340	1,118,179	1.96	0.43	54	558	361
	Sector Vessels	44,121,586	20,601,070	49,205,249	21,227,857	70,433,106	1.12	1.03	179	7,135	10,542
	Total	**44,271,347**	**22,515,434**	**49,499,088**	**22,052,197**	**71,551,286**	**1.12**	**0.98**	**233**	**7,693**	**10,904**

Notes: Data includes all vessels with a valid limited access multispecies permit that made at least one groundfish trip (declared into the fishery and landed >1 pound of any stock). Revenue and price reported in real 2018 dollars. "Trips" refer to commercial trips in the northeast Exclusive Economic Zone (EEZ).
*Sector plus common pool vessel counts may exceed total vessel count because vessels may switch between sector and common pool eligibilities during the FY.
From: GARFO DMIS Database. Accessed August 13, 2019.

Figure 1 - Trends in groundfish pounds landed (FY2010-FY2018).

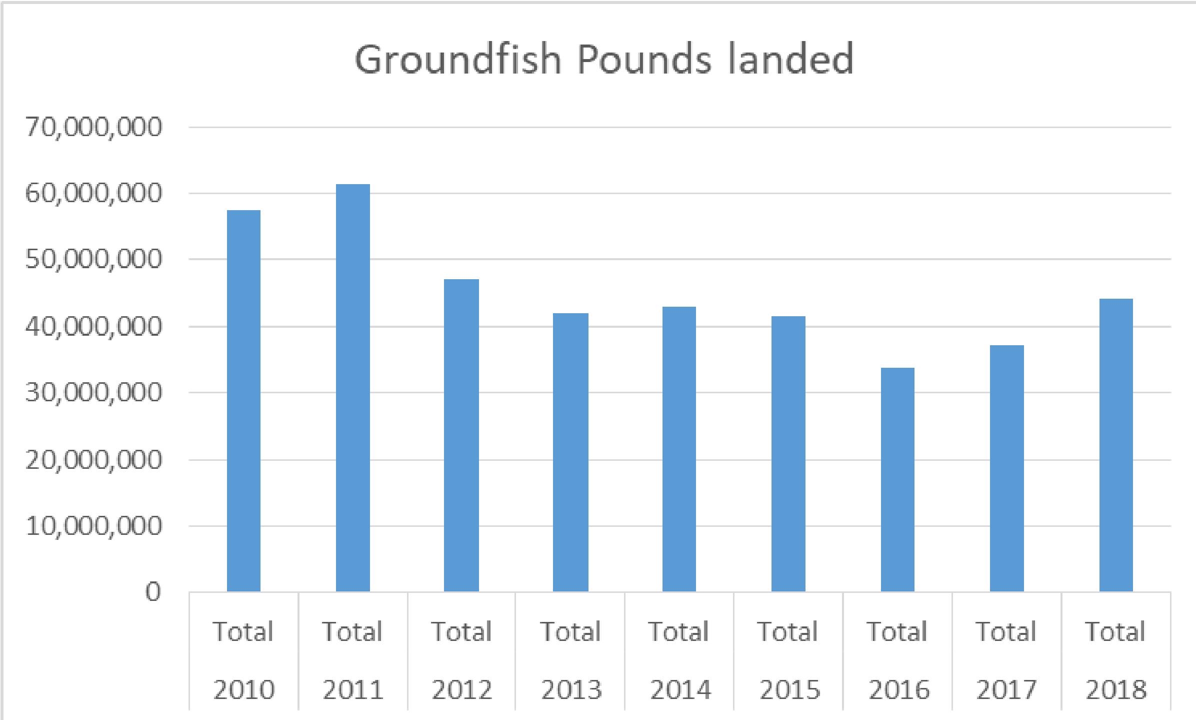


Figure 2 - Trends in groundfish gross revenues (FY2010-FY2018).

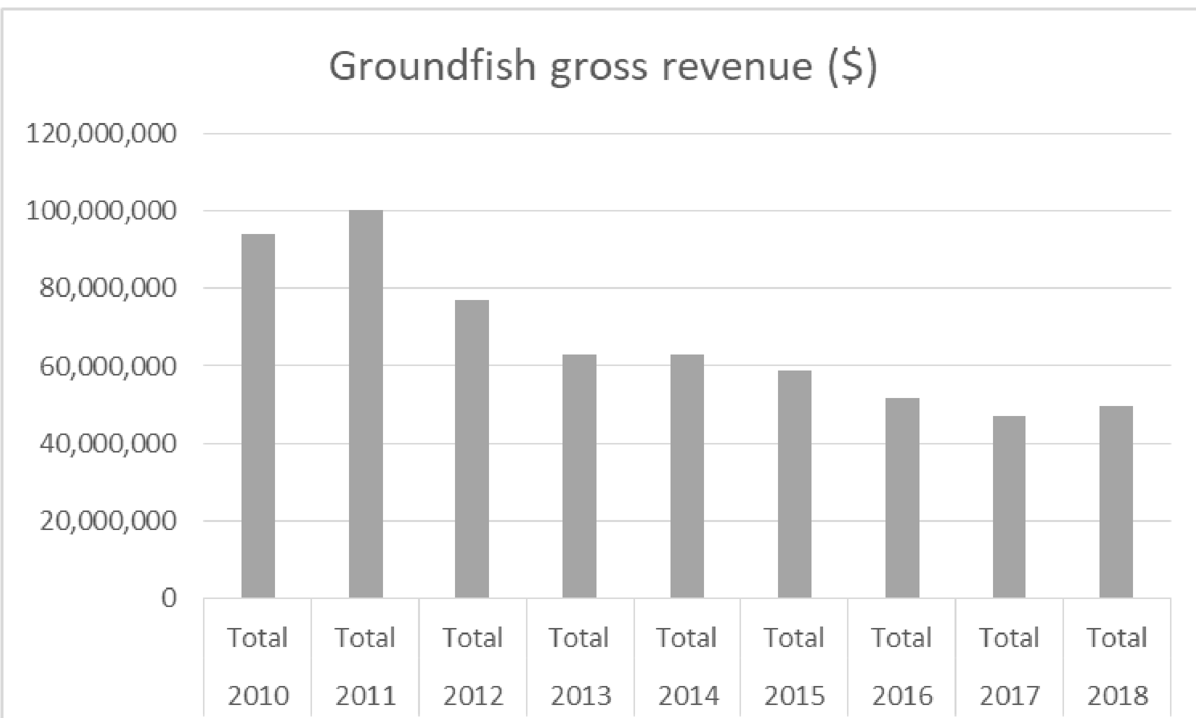
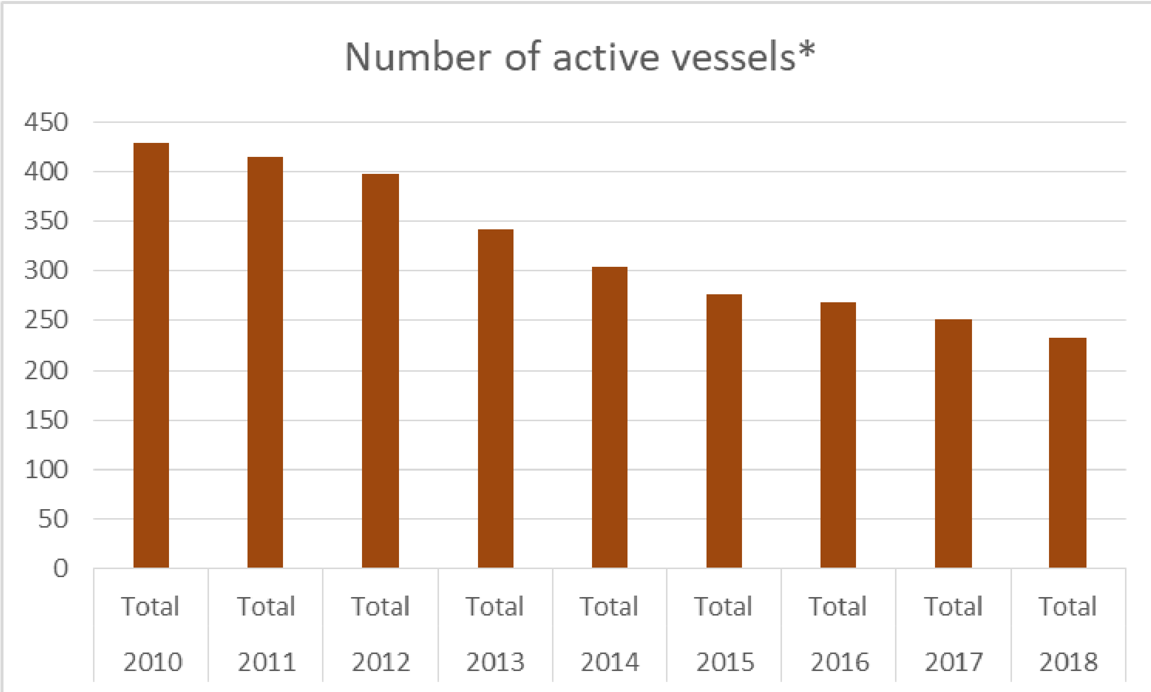


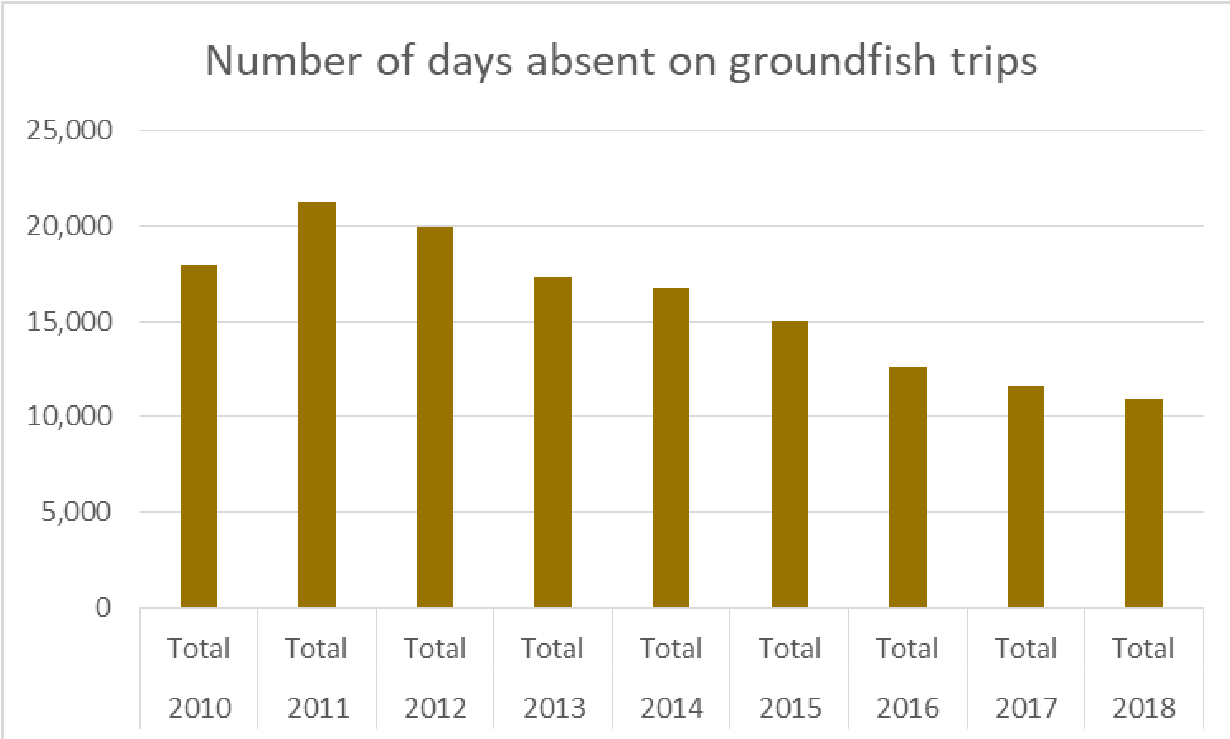
Figure 3- Trends in number of active groundfish vessels (FY2010-FY2018).



* Vessels with a valid limited access multispecies permit that made at least one groundfish trip (declared into the fishery and landed >1 pound of any stock).

Figure 4 - Trends in groundfish trips (FY2010-FY2018).

Figure 5 - Trends in days absent on groundfish trips (FY2010-FY2018).



6.6.1 Groundfish Fishery Overview

Amendment 16 to the Northeast Multispecies FMP was implemented for the New England groundfish fishery starting on May 1, 2010, the start of the 2010 fishing year. There were two substantial changes meant to adhere to the catch limit requirements and stock rebuilding deadlines of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSA). The first change developed "hard quota" annual catch limits (ACLs) for all 20 stocks in the groundfish complex. The second change expanded the use of Sectors, which are allocated subdivisions of ACLs called Annual Catch Entitlements (ACE) based on each sector's collective catch history.[19] Sectors received ACE for nine of 13 groundfish species (14 stocks + quotas for Eastern US/Canada cod and haddock; 16 ACEs) in the FMP and became exempt from many of the effort controls previously used to manage the fishery.

During the first year of sector management, 17 sectors operated, each establishing its own rules for using its allocations. Vessels with limited access permits that joined sectors were allocated 98% of the total commercial groundfish sub-ACL, based on their collective level of historical activity in the groundfish fishery. Approximately half (45%) of the limited access groundfish permits opted to remain in the common pool (Table 16)[20]. Common pool vessels act independently of one another, with each vessel

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[19] To determine the ACE, the sum of all of the sector members' potential sector contributions (PSCs) (a percentage of the ACL) are multiplied by the ACL.

[20] The number of LA permits overall has changed relatively little since the beginning of the sector program, the decline in number of vessels is due to the number of permits not currently affiliated with a vessel, but is eligible for

constrained by the number of DAS it can fish, by trip limits, and by all of the time and area closures. These restrictions help ensure that the groundfish catch of common pool vessels does not exceed the common pool's portion of the commercial groundfish sub- ACL for all stocks (about 2% for 2010) before the end of the fishing year.

In the second year of sector management, 58% of limited access permits enrolled in one of 16 sectors or one of two lease-only sectors. This proportion of vessels has remained stable over time, with around 42% to 44% of permits enrolling in the common pool between 2011 and 2018 (Table 16).

In this section, "groundfish trips", unless otherwise stated, are defined as vessels with a limited access groundfish permit that landed at least 1 pound of any stock on a trip that declared into the groundfish fishery. Groundfish landings only refer to landing stocks that are allocated species in the Northeast Multispecies plan (cod, haddock, pollock, redfish, yellowtail flounder, witch flounder, American plaice, etc.), but may have been caught on either sector or common pool trips. Non-groundfish landings include all other species caught, including whiting, lobster, skates, dogfish, and any other federally reported catch.

6.6.2 Fleet Characteristics

The overall trend since the start of sector management has been a slow decline in the number of groundfish eligibilities (Moratorium Right Identifiers, MRIs), from 1,439 in FY2010 to 1,324 in FY2018 (Table 16). This represents the number of individual fishing privileges and catch histories associated with each Northeast multispecies permit, through which Potential Sector Contributions (PSC) are calculated. While a given set of privileges may move from one vessel to another, and change permit numbers, the MRI always stays the same. Over time, the number of eligibilities in CPH (Confirmation of Permit History) has increased, from 94 in at the start of FY2010 to 425 in FY2018. The increase of eligibilities in CPH represents a decline in the number of permits associated with vessels, but because eligibilities in CPH may still join sectors, the number of eligibilities in CPH does not necessarily change individuals PSC, nor the ability for participants to passively obtain income from the groundfish fishery by leasing their ACE. Eligibilities may also move out of CPH during the fishing year, allowing the number of Limited Access permitted vessels to exceed the number of eligible permits at the start of the FY. Overall, there has been a decline in the number of permitted vessels in any year, from 1,389 in FY2010 to 918 in FY 2018. While over 900 vessels were associated with groundfish permits in FY 2018, 30% are inactive and did not land any groundfish or non-groundfish species on groundfish trips, only roughly 25% of permitted vessels reported landing allocated groundfish stocks. A key aspect of Amendment 16 is the ability of a sector to jointly decide how its ACE will be harvested, through redistribution within a sector and/or transferring ACE between sectors. Because inactive sector vessels may benefit if they lease their allocation, changes in the number of inactive vessels may result from a transfer of allocation and not necessarily vessels exiting the fishery.

renewal based on the previous vessels' fishing and permit history (i.e., Confirmation of Permit History, or CPH, see 50 CFR 648.4).

Table 16 - Number of eligibilities, eligibilities in CPH, permitted vessels, and active vessels (landing on groundfish trips) by fishing year.

Year	Fleet	Total Eligibilities*	Eligibilities in CPH*	Eligible permits*	LA permitted vessels**	Any landings***	Landed groundfish	% No landings
2010	Common Pool	678	72	606	636	421	100	34%
	Sector	761	22	739	753	436	292	42%
2011	Common Pool	594	80	514	514	339	82	34%
	Sector	828	88	739	772	445	290	42%
2012	Common Pool	558	83	475	501	319	72	29%
	Sector	850	145	704	728	445	285	38%
2013	Common Pool	529	83	446	468	315	80	28%
	Sector	851	190	661	688	419	231	37%
2014	Common Pool	525	85	440	432	317	60	27%
	Sector	845	218	627	632	406	218	36%
2015	Common Pool	519	97	422	418	294	63	30%
	Sector	838	272	566	573	381	206	34%
2016	Common Pool	501	101	400	406	292	60	28%
	Sector	840	298	542	563	392	198	30%
2017	Common Pool	499	102	396	404	297	50	26%
	Sector	834	313	521	535	376	188	30%
2018	Common Pool	491	103	388	396	279	53	30%
	Sector	833	321	508	522	359	170	31%

*On May 1st of the fishing year. On this date the number of LA vessels will equal to the number of eligibilities not in Confirmation of Permit History (CPH). These numbers exclude groundfish limited access eligibilities held as CPH. Starting in 2010, Amendment 16 authorized CPH owners to join sectors and to lease DAS. For purposes of comparison, CPH vessels are not included in the data for either Sector or Common Pool.
** Limited Access Permitted vessels includes the total eligible vessels at any time in the fishing year minus the number of vessels that did not renew a LA permit.
***Active vessels in this report received revenue from any species while fishing under a limited access groundfish permit, specifically on any trip where the vessel declared into the groundfish fishery.
Source: GARFO sector tables and GARFO sector monitoring tables
(https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/Sector_Monitoring/FY15_Groundfish_Tables.pdf.)

6.6.3 Effort

The groundfish fishery has traditionally been made up of a diverse fleet, comprised of a range of vessel sizes and gear types. The number of active vessels has generally declined across all years and size classes during the sector program (Table 17). From FY 2010 to 2018, the 30' to < 50' vessel size category, which has the largest number of active groundfish sector vessels, declined from 160 to 100 active vessels, with a low of 93 active vessels in 2015. 85 vessels in the same size class were active in the common pool in 2010 while only 33 were active in 2018. Only one sector vessel in the <30' vessel size category has ever participated and only between 2011-2014, while common pool vessels declined from 16 to 9 vessels. Active vessels in the 50' to <75' vessel size category and 75' and above vessel size category have also declined, from a maximum of 94 50'-75' vessels in 2012 to 51 in 2018. Between 2011 and 2016, only 15% fewer 75' vessels were participating, but 13 fewer vessels participated in 2018 than in 2017.

Primary gear types in the groundfish fishery are trawls (primarily otter trawls) and gillnet, but several other gear types including handline, longline, and pot gear may be used on groundfish trips, even if not used primarily to target groundfish stocks (Table 18). Historically, effort has been mostly evenly distributed across trawl and gillnet gears, with approximately 4,000 total trips each in 2010, but while the number of sector trawl trips was around 3,800 in 2018, only 1,400 sector gillnet trips were made in the same year. The number of sector handline trips has increased in recent years, from 182 sector trips in 2010 to 226 in 2018. Common pool trips utilizing other gear types other than trawl, including extra-large mesh (ELM) gear, have decreased significantly while the number of trips utilizing trawl gear has remained relatively constant despite large reductions in the number of active vessels.

Table 17 - Vessel activity by size class. Number of vessels fishing under a groundfish LA permit on declared groundfish trips FY2010-FY2018.

Fishing Year	Fleet	<30 ft	30 to 50 ft	50 to 75 ft	>75 ft
2010	Common Pool	16	85	25	3
	Sector	0	160	89	50
2011	Common Pool	16	72	24	5
	Sector	1	156	91	51
2012	Common Pool	13	58	21	5
	Sector	1	156	94	51
2013	Common Pool	15	60	19	3
	Sector	1	119	80	45
2014	Common Pool	13	44	19	0
	Sector	1	105	79	43
2015	Common Pool	12	34	16	2
	Sector	0	93	77	43
2016	Common Pool	12	38	8	1
	Sector	0	97	69	43
2017	Common Pool	9	37	7	1
	Sector	0	98	59	41
2018	Common Pool	9	33	11	1
	Sector	0	100	51	28

Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 18 - Number of trips and gear types used while fishing under a groundfish LA permit on declared groundfish trips FY2010-FY2018.

Fishing Year	Fleet	Trawl	Sep. Trawl	Gillnet	ELM	Handline	Longline	Pot	Other
2010	Common Pool	372	10	334	1183	182	29	21	1
	Sector	4253	241	3914	2243	142	470	1	1
2011	Common Pool	296	15	133	1316	410	20	24	0
	Sector	5557	205	5420	2273	151	717	0	0
2012	Common Pool	200	0	215	997	159	11	20	0
	Sector	5971	87	4935	1841	23	746	21	0
2013	Common Pool	409	0	85	832	152	4	6	0
	Sector	4508	84	2882	1896	19	114	6	0
2014	Common Pool	281	0	128	520	173	1	1	0
	Sector	3980	330	2830	2272	17	33	1	2
2015	Common Pool	570	0	129	44	186	0	8	0
	Sector	3967	207	1836	2177	76	39	11	26
2016	Common Pool	460	0	40	58	253	0	5	0
	Sector	3349	134	1779	2076	98	151	3	0
2017	Common Pool	413	0	38	15	126	1	3	0
	Sector	3526	70	1380	2254	269	126	8	0
2018	Common Pool	340	0	57	73	92	0	1	0
	Sector	3728	62	1432	2280	226	159	14	0

Note: trips do not sum to total groundfish trips since multiple gear types may be used on the same trip.
Source: GARFO DMIS tables. Accessed 8/14/2019.

6.6.3.1 Dealer Activity

All federally permitted groundfish vessels are required to sell to a federally permitted dealer. Federally permitted dealers are required to report all purchases of seafood, regardless of whether the vessels held a Federal or state-waters only permit. Dealers may obtain product from many other sources, so the groundfish activity levels are likely to capture only a portion of business activity by seafood wholesalers.

Since 2010, the number of dealers that reported buying groundfish from any groundfish trips (any vessel that declared into the groundfish fishery) has increased somewhat, but is lower than the maximum number of dealers which occurred in 2013, where 295 dealers reported purchasing from groundfish trips whereas in 2018 there were 224 (Table 19). It is possible to look at dealer activity in two ways: by where dealers are registered (Table 19), and by where they purchase, or receive, landings (Table 20). Economically, each may represent different pieces of information. Where the dealer is registered, similar to homeport, may better represent where revenue ultimately flows in the country, while the location of sale best represents where fish is landed, either to a truck, an auction, or a processing facility.

Table 19 shows the number of dealers by state of sale, specifically those buying any species from groundfish trips. Massachusetts has the most registered dealers, with 56 in 2018 alone, and no other state has more than 35 in any year between 2010 and 2018. New York and Rhode Island each had 18 in 2018, while Maine had around 15 dealers in recent years. New Hampshire had 13 registered dealers in 2018, the most in a five year period while Connecticut and New Jersey each had 11 and 9 registered dealers, respectively.

Table 20 shows the number of registered dealers by state of sale that reported buying any allocated groundfish species.[21] Similar to the trend for registered dealers, Massachusetts has more dealers that purchase groundfish in the state than any other state, at 38 in 2018. New York, Rhode Island, and Maine each had between 12 and 13 dealers which reported buying groundfish in 2018, while Connecticut and New Hampshire had 7 and 8, respectively. Virginia has had few dealers reported buying groundfish.

Table 19 - Number of registered dealers (by registered state) buying any allocated species from groundfish trips FY2010-FY2018.

Registered State	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT	5	9	10	10	6	15	11	10	11
MA	63	65	80	72	59	62	56	55	56
MD	2	2	4	3	3	NA	NA	NA	NA
ME	10	13	17	12	18	16	12	16	13
NC	NA	NA	NA	5	6	10	6	5	5
NH	12	11	12	6	7	6	10	13	13
NJ	8	11	11	14	13	14	4	5	9
NY	28	34	35	35	27	27	25	21	18
RI	26	26	28	34	28	24	21	16	18
VA	4	5	11	10	8	9	5	3	6
TOTAL*	158	176	208	201	175	183	150	144	149

Note: NA indicates no data were available.
*total does not indicate distinct dealer entities since dealers may purchase landings across multiple states.
Source: GARFO DMIS tables. Accessed 8/14/2019.

[21] Again, defined here as any stock that is allocated to sectors such as cod or haddock, does not include other non-allocated, but regulated, groundfish species such as ocean pout.

Table 20- Number of registered dealers (by sale state) reporting buying groundfish stocks from groundfish trips FY2010-FY2018.

Sale State	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT	2	5	3	4	5	10	9	7	7
MA	40	39	48	45	43	42	39	39	38
MD	1	1	1	1	NA	NA	NA	NA	NA
ME	7	8	10	9	15	15	8	10	12
NC	NA	NA	NA	1	4	4	2	2	NA
NH	8	9	7	4	4	5	8	9	8
NJ	3	4	2	8	4	10	3	3	4
NY	18	19	21	21	18	22	19	15	12
RI	16	15	19	21	17	15	14	10	13
VA	NA	1	5	3	3	5	1	1	2
TOTAL*	95	101	116	117	113	128	103	96	96

Note: NA indicates no data were available.
*total does not indicate distinct dealer entities since dealers may purchase landings across multiple states.
Source: GARFO DMIS tables. Accessed 8/14/2019.

6.6.4 Landings and Revenue

Table 15 summarizes major landings and revenues trends for the groundfish fishery. While total landed groundfish and non-groundfish pounds have decreased some over the sector period (from around 80 million pounds to 60 million pounds), the value of the groundfish fishery has declined more rapidly from nearly a $140 million dollar fishery in 2011 to less than $70 million dollars in 2017. This is reflected in the average price for groundfish, which declined from $1.64 per pound in 2011 to $1.12 per pound in 2018.

Table 21 shows the distribution of groundfish landings by dealer state. In 2018, Massachusetts by far makes up the majority share of groundfish landings (92%), followed by Maine (5%), New Hampshire (1%), and Rhode Island (1%). While Massachusetts has consistently received the majority of all groundfish pounds since 2010, the share has fluctuated across years; decreasing from 89% in 2010 to 82% in 2012 but rebounding to greater than 90% from 2016 to 2018. New Hampshire and Rhode Island have both experienced declines in their shares of groundfish landings in recent years. In 2012, Maine landings increased from 7% to 11% of total groundfish landings, but has declined in every year since 2015. Similarly, New Hampshire also had a larger share of landings in 2011-2012, between 4% and 5%, but has fallen to 1% in each year between 2015 and 2018.

When looking at the distribution of fishing revenue by state, Massachusetts again accounts for the majority share of groundfish revenue, fluctuating between 81% in 2012 and 89% in 2018 (Table 22). Maine, New Hampshire, and Rhode Island make up the bulk of the remaining share of groundfish revenue, but all three states have experienced a decline over the past five years. In comparison to changes in volume, the distribution of revenue the distribution of revenue is more evenly spread across states than pounds; in 2018, Maine accounted for 8% of groundfish revenue, New Hampshire accounted for 2%, while Connecticut and Rhode Island each accounted for approximately 1% of total groundfish revenue. Other states, including New York, New Jersey, Virginia, Maryland, and North Carolina each had positive landings and revenue in most years but the share of groundfish revenue was less than half a percent in any given year. More detailed information on groundfish landings and revenue by state is provided in Section 6.6.6.

Table 21 - Share of GF landings by dealer sale state FY2010-FY2018.

State	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT	0%	0%	0%	0%	0%	0%	0%	0%	1%
MA	89%	86%	82%	83%	85%	87%	91%	92%	92%
MD	0%	0%	0%	0%	NA	NA	NA	NA	NA
ME	5%	7%	11%	9%	10%	8%	7%	6%	5%
NC	NA	NA	NA	0%	0%	0%	0%	0%	NA
NH	3%	5%	4%	3%	2%	1%	1%	1%	1%
NJ	0%	0%	0%	0%	0%	0%	0%	0%	0%
NY	0%	0%	0%	1%	0%	1%	0%	0%	0%
RI	2%	2%	2%	3%	2%	2%	1%	1%	1%
VA	NA	0%	0%	0%	0%	0%	0%	0%	0%

Note: NA indicates no data were available.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 22 - Share of GF revenue by dealer sale state FY2010-FY2018.

State	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT	0%	0%	0%	0%	0%	0%	0%	0%	1%
MA	89%	86%	82%	81%	82%	83%	86%	88%	88%
MD	0%	0%	0%	0%	NA	NA	NA	NA	NA
ME	5%	7%	10%	11%	12%	10%	9%	8%	8%
NC	NA	NA	NA	0%	0%	0%	0%	0%	NA
NH	4%	5%	5%	4%	3%	1%	1%	2%	2%
NJ	0%	0%	0%	0%	0%	0%	0%	0%	0%
NY	0%	0%	0%	1%	1%	1%	1%	0%	0%
RI	2%	2%	2%	4%	3%	4%	3%	2%	1%
VA	NA	0%	0%	0%	0%	0%	0%	0%	0%

Note: NA indicates no data were available in that year.
Source: GARFO DMIS tables. Accessed 8/14/2019.

6.6.4.1 Reliance on Groundfish Fishery Revenue

This section describes the overall reliance of active groundfish permit holders on other sources of fishery revenue. Groundfish fishermen may participate in other fisheries within and across years for many reasons: weather, prices, quota availability, or due to regulatory changes (closures, etc.). This section deviates from other sections in this document since it looks at all revenue from vessels catching greater than 1 pound of groundfish (live pounds) but did not necessarily report selling any groundfish. This is to more closely match the vessels in other parts of the document, but to more comprehensively represent active, groundfish permit holders—even if they are primarily engaged in other fisheries. Over the last 3 fishing years, sector vessels are generally more reliant on groundfish revenue than common pool vessels.

The median (50th percentile), or typical, common pool vessel , received between 0% and 4% of its total revenue from groundfish species, compared to the median sector vessel which ranged between 24% and 31% (Table 23).

Vessels who spend more days absent on groundfish trips tend to be more reliant on groundfish revenue (Table 24-Table 25). Sector vessels who spend less than 5 days absent on groundfish trips a year generally earn less than 1% of their revenue from groundfish, as opposed to sector vessels fishing more than 160 days a year, typically receive around 75% of their revenue from groundfish species. Total revenues across all activities are highest for this class of reliant vessels, 22 vessels cumulatively landed between $33 and $35 million across FY2016-FY2018. The least reliant class of vessels also have high total revenues, between $19 and $32 million per year, but is spread across roughly twice as many vessels (43 in FY2018). Common pool vessels are not as active in the groundfish fishery, with no vessels spending more than 50 days absent per year over the last two fishing years. Vessels who spend between 20 and 50 days absent per year are slightly less reliant than sector vessels who spend just as much time at sea, less than 18% of revenue in any year, while sector vessels obtained between 18% and 26% of their revenue.

Table 23 - Reliance on groundfish revenue by group (sector, common pool) and fishing year (nominal dollars). Total revenue (on all trips) is shown for vessels with a LA groundfish permit, as well as groundfish revenue when fishing on declared groundfish trips. The proportion of groundfish revenue to total revenue is shown for the median vessel, as well as for those in the 25th and 75th percentiles.

									Proportion of GF Revenue			
FY	Group	Trips	Vessels	Length (mean)	Total Rev ($)	Total GF Rev ($)	Median ($)	Median GF ($)	median	25th	75th	total live GF lbs
2016	common	4,755	71	45	15,517,143	803,276	120,586	1,104	0.04	0.00	0.25	344,569
2017	common	4,221	72	48	19,220,009	435,376	105,538	566	0.01	0.00	0.13	194,970
2018	common	4,588	69	47	26,449,760	290,826	176,700	480	0.00	0.00	0.04	152,928
2016	sector	13,871	215	59	131,301,571	48,668,437	417,275	64,963	0.24	0.02	0.68	36,869,621
2017	sector	12,696	204	57	109,934,945	45,448,322	343,474	66,302	0.31	0.03	0.70	40,894,825
2018	sector	12,853	190	56	114,228,547	49,201,682	367,293	50,605	0.24	0.02	0.73	49,129,476

Table 24 - Reliance on groundfish revenue for sector vessels by days absent (DA) category in fishing years 2016-2018 (nominal dollars). Total revenue (on all trips) is shown for vessels with a LA groundfish permit, as well as groundfish revenue when fishing on declared groundfish trips. The proportion of groundfish revenue to total revenue is shown for the median vessel, as well as for those in the 25th and 75th percentiles.

									Proportion of GF Revenue		
FY	DA category	Trips	Vessels	Length (mean)	Total Rev ($)	Total GF Rev ($)	Median ($)	Median GF ($)	Median	25th	75th
2016	≤5	2,763	47	60	32,462,134	194,287	551,228	1,672	0.01	0.00	0.02
	>5≤20	3,670	46	49	13,997,990	1,993,502	195,587	31,764	0.22	0.06	0.50
	>20≤50	3,670	40	50	14,020,146	3,519,141	310,301	68,394	0.19	0.03	0.42
	>50≤80	1,851	27	58	14,411,932	4,431,407	385,741	160,321	0.26	0.16	0.76
	>80≤160	1,105	29	69	22,741,938	12,228,146	714,110	410,162	0.62	0.49	0.72
	>160	812	26	76	33,667,432	26,301,954	1,138,618	858,124	0.76	0.67	0.88
2017	≤5	2,705	42	54	19,884,755	182,143	329,601	1,255	0.00	0.00	0.04
	>5≤20	2,503	39	51	16,672,502	1,644,602	169,243	28,782	0.12	0.03	0.61
	>20≤50	4,298	53	51	14,636,198	4,021,504	242,769	67,059	0.26	0.09	0.67
	>50≤80	1,437	20	59	8,995,195	3,797,571	346,166	162,809	0.47	0.24	0.67
	>80≤160	933	25	65	15,091,689	8,891,800	603,620	310,214	0.65	0.46	0.73
	>160	820	25	76	34,654,606	26,910,703	1,272,254	916,142	0.72	0.68	0.82
2018	≤5	2,828	43	58	29,747,415	124,872	569,928	237	0.00	0.00	0.02
	>5≤20	2,004	30	44	6,891,702	1,156,686	126,456	21,531	0.21	0.08	0.60
	>20≤50	4,431	48	48	13,072,509	2,799,738	238,548	45,322	0.18	0.01	0.54
	>50≤80	1,696	24	57	10,967,242	4,695,653	366,731	161,133	0.54	0.15	0.73
	>80≤160	1,099	23	63	17,743,811	11,697,047	841,040	428,872	0.73	0.57	0.82
	>160	795	22	76	35,805,868	28,727,686	1,641,481	1,118,251	0.75	0.69	0.88

Table 25 - Reliance on groundfish revenue for common pool vessels by days absent (DA) category in fishing years 2016-2018 (nominal dollars). Total revenue (on all trips) is shown for vessels with a LA groundfish permit, as well as groundfish revenue when fishing on declared groundfish trips. The proportion of groundfish revenue to total revenue is shown for the median vessel, as well as for those in the 25th and 75th percentiles.

									Proportion of GF Revenue		
FY	DA category	Trips	Vessels	Length (mean)	Total Rev ($)	Total GF Rev ($)	Median ($)	Median GF ($)	Median	25th	75th
2016	≤5	2,803	47	46	11,395,354	126,602	72,402	500	0.01	0.00	0.14
	>5≤20	990	14	38	1,800,412	135,084	91,871	3,907	0.08	0.03	0.27
	>20≤50	870	9	49	2,208,498	432,041	259,652	62,330	0.18	0.10	0.28
	>50≤80	92	1	36	c	c	c	c	c	c	c
2017	≤5	2,814	52	51	16,189,059	51,960	81,497	12	0.00	0.00	0.02
	>5≤20	1,031	16	41	2,088,672	241,572	105,538	10,115	0.13	0.04	0.75
	>20≤50	376	4	44	942,278	141,844	285,411	38,539	0.15	0.13	0.22
2018	≤5	2,710	45	50	21,349,451	39,914	205,445	163	0.00	0.00	0.02
	>5≤20	1,510	21	42	4,053,302	187,429	164,070	6,782	0.04	0.00	0.27
	>20≤50	368	3	48	1,047,007	63,483	365,496	28,504	0.08	0.05	0.08

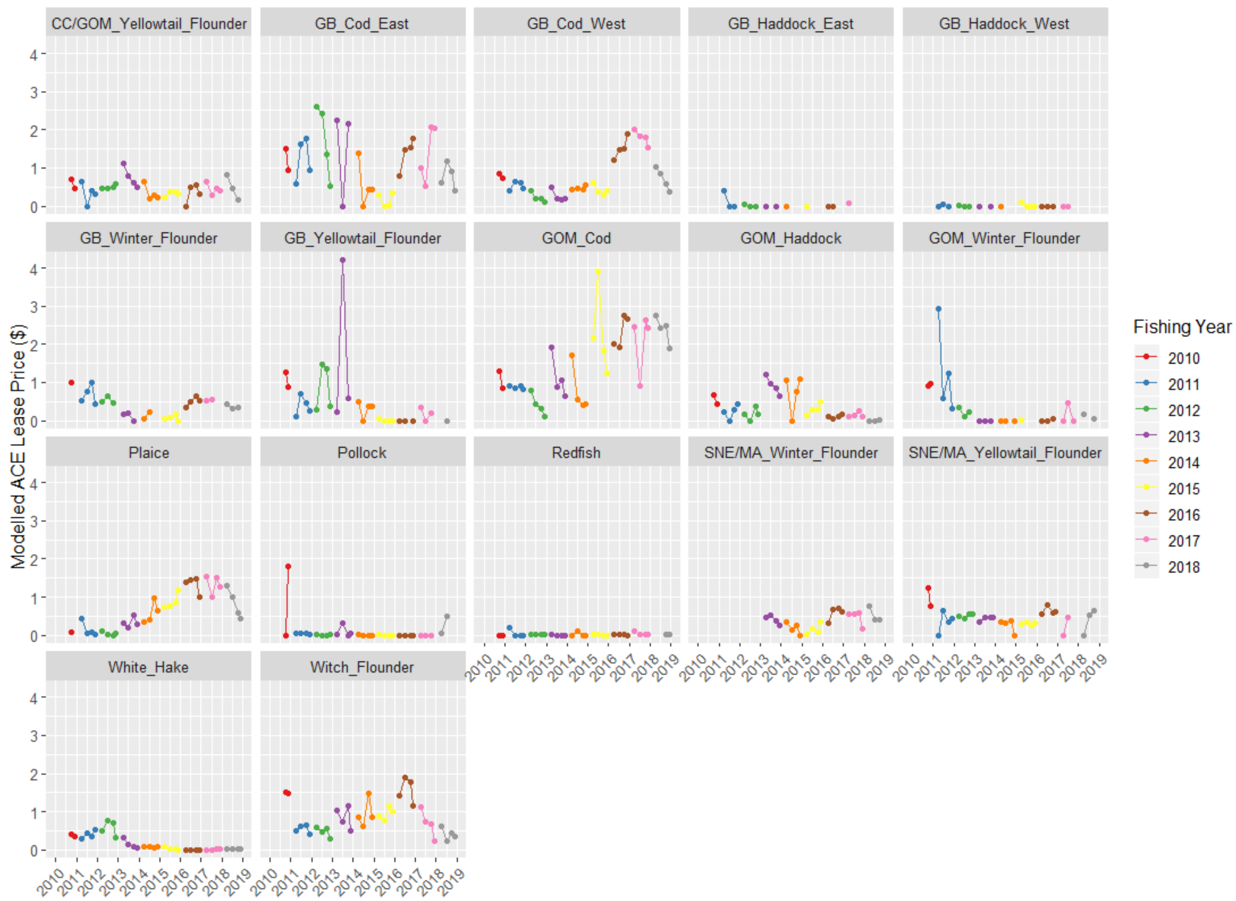
6.6.5 ACE Leasing

Starting with allocations in FY2010, each sector was given an initial ACE determined by the pooled potential sector contribution (PSC) from each entity joining that sector. Every limited access groundfish permit also has a tracking identification number called a Moratorium Right Identifier (MRI). PSC is technically allocated to MRIs, which are subsequently linked to vessels through Northeast Multispecies limited access fishing permits. A vessel's PSC is a percentage share of the total allocation for each allocated groundfish stock based on that vessel's fishing history. Once a sector roster and associated PSC is set at the beginning of a fishing year, each sector is then able to distribute its ACE among its members. By regulation, ACE is pooled within sectors, however most sectors seem to follow the practice of assigning catch allowances to member vessels based on PSC allocations. This is an important assumption because vessels catching more than their allocation of PSC must have leased additional quota, either as PSC from within the sector or as ACE from another sector.

During FY2010, 282 sector-affiliated MRIs had catch that exceeded their individual PSC allocations for at least one stock. These vessels are then assumed to have leased in an additional 22M pounds of ACE and/or PSC with an approximate value of $13.5M. In FY2011, 256 sector-affiliated vessels had catch that exceeded their individual PSC allocations. These vessels are then assumed to have leased in 31M pounds of quota. Although the number of vessels leasing ACE fell by 9% the estimated number of pounds leased was almost 41% greater in FY2011 than in FY2010 (Murphy, et al. 2012). There were 241 sector-affiliated MRIs had catch that exceeded individual PSC allocations for at least one stock. These MRIs leased in >23M pounds of ACE and/or PSC in FY2012 (Murphy, et al. 2014). In FY2013, 224 sector-affiliated MRIs had catch that exceeded individual PSC allocations for at least one stock in 2013, down from 242 in FY 2012. These MRIs leased in nearly 21 million pounds of ACE and/or PSC in FY 2013 (Murphy, et al. 2015).

A hedonic price model of reported inter- and intra-sector ACE leases between FY 2010 and FY 2018 shows quarterly price trends in ace leasing over time (Figure 6Figure 1). Several stocks do not have many reported trades, or are not associated with prices greater than $0, such as haddock, redfish, and in most periods, pollock. Other stocks show dramatic changes in price over time, yellowtail flounder stocks, traded for higher prices in the early 2010s, but have shown declines in recent years. GOM cod ACE lease prices have increased over time overall, but remains variable quarter to quarter.

Figure 6 - Hedonic model of quarterly ACE lease prices FY 2010 to FY 2018 for allocated groundfish stocks.



Source: SSB model, data from GARFO inter-sector trade tables and sector year end reports.

6.6.6 Fishing Communities

There are over 400 communities that have been the homeport or landing port to one or more Northeast groundfish fishing vessels since 2008. These ports occur throughout the New England and Mid-Atlantic. Consideration of the economic and social impacts on these communities from proposed fishery regulations is required by the National Environmental Policy Act (NEPA 1970) and the M-S Act. Before any agency of the federal government may take "actions significantly affecting the quality of the human environment," that agency must prepare an Environmental Assessment (EA) that includes the integrated use of the social sciences (NEPA Section 102(2)(C)). National Standard 8 of the MSA stipulates that "conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities" (16 U.S.C. § 1851(a)(8)).

A “fishing community” is defined in the Magnuson-Stevens Act, as amended in 1996, as “a community which is substantially dependent on or substantially engaged in the harvesting or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community” (16 U.S.C. § 1802(17)). Determining which fishing communities are “substantially dependent” on and “substantially engaged” in the groundfish fishery can be difficult.

Although it is useful to narrow the focus to individual communities in the analysis of fishing dependence, there are a number of potential issues with the confidential nature of the information. There are privacy concerns with presenting the data in such a way that proprietary information (landings, revenue, etc.) can be attributed to an individual vessel or a small group of vessels. This is particularly difficult when presenting information on ports that may only have a small number of active vessels. Table 26-Table 35 summarize trends by community, when possible, showing the number of dealers, vessels, trips landing in that community or state, as well as the associated groundfish and non-groundfish volume and revenue.

As discussed in Section 6.6.4, Massachusetts has the largest share of groundfish landings and revenue in the region in every year 2010 to 2018 and has several communities that each have high levels of groundfish landings and revenue. At the top, New Bedford and Gloucester each have been the highest grossing communities over the years; in the early years (2010 to 2012) each community has roughly equivalent gross revenue, with $31.4 million dollars of groundfish landed in Gloucester in 2010 and approximately $32 million landed in New Bedford in the same year (Table 26), or a little less than a third of total gross groundfish revenue in the same year (Table 15. Over time, revenue in both ports declined, but more slowly in New Bedford than in Gloucester. In 2014, New Bedford grossed over $21 million while Gloucester grossed around $15.5 million. But in recent years Gloucester has surpassed New Bedford as the top grossing groundfish port at nearly $18 million in 2018 while New Bedford had around $10.4 million.

Boston is consistently the third highest grossing port in the region, grossing anywhere between $9.8 and $13.27 million dollars in any given fishing year, though few dealers in the port (three or fewer in recent years) constrain the ability to report information, due to confidentiality restrictions. In addition, few vessels deliver to Boston considering the volume it receives; in FY 2018, over $11.5 million dollars worth of groundfish were landed by 21 vessels. This is in comparison to ports like Chatham, where 27 vessels landed less than a half million dollars worth of groundfish, in part because majority of the catch being landed on groundfish trips in this port is not groundfish, but mostly because the average trip volume is much lower. In 2018, vessels landing in Chatham earned almost 11.5 times as much from non-groundfish stocks than groundfish stocks (Table 26). This trend has been apparent in most fishing years during the sector program. However, the consolidation of revenue to few dealers is striking even in comparison to ports where the majority of revenue landed on groundfish trips comes from groundfish stocks. For example in Portland, Maine 29 vessels landed $2.8 million dollars worth of groundfish in 2018 and only $0.6 million dollars worth of non-groundfish, a fraction of what was landed in Boston (Table 27) shows that despite there being 30 to 50 vessels fishing on groundfish trips landing in Point Judith, revenue from groundfish stocks have not exceeded $1 million since 2016 and have only barely exceeded $2 million three times during the sector period. Fishery landings are highly concentrated in Point Judith compared to the rest of the state, with roughly 97% of groundfish landings (280,000 pounds) going to roughly 15 different dealers. This is also true in Maine, where the majority of groundfish revenue is landed in Portland in recent years, but a slightly larger share of revenue is landed in other ports (10-20% in most years), but no other ports could be separated out, due to confidentiality concerns. Total groundfish revenue in other Maine ports was less than $1 million since 2013 and generally around half a million, except revenue increased to almost three-quarters of a million dollars in 2018. Portland gross revenue has been around $3 million over the last three fishing years, but was highest in 2014 with nearly $6.78 million dollars Table 28.

Due to confidentiality reasons, no New Hampshire communities could be individually separated, in part because of limited activity in the state, compared to other areas. Less than 20 vessels have reported landings on groundfish trips since 2014, declining from a high of 31 in 2010 (Table 29). In addition, less than a million dollars worth of groundfish revenue has been landed in the state over the last four fishing years, which is down from $4.71 million in FY 2011. Generally, majority of total revenue landed on groundfish trips comes from groundfish stocks, especially in the early years of the sector program, but near equal amounts of revenue have been generated from non-groundfish stocks in recent years.

Unlike many of the port areas discussed, Connecticut has increased its presence in the groundfish fishery over time—groundfish revenue has increased from roughly $10,000 dollars in 2010 to $390,000 in 2018, despite the number of dealers and vessels remaining relatively constant, if not declining somewhat from early sector years (Table 30). In early years, majority of revenue on groundfish trips was derived from non-groundfish stocks, but in 2018 the ratio of revenue from groundfish to non-groundfish was closer to 1:1, with just over a half million dollars in revenue coming from non-groundfish stocks.

Finally, groundfish revenue from groundfish trips in other port areas south of Connecticut, from New Jersey to North Carolina, has been minimal over the sector period. An exception is Montauk, where $410,000 of groundfish revenue and $240,000 in non-groundfish revenue was landed in 2015, but recently, less than $50,000 in groundfish revenue has been landed in that port in any year since 2016. For all other southern-most states, less than $5,000 in groundfish revenue has been landed in most years, though for many groundfish trips landing non-groundfish is more common; approximately $1.9 million in non-groundfish stocks were landed across these states in 2018, whereas only $428,000 in groundfish was landed in the same states that year (Table 31-Table 35).

Table 26 - Massachusetts communities. Highly engaged communities separated, when data confidentiality allows. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
Boston	# dealers	6	5	3	3	3	3	c	c	3
	# vessels	26	26	20	20	23	21	c	c	21
	# trips	458	504	448	382	440	379	c	c	426
	GF revenue	12.80	13.27	11.81	10.14	11.52	9.82	c	c	11.51
	GF pounds	8.59	8.97	8.53	7.61	8.92	7.85	c	c	12.37
	NGF revenue	2.49	2.88	2.10	2.17	2.36	2.25	c	c	2.45
	NGF pounds	0.72	0.96	0.79	0.79	0.81	0.85	c	c	1.16
Chatham	# dealers	5	10	9	9	5	8	8	8	6
	# vessels	33	29	27	27	19	25	25	28	27
	# trips	1648	1988	1807	1270	1533	1334	1488	1494	1779
	GF revenue	2.47	2.68	1.10	0.82	0.56	0.55	0.23	0.46	0.37

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
	GF pounds	1.40	1.32	0.47	0.41	0.28	0.26	0.10	0.19	0.17
	NGF revenue	2.59	3.90	2.92	2.26	4.18	2.36	3.42	3.37	4.23
	NGF pounds	4.17	5.62	5.89	3.37	5.97	4.97	8.42	8.19	8.33
Gloucester	# dealers	19	23	24	29	23	25	25	29	34
	# vessels	123	110	98	85	74	69	67	65	62
	# trips	4450	5193	4376	2418	2034	1885	1677	1827	1919
	GF revenue	31.47	32.79	22.70	16.08	15.44	15.41	17.67	17.30	17.72
	GF pounds	19.06	20.85	15.31	11.75	11.45	12.80	14.41	17.04	18.88
	NGF revenue	5.12	5.93	4.51	3.72	4.20	4.02	4.72	5.04	4.28
	NGF pounds	3.25	3.05	3.53	1.83	2.61	2.18	2.28	2.63	1.95
New Bedford	# dealers	17	20	24	21	19	19	20	23	18
	# vessels	90	90	85	64	61	73	58	52	28
	# trips	1150	1346	1265	1011	1176	1048	847	649	393
	GF revenue	31.99	32.61	22.79	19.30	21.21	19.00	14.28	9.75	10.41
	GF pounds	20.08	19.26	12.13	12.76	14.24	12.84	8.06	6.22	7.12
	NGF revenue	5.72	9.00	7.03	5.80	6.62	5.75	5.99	4.47	3.65
	NGF pounds	3.04	4.76	4.11	2.96	3.61	3.31	3.05	3.08	2.03
Scituate	# dealers	11	13	17	12	10	10	8	8	7
	# vessels	11	13	15	8	7	7	10	6	11
	# trips	471	541	906	505	358	397	358	385	398
	GF revenue	0.83	1.14	1.32	0.87	0.50	0.68	0.70	0.70	0.72
	GF pounds	0.41	0.52	0.66	0.45	0.27	0.38	0.28	0.32	0.39
	NGF revenue	0.43	0.33	0.52	0.33	0.43	0.64	0.48	0.54	0.43
	NGF pounds	0.33	0.20	0.88	0.24	0.50	0.25	0.14	0.23	0.21
Other MA	# dealers	30	27	36	28	23	26	22	20	18
	# vessels	52	42	51	39	34	35	66	56	29
	# trips	594	737	557	363	246	341	638	732	332
	GF revenue	1.97	2.21	0.79	0.36	0.24	0.48	8.17	10.48	0.29
	GF pounds	0.88	1.00	0.41	0.19	0.11	0.23	6.08	9.05	0.14
	NGF revenue	0.50	0.66	0.69	0.56	0.66	0.84	3.51	3.41	1.20
	NGF pounds	0.45	0.69	0.85	0.66	0.49	0.76	1.57	1.46	0.60

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with ‘c’ was withheld due to confidentiality.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 27 - Rhode Island Communities. Highly engaged communities separated, when data confidentiality allows. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
Point Judith	# dealers	16	19	21	25	23	17	18	13	14
	# vessels	49	43	50	50	48	47	42	35	31
	# trips	753	868	966	1106	1017	1028	811	754	768
	GF revenue	1.70	2.08	1.72	2.16	1.90	2.00	1.24	0.87	0.63
	GF pounds	1.00	1.21	0.82	1.09	1.02	0.96	0.42	0.30	0.28
	NGF revenue	3.02	4.43	3.36	3.01	3.64	1.93	1.49	1.19	1.29
	NGF pounds	4.84	5.67	4.80	4.87	5.44	4.96	3.43	4.72	4.45
Other Rhode Island	# dealers	11	7	9	13	9	9	3	4	7
	# vessels	16	16	17	14	14	6	3	3	9
	# trips	318	482	434	328	156	73	56	35	42
	GF revenue	0.11	0.08	0.12	0.06	0.01	0.00*	0.01	0.00*	0.02
	GF pounds	0.06	0.04	0.05	0.02	0.00*	0.00*	0.00*	0.00*	0.01
	NGF revenue	1.12	2.00	1.55	1.02	0.50	0.16	0.16	0.12	0.08
	NGF pounds	1.04	1.83	1.40	1.02	0.50	0.15	0.21	0.12	0.16

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with 'c' was withheld due to confidentiality.
*indicates where is value is not truly zero, but is rounded to zero if less than 5,000 dollars/pounds.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 28 - Maine Communities. Highly engaged communities separated, when data confidentiality allows. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
Portland	# dealers	c	8	8	8	10	9	5	6	6
	# vessels	c	42	44	33	33	27	28	23	29
	# trips	c	753	778	734	695	447	366	394	417
	GF revenue	c	5.26	6.69	5.88	6.78	5.24	3.96	3.05	2.79
	GF pounds	c	3.62	4.57	3.52	4.06	3.08	1.91	1.85	1.94
	NGF revenue	c	0.84	0.85	0.67	0.60	0.62	0.48	0.65	0.59
	NGF pounds	c	0.38	0.31	0.26	0.26	0.25	0.22	0.40	0.41
Other Maine	# dealers	10	7	11	5	9	8	10	11	8
	# vessels	40	20	24	11	10	7	8	11	8
	# trips	774	449	373	178	226	159	156	171	225
	GF revenue	4.70	1.22	1.07	0.40	0.50	0.50	0.52	0.52	0.71
	GF pounds	2.99	0.76	0.63	0.22	0.26	0.26	0.20	0.21	0.34
	NGF revenue	0.53	0.27	0.28	0.08	0.08	0.10	0.06	0.10	0.13
	NGF pounds	0.36	0.24	0.30	0.12	0.24	0.03	0.02	0.04	0.06

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with ‘c’ was withheld due to confidentiality.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 29 – New Hampshire. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
All New Hampshire	# dealers	12	11	12	6	7	6	10	13	13
	# vessels	31	31	28	24	17	15	16	17	18
	# trips	1242	1720	1735	1104	998	627	485	554	641
	GF revenue	3.43	4.71	3.72	2.19	1.56	0.72	0.70	0.71	0.96
	GF pounds	1.96	2.88	1.79	1.30	0.76	0.41	0.29	0.32	0.51
	NGF revenue	0.43	0.66	0.72	0.40	0.72	0.66	0.49	0.63	0.68
	NGF pounds	0.72	1.42	1.80	0.61	1.85	1.09	0.83	0.86	0.84

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 30 – Connecticut. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
All Connecticut	# dealers	5	9	10	10	6	15	11	10	11
	# vessels	13	14	13	14	8	16	14	11	10
	# trips	94	197	170	143	52	230	196	162	180
	GF revenue	0.01	0.02	0.09	0.14	0.04	0.22	0.20	0.14	0.39
	GF pounds	0.01	0.01	0.04	0.10	0.02	0.11	0.08	0.05	0.24
	NGF revenue	0.34	0.76	0.88	0.45	0.23	0.71	0.54	0.40	0.55
	NGF pounds	0.51	0.53	0.54	0.37	0.13	1.61	1.74	1.15	1.13

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with ‘c’ was withheld due to confidentiality.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 31 - New York Communities. Highly engaged communities separated, when data confidentiality allows. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hampton Bays/ Shinnecock	# dealers	10	12	15	14	14	9	12	11	9
	# vessels	12	13	9	11	8	7	9	9	8
	# trips	202	203	200	214	408	120	205	254	222
	GF revenue	0.04	0.02	0.04	0.04	0.08	0.15	0.10	0.05	0.01
	GF pounds	0.02	0.01	0.02	0.02	0.04	0.08	0.04	0.02	0.01
	NGF revenue	0.38	0.51	0.49	0.45	1.07	0.16	0.59	0.78	0.67
	NGF pounds	0.19	0.25	0.30	0.29	0.35	0.07	0.13	0.13	0.11
Montauk	# dealers	18	20	24	26	16	18	16	13	13
	# vessels	19	23	27	20	13	21	20	15	11
	# trips	300	329	325	308	184	245	130	75	85
	GF revenue	0.19	0.06	0.16	0.39	0.23	0.41	0.15	0.06	0.01
	GF pounds	0.09	0.02	0.09	0.21	0.12	0.18	0.05	0.02	0.00*
	NGF revenue	0.81	1.12	1.25	0.77	0.54	0.24	0.19	0.14	0.14
	NGF pounds	0.59	0.70	0.79	0.57	0.35	0.15	0.12	0.08	0.17
Other NY	# dealers	8	8	3	6	5	5	c	c	c
	# vessels	7	8	3	9	5	5	c	c	c
	# trips	50	70	7	49	16	11	c	c	c
	GF revenue	0.00*	0.00*	0.00*	0.01	0.02	0.01	c	c	c
	GF pounds	0.00*	0.00*	0.00*	0.00*	0.01	0.00*	c	c	c
	NGF revenue	0.13	0.14	0.01	0.06	0.03	0.01	c	c	c
	NGF pounds	0.08	0.08	0.00*	0.04	0.03	0.00*	c	c	c

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with 'c' was withheld due to confidentiality.
*indicates where is value is not truly zero, but is rounded to zero if less than 5,000 dollars/pounds.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 32 – New Jersey. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
All New Jersey	# dealers	8	11	11	14	13	14	4	5	9
	# vessels	25	24	13	20	19	14	4	6	9
	# trips	250	263	81	174	110	41	9	13	20
	GF revenue	0.02	0.02	0.03	0.12	0.02	0.03	0.01	0.00*	0.01
	GF pounds	0.01	0.02	0.02	0.06	0.01	0.02	0.00*	0.00*	0.00*
	NGF revenue	0.95	0.97	0.25	0.41	0.35	0.21	0.08	0.03	0.09
	NGF pounds	0.62	0.60	0.15	0.36	0.28	0.12	0.03	0.01	0.04

Notes: Millions of $2018 and millions of landed pounds where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with 'c' was withheld due to confidentiality.
*indicates where is value is not truly zero, but is rounded to zero if less than 5,000 dollars/pounds.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 33 – Maryland. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
All Maryland	# dealers	c	c	4	3	c	c	c	c	c
	# vessels	c	c	4	3	c	c	c	c	c
	# trips	c	c	35	30	c	c	c	c	c
	GF revenue	c	c	0.00*	0.00*	c	c	c	c	c
	GF pounds	c	c	0.00*	0.00*	c	c	c	c	c
	NGF revenue	c	c	0.12	0.09	c	c	c	c	c
	NGF pounds	c	c	0.08	0.09	c	c	c	c	c

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with 'c' was withheld due to confidentiality.
*indicates where is value is not truly zero, but is rounded to zero if less than 5,000 dollars/pounds.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 34 – Virginia. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
All Virginia	# dealers	4	5	11	10	8	9	5	3	6
	# vessels	11	10	16	19	19	14	9	4	5
	# trips	178	183	145	133	91	49	15	5	8
	GF revenue	0.00	0.00*	0.00*	0.02	0.00*	0.00*	0.00*	0.00*	0.00*
	GF pounds	0.00	0.00*	0.00*	0.01	0.00*	0.00*	0.00*	0.00*	0.00*
	NGF revenue	0.48	0.73	1.15	1.12	0.91	0.65	0.50	0.14	0.24
	NGF pounds	0.42	0.49	0.68	0.64	0.49	0.27	0.17	0.04	0.08

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with 'c' was withheld due to confidentiality.
*indicates where is value is not truly zero, but is rounded to zero if less than 5,000 dollars/pounds.
Source: GARFO DMIS tables. Accessed 8/14/2019.

Table 35 - North Carolina. Landings and revenue represents total groundfish and non-groundfish revenue landed on groundfish trips, by dealer location (Millions of pounds/millions of $2018).

Port	Metric	2010	2011	2012	2013	2014	2015	2016	2017	2018
All North Carolina	# dealers	c	c	c	5	6	10	6	5	5
	# vessels	c	c	c	7	11	12	10	8	4
	# trips	c	c	c	11	30	30	15	12	6
	GF revenue	c	c	c	0.00*	0.00*	0.00*	0.00*	0.00*	0.00
	GF pounds	c	c	c	0.00*	0.00*	0.00*	0.00*	0.00*	0.00
	NGF revenue	c	c	c	0.36	2.59	1.80	0.44	0.94	0.19
	NGF pounds	c	c	c	0.19	1.03	0.70	0.14	0.27	0.07

Notes: Millions of $2018 and millions of landed pounds, where GF is groundfish pounds and revenue and NGF is non-groundfish pounds and revenue from both sector and common pool trips. Data marked with 'c' was withheld due to confidentiality.
*indicates where is value is not truly zero, but is rounded to zero if less than 5,000 dollars/pounds.
Source: GARFO DMIS tables. Accessed 8/14/2019.

6.6.6.1 Community Fishing Engagement and Social Vulnerability Indicators

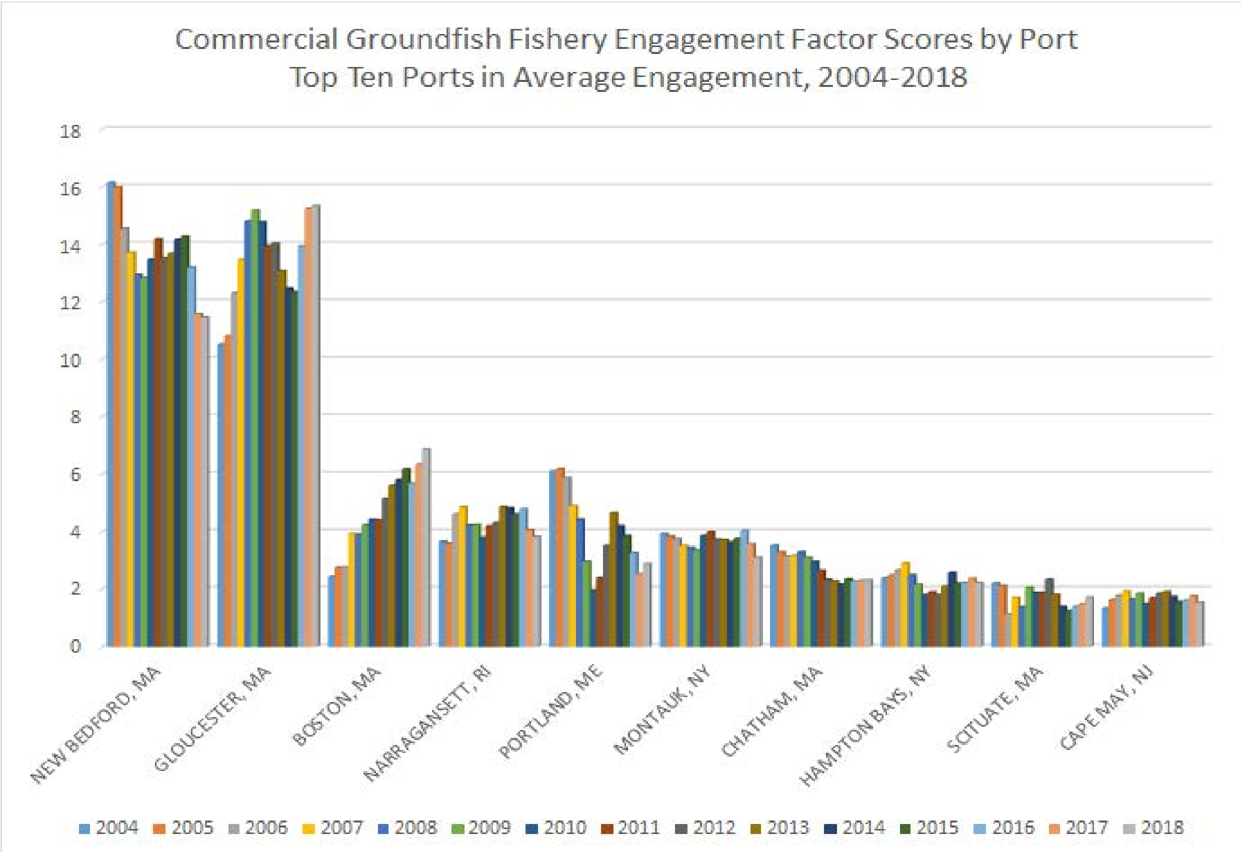
In addition to primary and secondary port classifications for groundfish landings and revenue, fishing communities can also be understood in terms of overall engagement in the commercial groundfish fishery and other social and economic community conditions. NOAA Fisheries social scientists produce indicators of commercial fishing engagement, reliance, and other community characteristics for virtually all fishing communities throughout United States, referred to as the Social Indicators of Fishing Community Vulnerability and Resilience (Colburn and Jepson 2012). The Social Indicators are composite indices of factors that comprise community-level latent constructs, such as commercial fishing engagement or social vulnerability. The strength of these indicators is that they provide greater depth and contextualization to our understanding of fishing communities than the more commonly utilized landings and revenue statistics. The Social Indicators provide a more comprehensive view of fishing communities by including social and economic conditions that can influence the viability of commercial fishing activities, such as gentrification pressure, poverty, and housing characteristics, among other factors.

6.6.6.1.1 2004-2018 Groundfish-Specific Commercial Engagement

The Groundfish-Specific Engagement Indicator is a numerical index that reflect the level of a community's engagement in the groundfish fishery relative to other communities in the Northeast. This index was generated using a principal components factor analysis (PCFA) of variables related to groundfish fishing activity from NOAA Fisheries regional datasets. PCFA is a common statistical technique used to identify factors that are related, yet linearly independent, and likely represent a latent or unobservable concept when considered together, such as factors that contribute to the level of a community's social vulnerability or engagement in commercial fishing. The variables that were identified to best reflect community engagement in the groundfish fishery were the value of groundfish landings (in dollars), the groundfish pounds landed, the number of federally permitted dealers that purchased at least one pound of groundfish, and the number of vessels with at least one category of large mesh groundfish permit (multiple permits on one vessel in a given year are not double counted). It should be noted that a high engagement score does not necessarily mean that a community or its fishery participants are solely dependent upon commercial groundfish fishing activities. There may be other commercial fishing or economic activities that may sustain the livelihoods of individuals or entities within these communities that have relied on groundfish historically.

Figure 7 displays the factor scores for the Groundfish-Specific Commercial Engagement Indicator for the ten communities that have the highest average commercial engagement with groundfish between 2004 and 2018. The index factor scores are commonly categorized from low to high based on the number of standard deviations from the mean, which is set at zero. Categories rank from 0.00 or below as "low", 0.00 – 0.49 as "medium," and 0.50 – 0.99 as "medium-high," and 1 standard deviation or above as "high." All of the ports displayed in Figure 7 have "high" commercial groundfish engagement, but New Bedford and Gloucester have had dramatically higher levels of engagement in commercial groundfish than other highly engaged ports over the last fifteen years. These two communities had more than twice the level of engagement in commercial groundfish than the third most highly engaged community, Boston, MA. The remaining seven highly engaged communities included, in order of their levels of engagement: Narragansett/Point Judith, RI, Portland, ME, Montauk, NY, Chatham, MA, Hampton Bays/Shinnecock, NY, Scituate, MA, and Cape May, NJ. Most of these communities have fluctuated in engagement over time, but New Bedford, Portland, and Chatham have displayed a clear trend of declining engagement over the fifteen-year period from 2004 to 2018. Boston has been the only community with a clear trend of increasing engagement over this period. In recent years, Narragansett/Point Judith and Montauk have declined in engagement in commercial groundfish.

Figure 7 - Commercial Groundfish Fishery Engagement Scores.



6.6.6.1.2 2012-2016 Community Social Vulnerability and Gentrification Pressure Indicators

The Community Social Vulnerability Indicators include indices of labor force structure, housing characteristics, poverty, population composition, and personal disruption. The labor force structure index measures the makeup of the labor force and is reversed scored so that a higher factor score represents fewer employment opportunities and greater labor force vulnerability. The housing characteristics index measures vulnerability related to infrastructure and home and rental values. It is also reversed score so that a higher score represents more vulnerable housing infrastructure. The poverty index captures multiple different factors that contribute to an overall level of poverty in a given area. A higher poverty index score would indicate a greater level of vulnerability due to a higher proportion of residents receiving public assistance and below federal poverty limits. The population composition index measures the presence of vulnerable populations (i.e., children, racial/ethnic minorities, and/or single-parent, female-headed households) and a higher score would indicate that a community's population is composed of more vulnerable individuals. Finally, the personal disruption index considers variables that affect individual-level vulnerability primarily and include factors such as low individual-level educational attainment or unemployment. Higher scores of personal disruption likely indicate greater levels of individual vulnerability within a community, which can in turn impact the overall level of community social vulnerability.

Gentrification Pressure Indicators include housing disruption, urban sprawl, and retiree migration. The Housing Disruption Index combines factors that correspond to unstable or shifting housing markets in which home values and rental prices may cause residents to become displaced. The Urban Sprawl Index indicates the extent of population increase due to migration from urban centers to suburban and rural areas, which often results in cost of living increases and gentrification in the destination communities. The Retiree Migration Index characterizes communities by the concentration of retirees or individuals above retirement age whose presence often raises the home values and rental rates, as well as increase the need for health care and other services.

Data used to develop these indices come from multiple secondary data sources, but primarily the U.S. Census American Community Survey (ACS) at the place level (Census Designated Place (CDP) and Minor Civil Division (MCD)). More information about the data sources, methods, and other background details can be found online at https://www.st.nmfs.noaa.gov/humandimensions/social-indicators/.

Table 36 displays the Community Social Vulnerability Indicator Categorical Scores for the ten communities that have the highest average commercial engagement with groundfish between 2004 and 2018. Place-level population size as estimated by the 2016 ACS is also given in Table 36. Table 37 displays the Community Gentrification Pressure Indicator Categorical Scores for these ten communities.

Table 36 - Community Social Vulnerability Indicator Categorical Scores.

Community	Total Population	Poverty	Labor Force	Housing Characteristics	Population Composition	Personal Disruption
New Bedford, MA	94,988	High	Low	Med-High	Med-High	Med-High
Gloucester, MA	29,546	Low	Low	Medium	Low	Low
Boston, MA	658,279	Med-High	Low	Low	Med-High	Medium
Narragansett, RI	15,672	Low	Medium	Low	Low	Low
Portland, ME	66,649	Med-High	Low	Medium	Low	Low
Montauk, NY	3,510	Low	Medium	Low	Low	Low
Chatham, MA	1,429	Medium	Med-High	Medium	Low	Low
Hampton Bays, NY	13,040	Low	Low	Low	Low	Low
Scituate, MA	18,390	Low	Low	Low	Low	Low
Cape May, NJ	3,529	Low	High	Medium	Low	Low

Table 37 - Community Gentrification Pressure Indicator Categorical Scores.

Community	Housing Disruption	Retiree Migration	Urban Sprawl
New Bedford, MA	Medium	Low	Med-High
Gloucester, MA	Medium	Low	Medium
Boston, MA	Med-High	Low	High
Narragansett, RI	Med-High	Medium	Low
Portland, ME	Med-High	Low	Medium
Montauk, NY	High	Med-High	Med-High
Chatham, MA	Medium	High	Medium
Hampton Bays, NY	High	Medium	Med-High
Scituate, MA	Med-High	Low	Med-High
Cape May, NJ	High	High	Low

6.6.6.2 Employment

Along with the restrictions associated with presenting confidential information, there is also limited quantitative socio-economic data upon which to evaluate the community-specific importance of the multispecies fishery. In addition to the direct employment of captains and crew, the industry is known to support ancillary businesses such as gear, tackle, and bait suppliers; fish processing and transportation; marine construction and repair; and restaurants. Regional economic models do exist that describe some of these inter-connections at that level (Clay et al. 2007; NMFS 2010c; Olson & Clay 2001; Thunberg 2007).

Throughout the Northeast, many communities benefit indirectly from the multispecies fishery, but these benefits are often difficult to attribute. The direct benefit from employment in the fishery can be estimated by the number of crew positions. However, crew positions do not equate to the number of jobs in the fishery and do not make the distinction between full and part-time positions. In FY 2018, vessels with limited access groundfish permits provided 1,877 crew positions, with 46% coming from vessels with homeports in Massachusetts (Table 38). Since at least FY 2010, the total number of crew positions provided by limited access groundfish vessels has declined by 17.6%. Changes in crew positions vary across homeport states.

A crew day[22] is a measure of employment that incorporates information about the time spent at sea earning a share of the revenue. Conversely, crew days can be viewed as an indicator of time invested in the pursuit of "crew share" (the share of trip revenues received at the end of a trip). The time spent at sea has an opportunity cost. For example, if crew earnings remain constant, a decline in crew days would reveal a benefit to crew in that less time was forgone for the same amount of earnings. In FY 2018, vessels with limited access groundfish permits used 144,400 crew days, with 46% coming from vessels with homeports in Massachusetts (Table 38). Since at least FY 2010, the total number of crew days used

[22] Similar to a "man-hour," a "crew day" is calculated by multiplying a vessel's crew size by the days absent from port. Since the number of trips affects the crew-days indicator, the indicator is also a measure of work opportunity.

by limited access groundfish vessels across the Northeast has declined, with a slight increase from FY 2014 to FY 2016. The number of crew positions and crew days give some indication of the direct benefit to communities from the multispecies fishery through employment. But these measures, by themselves, do not show the benefit or lack thereof at the individual level. Many groundfish captains and crew are second- or third-generation fishermen who hope to pass the tradition on to their children. This occupational transfer is an important component of community continuity as fishing represents a valued occupation in many of the smaller port areas.

Table 38 - Number of crew positions and crew days on active vessels by homeport and state.

		FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2016	FY 2018
CT	positions	38	41	39	39	46	50	44	44	41
	days	4016	3002	4478	3576	2946	3412	3616	3309	3519
MA	positions	1134	1070	1050	984	979	950	963	930	886
	days	81848	84021	81687	73646	73782	76411	75355	66523	65823
ME	positions	252	228	243	223	220	185	189	199	189
	days	15475	14781	16546	15270	14309	12344	12928	12528	10572
NH	positions	107	105	96	87	77	57	72	66	72
	days	3883	4939	5166	4512	4070	3306	3146	2741	3249
NJ	positions	149	145	149	153	149	155	157	169	162
	days	10084	9906	10333	9664	9334	10219	11603	12071	11803
NY	positions	209	217	209	194	192	173	170	178	168
	days	15802	16048	15114	14636	14365	13658	14579	14738	14314
RI	positions	253	248	232	224	225	223	216	225	221
	days	26769	25165	24258	25629	23107	23699	23707	23532	24447
Other	positions	130	128	128	134	131	138	145	139	139
	days	11867	11597	11648	11199	9567	11521	11900	11837	10673
Total	**Total crew positions**	2271	2183	2147	2038	2019	1931	1956	1950	1877
	Total crew days	169744	169459	169231	158132	151479	154570	156835	147280	144400

Source: GARFO DMIS tables. Accessed 8/14/2019.

6.6.6.2.1 Crew Characteristics

The Socio-Economic Survey of Hired Captains and Crew in New England and Mid-Atlantic Commercial Fisheries (hereafter referred to as the Crew Survey) is an ongoing effort conducted by the Social Sciences Branch (SSB) of the National Oceanic and Atmospheric Administration (NOAA) Fisheries Northeast Fisheries Science Center (NEFSC) intended to gather general information about the characteristics and experiences of commercial fishing crew members (including hired captains) because little is known about this critical segment of the commercial fishing industry. Information collected by the survey include demographic information, wage calculations systems, well-being, fishing practices, job satisfaction, job opportunities, and attitudes towards fisheries management, among other subjects. There have been two waves of Crew Survey data collection thus far – Wave 1 in 2012-13 and Wave 2 in 2018-19.

The 2012 implementation of the Crew Survey began in the fall of 2012 and lasted approximately one year. Given the lack of a registry or population database to draw a crew sample from, the Crew Survey was conducted mainly through in-person interviews using an intercept method at the docks of sampled ports. Ports from Maine to North Carolina were randomly sampled based on a stratified sampling design that took into consideration seasonally-based fishing activity and geographic diversity in the region's fisheries (Henry and Olson 2014). A sample size of 1,330 was calculated from an estimated crew population of 30,000. Population estimates were derived from prior SSB research utilizing data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages and the Bureau of Economic Analysis Regional Economic Information System (Henry and Olson 2014; Steinback and Thunberg 2006). Crew members were interviewed using an intercept method with interviewers approaching crew on the docks and entering survey responses into Nook tablet computers. The random intercept method is commonly used to maximize response rates among hard-to-reach populations, such as crew, who are transient and for whom contact information is unavailable (Miller et.al. 1997; Kitner 2006). Prior survey research of fishermen in this region have achieved response rates of up to 90 percent (Pollnac et al. 2014). The final number of completed surveys was 359, with 42 incompletes and 654 refusals (Henry and Olson 2014).

A variety of factors contributed to the difficulty SSB had in obtaining a higher response rate, including scheduling problems related to the arrival and departure times being at odd/random hours and outright refusals to participate. The ports with the largest number of respondents were (in descending order) New Bedford, MA (n = 58), Gloucester, MA (n = 48), Cape May, Newport News, VA (n = 29), NJ (n = 27), Point Judith, RI (n = 27), Chatham, MA (n = 17), Rockland, ME (n = 14), Portland, ME (n = 14), Montauk, NY (n = 14), and Wanchese, NC (n = 14), and Portsmouth, NH (n = 11).

The 2018-19 Wave 2 sample for the Crew Survey was again collected using an intercept method, but a different sampling strategy than the 2012 design was used to derive a sample of ports at which to conduct intercept interviews. Prior to port-level sampling, a target sample of 452 respondents was calculated using Cochran's (1977) formula for categorical data with a 20% buffer to accommodate nonresponse due to the logistical challenges of the intercept method. This sample size calculation was based on an estimated 21,616 employed in commercial fishing in the Northeast and Mid-Atlantic. To establish a list of ports to visit for intercepts, a quasi-random sample of fishing ports was selected from the universe of ports in the Northeast and Mid-Atlantic states. In order to ensure that the most active ports were selected, a probability proportional to size (PPS) sampling method was applied in order to purposively add weight in the selection process to ports with more fishing activity. Under the PPS approach a port's probability of being selected into the sample is related to the "size" of the port, with larger ports being more likely to be selected into the sample. The PPS approach was necessary to ensure that selected ports were more active and thus, more likely to result in completed crew surveys. Port size was assessed using a commercial fishing engagement index from the 2014 NOAA Fisheries Social Indicators (Jepson and Colburn 2013). This index is reported by community and was generated from a principal component factor analysis of variables associated with fishing activity. The "community level" here refers to data at the level of Census Designated Place (CDP) nested within a set of counties designated as "coastal" by their connection to the ocean through a coastline, river, bay, or estuary. The variables used to determine commercial fishing engagement included the number of commercial fishing permits, the value of landings, dealers with landings, and the total landings in pounds. A sample of fifty CDPs containing moderately and highly engaged ports throughout the Northeast and the Mid-Atlantic was drawn using the PPS method.

6.6.6.2.2 Crew Demographics

In this section, descriptive statistics for demographic variables from both Waves 1 and 2 of the Crew Survey are reported. Demographic variables reported in this section include respondents' primary fishery, age, race and ethnicity, annual income from fishing, educational attainment, health insurance coverage status, and marital status. Descriptive statistics for these data are also provided in Table 39 – Table 40. According to these data, the total number of crew respondents primarily targeting groundfish dropped 13% between 2012 and 2018. In 2012, about 20% of respondents reported that they primarily targeted groundfish, whereas only 7% of respondents primarily targeted groundfish in 2018. This decline in groundfish targeting is likely the result of a multitude of confounding factors, including changes in management, market, and ecosystem conditions, but does roughly correspond to the catch share period under review and may be in part due to the transition to this system of management in particular. While these data do not track whether specific crew members who previously targeted groundfish shifted to targeting another fishery or left the commercial fishing industry altogether, the other two most common primary fisheries targeted among crew have been scallop (28% in 2012 and 32% in 2018) and lobster (20% in 2012 and 18% in 2018).

The mean age for all respondents increased from 38 in 2012 to 40 in 2018. Groundfish-targeting crew were slightly older than crew in other fisheries and that age difference increased between 2012 and 2018 – the average age of groundfish-targeting crew was 40 in 2012 and increased to 43 in 2018. The increasingly higher mean age among groundfish versus other crew may indicate that groundfish-targeting crew are undergoing a "graying of the fleet" phenomenon at a rate higher than crew targeting other fisheries. The large majority of crew across all fisheries in 2012 and 2018 identified as non-Hispanic, white. Groundfish-targeting crew were even more racially and ethnically homogenous than crew targeting other fisheries.

In 2012, about 90% of groundfish-targeting crew identified as non-Hispanic white versus about 83% of crew targeting other fisheries. While only about 10% of the sample identified as Hispanic or Latino overall, groundfish-targeting crew were significantly less likely to identify as Hispanic or Latino than crew in other fisheries (4% targeting groundfish versus 11% targeting other fisheries). The disparity in racial and ethnic representation by fishery increased in 2018, with about 94% of groundfish-targeting crew identifying as non-Hispanic white versus about 86% of crew targeting other fisheries.

Self-reported annual fishing incomes increased from 2012 to 2018 among crew across all fisheries. The mean self-reported income among crew across all fisheries in 2012 was between $50,000 and $59,999. In 2018 the mean self-reported income category jumped to between $80,000 and $89,999. While about three-quarters (75%) of groundfish-targeting crew reported incomes over $60,000 in 2018, a higher percentage of crew in other non-groundfish fisheries reported incomes above $90,000 (36% of groundfish-targeting versus 43% of all other crew). This may signal evidence for greater potential among crew in non-groundfish fisheries to reach substantially higher income categories than those fishing primarily for groundfish. Much of this difference may be explained by crew respondents in the scallop fishery, which is currently one of the most lucrative fisheries in the Northeast. While these data cannot identify individual-level changes in income because they do not track respondents between waves, it is possible that some of the crew in 2012 shifted their employment from groundfish to scallop vessels given the likely opportunity for higher earning potential in the scallop fishery. Educational attainment among crew remained virtually unchanged between 2012 and 2018, with the large majority in both samples having attained a high school education or less (76% in 2012 and 77% in 2018).

Health insurance coverage rates also did not shift very much from 2012 to 2018, but the percentage of groundfish-targeting crew without health insurance was substantially higher than crew in other fisheries and did increase from 2012. About 58% of all crew respondents reported that they had some kind of health insurance coverage, whereas about 42% of crew did not have health insurance. While these overall percentages are nearly identical to the 2012 wave results, the percent of groundfish-targeting crew without insurance increased about 6%, from 44% in 2012 to 50% in 2018. There were substantial percentage differences in sources of health insurance by fishery as well. Among those who reported they had coverage in 2018, about seven in ten (69%) groundfish-targeting crew said they had private health insurance. On the other hand, crew in other fisheries reported a wider variety of sources of health insurance coverage, including private insurance (45%), federal or state insurance (23%), a spouse's or partner's insurance (18%), or some other source of insurance (13%).

Very few crew respondents across all fisheries (about 1%) reported having insurance provided by their employer, the vessel owner. In 2012, the largest proportion of groundfish-targeting crew received insurance from a spouse's or partner's plan, whereas in 2018 the majority had purchased private insurance. Given the health risks associated with commercial fishing and the high average costs of private insurance, groundfish-targeting crew likely spend a considerable amount of their relatively moderate earnings on health insurance coverage. These costs might also help explain why such a large proportion of commercial fishermen overall (42%), and half of groundfish-targeting crew (50%), in 2018 reported that they do not have health insurance coverage at all. Finally, more than three-quarters (77%) of crew were either single and never married (40%) or married (37%) in 2018. Far fewer were either divorced (13%), living with an unmarried partner (7%), separated from their spouse (2%), or widowed (2%). There were no substantial differences between crew in groundfish versus other fisheries and these overall percentages changed little from 2012 to 2018.

Table 39 - 2012 Crew Survey Demographics.

	Groundfish Crew	Other Crew	Total Crew
	N (%)	N (%)	N (%)
Total	72 (100%)	287 (100%)	359 (100%)
15 – 24	11 (15%)	52 (18%)	63 (18%)
25 – 34	21 (29%)	72 (25%)	93 (26%)
35 – 44	12 (17%)	82 (29%)	94 (26%)
45 – 54	14 (19%)	56 (20%)	70 (20%)
55 or above	14 (19%)	25 (9%)	39 (11%)
Hispanic	3 (4%)	31 (11%)	34 (9%)
Non-Hispanic	69 (96%)	256 (89%)	325 (91%)
White	66 (92%)	240 (84%)	306 (85%)
Black/African-American	0 (0%)	10 (3%)	10 (3%)
American Indian or Alaskan Native	1 (1%)	7 (2%)	8 (2%)
Asian	0 (0%)	0 (0%)	0 (0%)
Native Hawaiian or Pacific Islander	0 (0%)	0 (0%)	0 (0%)
Some Other Race	1 (1%)	17 (6%)	18 (5%)
Person of Two or More Races	1 (1%)	10 (3%)	11 (3%)
Don’t Know/No Answer	3 (4%)	3 (1%)	6 (2%)
Less than $30,000	12 (17%)	69 (24%)	81 (23%)
$30,000 - $59,999	30 (42%)	92 (32%)	122 (34%)
$60,000 - $89,999	14 (19%)	47 (16%)	61 (17%)
$90,000 or More	16 (22%)	79 (28%)	95 (26%)
Less than High School	9 (13%)	51 (18%)	60 (17%)
High School or GED	44 (61%)	167 (58%)	211 (59%)
Associate’s/Two-year Degree	9 (13%)	39 (14%)	48 (13%)
Bachelor’s/Four-year Degree	5 (7%)	25 (9%)	30 (8%)
Graduate Degree	2 (3%)	1 (<1%)	3 (1%)
Don’t Know/No Answer	3 (4%)	4 (1%)	7 (2%)
Health Insurance	38 (53%)	169 (59%)	207 (58%)
From Vessel Owner	*1 (1%)*	*8 (3%)*	*9 (3%)*
From Another Employer	*0 (0%)*	*3 (1%)*	*3 (1%)*
From Spouse/Partner	*15 (21%)*	*40 (14%)*	*55 (15%)*
Private Insurance	*10 (14%)*	*72 (25%)*	*82 (23%)*
Federal/State Insurance	*9 (13%)*	*29 (10%)*	*38 (11%)*
Other	*2 (3%)*	*13 (5%)*	*15 (4%)*
Don’t Know/No Answer	*1 (1%)*	*4 (1%)*	*5 (1%)*
No Health Insurance	32 (44%)	115 (40%)	147 (41%)
Don’t Know/No Answer	2 (3%)	3 (1%)	5 (1%)
Married	32 (44%)	126 (44%)	158 (44%)
Widowed	1 (1%)	0 (0%)	1 (<1%)
Divorced	8 (11%)	37 (13%)	45 (13%)
Separated	1 (1%)	6 (2%)	7 (2%)
Never Married	23 (32%)	101 (35%)	124 (35%)
Living with Partner	6 (8%)	16 (6%)	22 (6%)
No Answer	1 (1%)	1 (<1%)	2 (1%)

Table 40 - 2018 Crew Survey Demographics.

	Groundfish Crew	Other Crew	Total Crew
	N (%)	N (%)	N (%)
Total	33 (100%)	446 (100%)	479 (100%)
18 – 24	4 (12%)	49 (11%)	53 (11%)
25 – 34	6 (18%)	146 (33%)	152 (32%)
35 – 44	10 (30%)	89 (20%)	99 (21%)
45 – 54	5 (15%)	99 (22%)	104 (22%)
55 or above	8 (24%)	63 (14%)	71 (15%)
Hispanic	0 (0%)	32 (7%)	32 (7%)
Non-Hispanic	33 (100%)	414 (93%)	447 (93%)
White	31 (94%)	392 (88%)	423 (88%)
Black/African-American	0 (0%)	6 (1%)	6 (1%)
American Indian or Alaskan Native	0 (0%)	1 (<1%)	1 (<1%)
Asian	0 (0%)	5 (1%)	5 (1%)
Native Hawaiian or Pacific Islander	0 (0%)	1 (<1%)	1 (<1%)
Some Other Race	0 (0%)	22 (5%)	22 (5%)
Person of Two or More Races	2 (6%)	7 (2%)	9 (2%)
Don't Know/No Answer	0 (0%)	12 (3%)	12 (3%)
Less than $30,000	2 (6%)	41 (9%)	43 (9%)
$30,000 - $59,999	5 (15%)	88 (20%)	93 (19%)
$60,000 - $89,999	13 (39%)	80 (18%)	93 (19%)
$90,000 or More	12 (36%)	191 (43%)	203 (42%)
No Answer	1 (3%)	46 (10%)	47 (10%)
Some High School	6 (18%)	59 (13%)	65 (14%)
High School or GED	20 (61%)	280 (64%)	300 (63%)
Associate's/Two-year Degree	1 (3%)	53 (12%)	54 (11%)
Bachelor's/Four-year Degree	6 (18%)	45 (10%)	51 (11%)
Graduate Degree	0 (0%)	3 (1%)	3 (1%)
Health Insurance	16 (48%)	262 (59%)	278 (58%)
From Vessel Owner	*1 (3%)*	*2 (<1%)*	*1 (3%)*
From Another Employer	*0 (0%)*	*1 (<1%)*	*1 (<1%)*
From Spouse/Partner	*1 (3%)*	*47 (11%)*	*48 (10%)*
Private Insurance	*11 (33%)*	*118 (26%)*	*129 (27%)*
Federal/State Insurance	*3 (9%)*	*61 (14%)*	*64 (13%)*
Other	*0 (0%)*	*32 (7%)*	*32 (7%)*
Don't Know/No Answer	*0 (0%)*	*1 (<1%)*	*1 (<1%)*
No Health Insurance	16 (48%)	184 (41%)	200 (42%)
Don't Know/No Answer	1 (3%)	0 (0%)	1 (<1%)
Married	12 (36%)	164 (37%)	176 (37%)
Widowed	1 (3%)	6 (1%)	7 (1%)
Divorced	6 (18%)	58 (13%)	64 (13%)
Separated	0 (0%)	11 (2%)	11 (2%)
Never Married	12 (36%)	177 (40%)	189 (39%)
Living with Partner	2 (6%)	29 (7%)	31 (6%)
No Answer	0 (0%)	1 (<1%)	1 (<1%)

6.6.6.2.3 Crew Employment Characteristics

In this section, descriptive statistics are presented for various aspects of crew employment. These include primary port, time employed in commercial fishing, number of days per trip and hours worked per day, average size of crew, owner-operator status, position on the vessel, path to employment, payment systems, and fishing expenses deducted from crew payment. Descriptive statistics for these data are also provided in Table 41 – Table 42.

Groundfish-targeting crew in 2012 were concentrated mostly in Gloucester (36%) and New Bedford (11%), but other ports with substantial groundfish crew included Portland, ME (8%), Boston, MA (8%), Portsmouth, NH (7%), and Montauk, NY (6%). By 2018, the vast majority of groundfish-targeting crew worked mostly in just three ports in 2018 – Gloucester, MA (33%), Boston, MA (27%), and Portland, ME (24%). Groundfish-targeting have been involved in commercial fishing longer than crew in other fisheries, but they tend to be employed on their current vessels for shorter durations. Crew overall in 2018 reported being employed in commercial fishing on average about 19 years and reported on average being employed on their current vessels for about 6 of those years. By contrast, groundfish-targeting crew were employed in commercial fishing on average about 22 years, but only reported on average having been employed for 4 years on their current vessels. About 28% of crew in 2018 worked on vessels that fished for single-day trips, whereas about 72% worked on vessels that fished on trips for multiple days. Among those on vessels that fished for multiple days per trip, respondents reported a mean of about 7 days per trip. Groundfish-targeting crew on reported slightly fewer days per trip with a mean of about 6 days. While their trips lasted less time than crew in other fisheries, groundfish-targeting crew reported working significantly more hours per day than crew in other fisheries. On average, groundfish-targeting crew reported working for about 17 hours per day, compared to about 15 working hours per day among crew in other fisheries. Longer working hours may correspond to smaller crew sizes. Groundfish-targeting crew in 2012 and 2018 reported working on vessels with fewer crew than those in other fisheries. In 2018, groundfish-targeting crew reported a mean of four crew members including captains, whereas crew in other fisheries reported a mean of five members.

About 57% of crew overall in 2018 worked on vessels that were not owner-operated, while about 43% worked on owner-operated vessels. Groundfish-targeting crew worked substantially more often on vessels that were not owner-operated – about 73% of groundfish crew worked on vessels that were not owner-operated. This represents a substantial decrease among groundfish crew working for owner-operators between 2012 and 2018 - about 56% of groundfish-targeting crew reported being employed on vessels that were owner-operated in 2012, whereas only about 27% did in 2018. Overall, the vast majority of crew respondents in 2012 (87%) reported that they were paid through a share system, whereas only about 13% were paid per trip (12%) or hourly (1%). Groundfish crew were even more likely to be paid by share system, with about 93% working under this type of payment system. Groundfish crew under share systems received slightly less of the overall share than crew in all other fisheries. Among groundfish crew paid through a share system, respondents on average reported that about 60% of the share goes to the vessel owner and 40% is divided between the crew. Crew in other fisheries, on the other hand, report on average that they receive about 43% of the share while the vessel owner takes about 57% of the share. This three-percent difference was not statistically significant. Similar to groundfish crew surveyed in 2012, the overwhelming majority of groundfish crew in 2018 (about 94%) reported that they were paid through a share system. This was not statistically different from crew in other fisheries, the large majority (about 85%) of whom in 2018 also reported that they were paid through share systems. Among those paid under share systems, groundfish crew in 2018 on average reported that the vessel owner share was about 57% and the share for the crew was about 43%. Crew in other fisheries reported on average that the vessel owner received 55% of the share and 45% went to the crew. These mean percentages for share distributions were not statistically different between fisheries.

Fishing trip expenses are sometimes deducted from crew shares under share systems. Majorities of crew respondents overall reported that fuel/oil (70%) and food (65%) were deducted from their shares. Other expenses deducted included general fishing supplies (43%), ice (38%), bait (13%), fishing quota (4%), and all other costs (22%). Among these trip costs, groundfish crew were significantly less likely to have fuel/oil deducted from their shares (53% groundfish crew vs. 74% other crew). On the other hand, groundfish crew were significantly more likely to have fishing quota deducted from their shares (16%

groundfish crew versus 1% other crew). Among groundfish crew paid under share systems in 2018, most reported that fuel (58%), food (55%), and ice (51%) were expenses deducted from their shares. Nearly half (48%) reported that fishing quota was deducted from their shares and this was a substantially higher percentage than crew in other fisheries, among whom only about 5% reported having quota deducted from their shares. This difference between groundfish and other crew was statistically significant (x^2 = 76.9264, p<.001).

Table 41 - 2012 Crew Survey Job Characteristics.

	Groundfish Crew	Other Crew	Total Crew
	N (%)	N (%)	N (%)
Total	72 (100%)	287 (100%)	359 (100%)
Years in the commercial fishing industry			
Less than 5	10 (14%)	56 (20%)	66 (18%)
5 to 15	20 (28%)	80 (28%)	100 (28%)
16 to 29	20 (28%)	89 (31%)	109 (30%)
30 or More	20 (28%)	61 (21%)	81 (23%)
Don't know/No answer	2 (3%)	1 (<1%)	3 (1%)
Years on current vessel			
Less than 5	39 (54%)	170 (59%)	209 (58%)
5 to 15	23 (32%)	91 (32%)	114 (32%)
16 to 29	8 (11%)	18 (6%)	26 (7%)
30 or more	2 (3%)	8 (3%)	10 (3%)
Trip Duration			
1 day	30 (42%)	121 (42%)	151 (42%)
2 to 4 days	11 (15%)	44 (15%)	55 (15%)
5 to 7 days	15 (21%)	34 (12%)	49 (14%)
More than 7 days	16 (22%)	88 (31%)	104 (29%)
Hours worked per day			
8 hours or less	4 (6%)	46 (16%)	50 (14%)
9 to 14 hours	26 (36%)	88 (31%)	114 (32%)
15 to 17 hours	19 (26%)	42 (15%)	61 (17%)
18 hours or more	23 (32%)	111 (39%)	134 (37%)
Owner-operator	40 (56%)	168 (59%)	208 (58%)
Hired Captain	32 (44%)	118 (41%)	150 (42%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
Position on vessel			
Captain	16 (22%)	52 (18%)	68 (19%)
Deckhand	37 (51%)	178 (62%)	215 (60%)
Other	4 (6%)	25 (9%)	29 (8%)
Multiple positions	15 (21%)	32 (11%)	47 (13%)
Payment system			
Share system	67 (93%)	238 (83%)	305 (85%)
Owner share, mean % (n)	*60% (57)*	*57% (225)*	*58% (282)*
Crew share, mean % (n)	*40% (57)*	*43% (225)*	*42% (282)*
Don't know/No Answer, (n)	*(15)*	*(62)*	*(77)*
Other payment system	5 (7%)	39 (14%)	44 (12%)
Multiple payment systems	0 (0%)	8 (3%)	8 (2%)
Don't know/No Answer	0 (0%)	2 (1%)	2 (1%)
Expenses deducted from share, N (discrete %)	67 (100%)	246 (100%)	313 (100%)
Fuel	27 (40%)	145 (59%)	172 (55%)
Food	30 (45%)	130 (53%)	160 (51%)
Ice	16 (24%)	78 (32%)	94 (30%)
Bait	3 (4%)	28 (11%)	31 (10%)
Supplies	20 (30%)	84 (34%)	104 (33%)
Fishing quota	8 (12%)	1 (<1%)	9 (3%)
Other	11 (16%)	43 (17%)	54 (17%)

Table 42 - 2018 Crew Survey Job Characteristics.

	Groundfish Crew	Other Crew	Total Crew
	N (%)	N (%)	N (%)
Total	33 (100%)	446 (100%)	479 (100%)
Years in the commercial fishing industry			
Less than 5	5 (15%)	72 (16%)	77 (16%)
5 to 15	10 (30%)	159 (36%)	169 (35%)
16 to 29	6 (18%)	104 (23%)	110 (23%)
30 or More	12 (36%)	111 (25%)	123 (26%)
Years on current vessel			
Less than 5	23 (70%)	266 (60%)	289 (60%)
5 to 15	8 (24%)	141 (32%)	149 (31%)
16 to 29	2 (6%)	34 (8%)	36 (8%)
30 or more	0 (0%)	5 (1%)	5 (1%)
Trip Duration			
1 day	3 (9%)	131 (29%)	134 (28%)
2 to 4 days	8 (24%)	77 (17%)	85 (18%)
5 to 7 days	17 (52%)	87 (20%)	104 (22%)
More than 7 days	5 (15%)	150 (34%)	155 (32%)
No answer	0 (0%)	1 (<1%)	1 (<1%)
Hours worked per day			
8 hours or less	0 (0%)	50 (11%)	50 (10%)
9 to 14 hours	10 (30%)	128 (29%)	138 (29%)
15 to 17 hours	8 (24%)	119 (27%)	127 (27%)
18 hours or more	15 (45%)	149 (33%)	164 (34%)
Owner-operator	9 (27%)	198 (44%)	207 (43%)
Hired Captain	24 (73%)	247 (55%)	271 (57%)
Don’t know/No answer	0 (0%)	1 (<1%)	1 (<1%)
Position on vessel			
Captain	10 (30%)	93 (21%)	103 (22%)
Deckhand	13 (39%)	231 (52%)	244 (51%)
Other	6 (18%)	78 (18%)	84 (18%)
Multiple positions	10 (12%)	44 (10%)	48 (10%)
Payment system			
Share system	31 (94%)	378 (85%)	409 (85%)
Owner share, mean % (n)	*57% (19)*	*55% (232)*	*55% (251)*
Crew share, mean % (n)	*43% (19)*	*45% (232)*	*45% (251)*
Don’t know/No Answer, (n)	*(12)*	*(146)*	*(158)*
Other payment system	2 (6%)	67 (15%)	69 (14%)
Don’t know/No Answer	0 (0%)	1 (<1%)	1 (<1%)
Expenses deducted from share, N (discrete %)			
Fuel	19 (58%)	324 (73%)	343 (72%)
Food	18 (55%)	264 (59%)	282 (59%)
Ice	17 (51%)	237 (53%)	254 (53%)
Bait	4 (12%)	86 (19%)	90 (19%)
Supplies	9 (27%)	139 (31%)	148 (31%)
Fishing quota	16 (48%)	23 (5%)	39 (8%)
Other	5 (15%)	24 (5%)	29 (6%)

6.6.6.2.4 Crew Job Satisfaction

Descriptive statistics for these data are also provided in Table 43 – Table 44. In 2012, groundfish crew were less likely to be satisfied with their actual earnings than crew involved in other fisheries. Less than half (46%) of groundfish crew were either satisfied or very satisfied with their actual earnings, compared to nearly two thirds (65%) of crew in other fisheries, and this was a statistically significant difference (t = 4.0598, $p<.001$). Similarly, groundfish crew were also less likely to be satisfied with the predictability of their earnings than crew in other fisheries. Only 13% of groundfish crew reported being either satisfied or very satisfied with the predictability of their earnings, compared with about 40% of crew in other fisheries and this difference was statistically significant (t = 4.6251, $p<.001$).

Groundfish crew surveyed in 2012 were less satisfied with the overall safety of the job than crew in other fisheries. About 44% of groundfish crew were either satisfied or very satisfied with the safety of their jobs, compared to 60% of crew in other fisheries expressing satisfaction with the safety of their jobs. This difference was statistically significant (t = 1.6964, $p<.05$). While groundfish crew in 2012 were less satisfied than crew in other fisheries with the amount time they spent away from home, the substantial percentage difference was not statistically significant. About 32% of groundfish crew reported being either satisfied or very satisfied with the amount of time they spent away from home, compared to about 45% of crew in other fisheries.

Crew in groundfish and other fisheries shared generally similar levels of satisfaction with the fatigue and impact on their overall health associated with the job in 2012. About 43% of groundfish crew and 39% of crew in other fisheries reported feeling satisfied or very satisfied with the physical fatigue of the job. This relatively small percentage difference was not statistically significant. The same percentage of groundfish crew, 43%, were either satisfied or very satisfied with the healthfulness of the job, compared to slightly over half (51%) of crew in other fisheries. This difference was also not statistically significant.

Groundfish crew in 2012 were less satisfied with the adventure and challenge of the job, as well as the opportunity to be their own boss, than crew in other fisheries, but overall both groundfish and crew in other fisheries were highly satisfied with these aspects of the job. About 82% of groundfish crew were either satisfied or very satisfied with the adventure of the job, compared with 93% of crew in other fisheries. While both groups of crew had very high levels of satisfaction with this aspect of their work, groundfish crew were statistically less likely to be satisfied than crew in other fisheries (t = 2.2562, $p<.01$). A similar percentage of groundfish crew, 83%, reported being either satisfied or very satisfied with the challenge of the job. This was not much different from crew in other fisheries, 88% of whom were either satisfied or very satisfied with the challenge of the job. Finally, groundfish crew in 2012 were significantly less likely than crew in other fisheries to be satisfied with the opportunity to be their own boss (t = 2.8473, $p<.01$). Just over half (53%) of groundfish crew were either satisfied or very satisfied, whereas more than two thirds of crew in other fisheries (67%) were either satisfied or very satisfied with the opportunity to be their own boss. While respondents may have slightly varying interpretations of this question, it reveals the perceptions about opportunity for growth within the industry among crew and groundfish generally appear to have less satisfaction with their opportunities for growth and advancement than crew in other fisheries. Respondents may also interpret this to refer to the level of autonomy they feel while conducting their work. Therefore, groundfish crew may also feel less autonomy in their jobs than crew in other fisheries.

Satisfaction with earnings increased considerably among groundfish crew in 2018 from 2012, but there remained some substantial gaps in satisfaction levels between groundfish and other crew in the 2018 survey wave. Three quarters (75%) of groundfish crew in 2018 were either satisfied or very satisfied with their actual earnings, compared with about 80% of crew in other fisheries. This was not a statistically significant difference. On the other hand, only 42% of groundfish crew were either satisfied or very satisfied with the predictability of their earnings, whereas over half (52%) of crew in other fisheries reported that they were satisfied or very satisfied with the predictability of their earnings. While this was a substantial percentage difference, it was also not statistically significant.

Crew in groundfish and other fisheries expressed roughly similar levels of satisfaction with the safety of their jobs in 2018. About 73% of groundfish crew were either satisfied or very satisfied with the safety of their jobs, compared with about 70% of crew in other fisheries. Relative to the results of the 2012 survey, groundfish crew have become substantially more satisfied with the safety of their work over time and there no longer appears to be a significant gap between their satisfaction with safety and the satisfaction of crew in other fisheries. By contrast, however, groundfish crew in 2018 remained significantly less satisfied with the amount time spent away from home than crew in other fisheries ($t = 3.2365$, $p<.001$). Interestingly, there was no significant difference between groundfish and other crew in 2012 on satisfaction with time away from home. Therefore, while satisfaction with job safety has increased among groundfish crew, satisfaction with time spent away from home has significantly declined over time among groundfish crew relative to crew in other fisheries.

Groundfish crew in 2018 expressed less satisfaction with the physical fatigue and healthfulness of the job than crew in other fisheries. Only about 30% of groundfish crew were either satisfied or very satisfied with the physical fatigue of the job, compared to about 43% of crew in other fisheries. Though this is a substantial percentage difference, it was not statistically significant. Groundfish crew, however, were both substantially and statistically less likely to be satisfied with the healthfulness of the job (i.e., the impact on physical and mental health) than crew in other fisheries. About 45% of groundfish crew were either satisfied or very satisfied with the healthfulness of the job, compared to well over half (59%) of crew in other fisheries. This difference was statistically significant ($t = 2.1909$, $p<.01$). Interestingly, groundfish crew in 2012 were not statistically different from other crew in terms of their satisfaction with the healthfulness of the job. While they were slightly more likely to express satisfaction with the healthfulness of the job in 2018 versus 2012 (45% versus 43%, respectively), this slight increase was significantly outpaced by the increasing satisfaction among crew in other fisheries. In other words, this suggests that groundfish crew are not experiencing similar improvements to the healthfulness of the job attained by crew in other fisheries.

Similar to the 2012 survey results, most crew across both groundfish and other fisheries were satisfied with the adventure and challenge of the job, and the opportunity to be their own boss. There were no significant differences between groundfish and other crew in terms of their levels of satisfaction with any of these three aspects of their work. The large majority of both groundfish (88%) and other (86%) crew reported either being satisfied or very satisfied with the adventure of their jobs. Likewise, large majorities of both groundfish (88%) and other (83%) crew reported either being satisfied or very satisfied with the challenge of their jobs. In slight contrast, smaller majorities of groundfish (57%) and other (71%) crew were either satisfied or very satisfied with the opportunity to be their own boss. Interestingly, while not statistically significant, groundfish crew were substantially less likely to be satisfied with the opportunity to be their own boss than crew in other fisheries. This is mirrored by the finding from 2012 survey results that groundfish crew were significantly less likely to be satisfied with aspect of their jobs as well. While satisfaction among groundfish crew with the opportunity to be their boss is up slightly in 2018 from 2012, groundfish crew remain still substantially less satisfied than crew in other fisheries. This suggests that either their autonomy or ability to advance in their careers is not quite as satisfactory as those who are employed as crew in other fisheries.

Table 43 - 2012 Crew Survey Job Satisfaction.

	Groundfish Crew	Other Crew	Total Crew
Total	72 (100%)	287 (100%)	359 (100%)
"Your actual earnings"			
Very satisfied	2 (3%)	48 (17%)	50 (14%)
Satisfied	27 (38%)	137 (48%)	164 (46%)
Neutral	10 (14%)	20 (7%)	30 (8%)
Dissatisfied	19 (26%)	58 (20%)	77 (21%)
Very Dissatisfied	12 (17%)	20 (7%)	32 (9%)
Don't know/No answer	2 (3%)	4 (1%)	6 (2%)
"Predictability of your earnings"			
Very satisfied	0 (0%)	13 (5%)	13 (4%)
Satisfied	9 (13%)	100 (35%)	109 (30%)
Neutral	11 (15%)	47 (16%)	58 (16%)
Dissatisfied	32 (44%)	84 (29%)	116 (32%)
Very Dissatisfied	18 (25%)	41 (14%)	59 (16%)
Don't know/No answer	2 (3%)	2 (1%)	4 (1%)
"Job safety"			
Very satisfied	11 (15%)	37 (13%)	48 (13%)
Satisfied	21 (29%)	135 (47%)	156 (43%)
Neutral	17 (24%)	54 (19%)	71 (20%)
Dissatisfied	20 (28%)	45 (16%)	65 (18%)
Very Dissatisfied	3 (4%)	14 (5%)	17 (5%)
Don't know/No answer	0 (0%)	2 (1%)	2 (1%)
"Time spent away from home"			
Very satisfied	6 (8%)	26 (9%)	32 (9%)
Satisfied	17 (24%)	104 (36%)	121 (34%)
Neutral	16 (22%)	54 (19%)	70 (20%)
Dissatisfied	21 (29%)	69 (24%)	90 (25%)
Very Dissatisfied	10 (14%)	33 (12%)	43 (12%)
Don't know/No answer	2 (3%)	1 (<1%)	3 (1%)
"Physical fatigue of the job"			
Very satisfied	2 (3%)	17 (6%)	19 (5%)
Satisfied	29 (40%)	92 (32%)	121 (34%)
Neutral	16 (22%)	75 (26%)	91 (25%)
Dissatisfied	18 (25%)	81 (28%)	99 (28%)
Very Dissatisfied	6 (8%)	19 (7%)	25 (7%)
Don't know/No answer	1 (1%)	3 (1%)	4 (1%)
"Healthfulness of the job"			
Very satisfied	7 (10%)	45 (16%)	52 (14%)
Satisfied	24 (33%)	100 (35%)	124 (35%)
Neutral	14 (19%)	53 (18%)	67 (19%)
Dissatisfied	23 (32%)	69 (24%)	92 (26%)
Very Dissatisfied	2 (3%)	15 (5%)	17 (5%)
Don't know/No answer	2 (3%)	5 (2%)	7 (2%)
"Adventure of the job"			
Very satisfied	36 (50%)	170 (59%)	206 (57%)
Satisfied	23 (32%)	97 (34%)	120 (33%)
Neutral	7 (10%)	10 (3%)	17 (5%)
Dissatisfied	4 (6%)	7 (2%)	11 (3%)
Very Dissatisfied	1 (1%)	2 (1%)	3 (1%)
Don't know/No answer	1 (1%)	1 (<1%)	2 (1%)
"Challenge of the job"			
Very satisfied	28 (39%)	110 (38%)	138 (38%)
Satisfied	31 (43%)	142 (50%)	173 (48%)
Neutral	6 (8%)	21 (7%)	27 (8%)
Dissatisfied	5 (7%)	11 (4%)	16 (4%)
Very Dissatisfied	1 (1%)	1 (<1%)	2 (1%)
Don't know/No answer	1 (1%)	2 (1%)	3 (1%)

	Groundfish Crew	Other Crew	Total Crew
"Opportunity to be your own boss"			
Very satisfied	15 (21%)	98 (34%)	113 (31%)
Satisfied	23 (32%)	96 (33%)	119 (33%)
Neutral	14 (19%)	43 (15%)	57 (16%)
Dissatisfied	13 (18%)	36 (13%)	49 (14%)
Very Dissatisfied	6 (8%)	10 (3%)	16 (4%)
Don't know/No answer	1 (1%)	4 (1%)	5 (1%)

Table 44 - 2018 Crew Survey Job Satisfaction.

	Groundfish Crew	Other Crew	Total Crew
Total	33 (100%)	446 (100%)	479 (100%)
"Your actual earnings"			
Very satisfied	10 (30%)	98 (22%)	108 (23%)
Satisfied	15 (45%)	259 (58%)	274 (57%)
Neutral	3 (9%)	59 (13%)	62 (13%)
Dissatisfied	4 (12%)	23 (5%)	27 (6%)
Very Dissatisfied	1 (3%)	6 (1%)	7 (1%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
"Predictability of your earnings"			
Very satisfied	0 (0%)	19 (4%)	19 (4%)
Satisfied	14 (42%)	212 (48%)	226 (47%)
Neutral	9 (27%)	113 (25%)	122 (25%)
Dissatisfied	7 (21%)	76 (17%)	83 (17%)
Very Dissatisfied	3 (9%)	25 (6%)	28 (6%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
"Job safety"			
Very satisfied	3 (9%)	72 (16%)	75 (16%)
Satisfied	21 (64%)	242 (54%)	263 (55%)
Neutral	6 (18%)	98 (22%)	104 (22%)
Dissatisfied	3 (9%)	26 (6%)	29 (6%)
Very Dissatisfied	0 (0%)	7 (2%)	7 (1%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
"Time spent away from home"			
Very satisfied	1 (3%)	20 (4%)	21 (4%)
Satisfied	5 (15%)	156 (35%)	161 (34%)
Neutral	6 (18%)	122 (27%)	128 (27%)
Dissatisfied	16 (48%)	113 (25%)	129 (27%)
Very Dissatisfied	5 (15%)	34 (8%)	39 (8%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
"Physical fatigue of the job"			
Very satisfied	0 (0%)	8 (2%)	8 (2%)
Satisfied	10 (30%)	185 (41%)	195 (41%)
Neutral	14 (42%)	149 (33%)	163 (34%)
Dissatisfied	7 (21%)	91 (20%)	98 (20%)
Very Dissatisfied	2 (6%)	12 (3%)	14 (3%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
"Healthfulness of the job"			
Very satisfied	1 (3%)	27 (6%)	28 (6%)
Satisfied	14 (42%)	235 (53%)	249 (52%)
Neutral	8 (24%)	121 (27%)	129 (27%)
Dissatisfied	9 (27%)	52 (12%)	61 (13%)
Very Dissatisfied	1 (3%)	9 (2%)	10 (2%)
Don't know/No answer	0 (0%)	2 (<1%)	2 (<1%)
"Adventure of the job"			
Very satisfied	18 (55%)	223 (50%)	241 (50%)
Satisfied	11 (33%)	160 (36%)	171 (36%)
Neutral	2 (6%)	54 (12%)	56 (12%)

	Groundfish Crew	Other Crew	Total Crew
Dissatisfied	2 (6%)	7 (2%)	9 (2%)
Very Dissatisfied	0 (0%)	1 (<1%)	1 (<1%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
"Challenge of the job"			
Very satisfied	12 (36%)	157 (35%)	169 (35%)
Satisfied	17 (52%)	214 (48%)	231 (48%)
Neutral	3 (9%)	60 (13%)	63 (13%)
Dissatisfied	1 (3%)	14 (3%)	15 (3%)
Very Dissatisfied	0 (0%)	0 (0%)	0 (0%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)
"Opportunity to be your own boss"			
Very satisfied	7 (21%)	124 (28%)	131 (27%)
Satisfied	12 (36%)	190 (43%)	202 (42%)
Neutral	8 (24%)	74 (17%)	82 (17%)
Dissatisfied	4 (12%)	36 (8%)	40 (8%)
Very Dissatisfied	2 (6%)	21 (5%)	23 (5%)
Don't know/No answer	0 (0%)	1 (<1%)	1 (<1%)

6.6.6.2.5 Crew Attitudes towards Fisheries Management

Descriptive statistics for these data are also provided in Table 45 – Table 46. Most crew in 2012 across both groundfish and all other fisheries were not involved in any capacity in the process of fisheries management (i.e., attending meetings, writing letters, or any other participatory activities). Just over one third (35%) of groundfish crew, and under one third (32%) of crew in other fisheries, reported having ever participated in any aspect of fisheries management. Even though most crew do not participate in the fisheries management process, groundfish crew tend to have less favorable views about fisheries management policies and their impacts than crew in other fisheries. Groundfish crew in 2012 were significantly more likely than crew in other fisheries to agree that the rules and regulations change too quickly (t = 3.5220, p<.001). The vast majority of groundfish crew, about 91%, either agreed or strongly agreed that the rules and regulations change so quickly it's hard to keep up, whereas a much smaller majority of all other crew, about 58%, agreed or strongly agreed with this statement.

Groundfish crew were significantly more likely than crew in other fisheries to disagree that the fines associated with breaking the rules were fair (t = 2.3179, p<.01). A sizeable majority of groundfish crew (69%) either disagreed or strongly disagreed that the fines associated with breaking rules and regulations of their primary fisheries were fair, compared with only 38% of crew in other fisheries who disagreed that the fines had been fair. The majority of crew in other fisheries either agreed the fines were fair, were neutral toward this statement, or didn't know or have an answer.

Finally, groundfish crew in 2012 were significantly more likely than crew in other fisheries to agree that the rules and regulations of their primary fishery were too restrictive (t = 2.8984, p<.01). More than three quarters (77%) of groundfish crew either agreed or strongly agreed that the rules and regulations were too restrictive, whereas a smaller majority (62%) of crew in other fisheries agreed with this sentiment.

Similar to the results of the 2012 survey, the majority of crew in 2018 across all fisheries reported they did not participate in any aspect of fisheries management, including attending meetings, writing letters, or any other participatory method available to them. While not a statistically significant difference, groundfish crew were substantially less likely than crew in other fisheries in 2018 to have participated in the management process. Only a little more than one quarter (27%) of groundfish crew reported that they had participated in fisheries management, whereas a larger minority of crew in other fisheries, about 41%, reported that they had participated. In comparison to the 2012 results, which indicated only a 3%

difference, this 14% difference in 2018 reflects a sizeable growth in the disparity of management participation across fisheries.

Attitudes towards management policies and their impacts had not improved from 2012 to 2018 among groundfish crew compared to crew in other fisheries. Groundfish crew in 2018 remained significant more likely than crew in other fisheries to agree that the rules change too quickly (t = 1.9242, p<.05) and less likely to agree that the fines associated with breaking rules were fair (t = 3.2489, p<.001). About three quarters (75%) of groundfish crew either agreed or strongly agreed that the rules change too quickly, compared with a much smaller and only slight majority (51%) of crew in other fisheries who agreed the rules change too fast. Moreover, only slightly more than one quarter of groundfish crew (27%) agreed or strongly agreed that the fines associated with breaking the rules are fair, compared with nearly half of crew in other fisheries (48%) who agreed that the fines were fair. Interestingly, groundfish crew were not significantly more likely than crew in other fisheries to agree that the rules were too restrictive. About 63% of groundfish crew either agreed or strongly agreed that the rules and regulations of their primary fishery were too restrictive, compared with about 51% of crew in other fisheries. Despite not being a statistically significant difference, groundfish crew were still about 12% more likely to agree that the rules were too restrictive.

Table 45 - 2012 Crew Survey Attitudes Toward Fisheries Management.

	Groundfish Crew	Other Crew	Total Crew
Total	37 (100%)	163 (100%)	200 (100%)
"Have you ever participated in fisheries management?"			
Yes	13 (35%)	52 (32%)	65 (33%)
No	24 (65%)	111 (68%)	135 (68%)
Total	35 (100%)	124 (100%)	159 (100%)
"The rules and regulations change so quickly it's hard to keep up."			
Strongly Agree	13 (37%)	28 (23%)	41 (26%)
Agree	19 (54%)	43 (35%)	62 (39%)
Neutral	2 (6%)	10 (8%)	12 (8%)
Disagree	1 (3%)	35 (28%)	36 (23%)
Strongly Disagree	0 (0%)	2 (2%)	2 (1%)
Don't know/No answer	0 (0%)	6 (5%)	6 (4%)
"The fines that are associated with breaking the rules and regulations of my primary fishery are fair."			
Strongly Agree	0 (0%)	2 (2%)	2 (1%)
Agree	8 (23%)	27 (22%)	35 (22%)
Neutral	1 (3%)	16 (13%)	17 (11%)
Disagree	8 (23%)	26 (21%)	34 (21%)
Strongly Disagree	16 (46%)	21 (17%)	37 (23%)
Don't know/No answer	2 (6%)	32 (26%)	34 (21%)
"I feel that the regulations in my primary fishery are too restrictive."			
Strongly Agree	19 (54%)	29 (23%)	48 (30%)
Agree	8 (23%)	48 (39%)	56 (35%)
Neutral	3 (9%)	13 (10%)	16 (10%)
Disagree	4 (11%)	29 (23%)	33 (21%)
Strongly Disagree	0 (0%)	2 (2%)	2 (1%)
Don't know/No answer	1 (3%)	3 (2%)	4 (3%)

Table 46 - 2018 Crew Survey Attitudes Toward Fisheries Management.

	Groundfish Crew	Other Crew	Total Crew
Total	33 (100%)	446 (100%)	479 (100%)
"Have you ever participated in fisheries management?"			
Yes	9 (27%)	181 (41%)	190 (40%)
No	24 (73%)	264 (59%)	288 (60%)
No answer	0 (0%)	1 (<1%)	1 (<1%)
"The rules and regulations change so quickly it's hard to keep up."			
Strongly Agree	13 (39%)	85 (19%)	98 (20%)
Agree	12 (36%)	187 (42%)	199 (42%)
Neutral	2 (6%)	94 (21%)	96 (20%)
Disagree	6 (18%)	73 (16%)	79 (16%)
Strongly Disagree	0 (0%)	5 (1%)	5 (1%)
Don't know/No answer	0 (0%)	2 (<1%)	2 (<1%)
"The fines that are associated with breaking the rules and regulations of my primary fishery are fair."			
Strongly Agree	0 (0%)	23 (5%)	23 (5%)
Agree	9 (27%)	190 (43%)	199 (42%)
Neutral	10 (30%)	134 (30%)	144 (30%)
Disagree	6 (18%)	56 (13%)	62 (13%)
Strongly Disagree	8 (24%)	41 (9%)	49 (10%)
Don't know/No answer	0 (0%)	2 (<1%)	2 (<1%)
"I feel that the regulations in my primary fishery are too restrictive."			
Strongly Agree	11 (33%)	96 (22%)	107 (22%)
Agree	10 (30%)	130 (29%)	140 (29%)
Neutral	3 (9%)	113 (25%)	116 (24%)
Disagree	7 (21%)	97 (22%)	104 (22%)
Strongly Disagree	2 (6%)	8 (2%)	10 (2%)
Don't know/No answer	0 (0%)	2 (<1%)	2 (<1%)

6.6.7 Consolidation and Redirection

The multiple regulatory constraints placed on common pool groundfish fishermen are intended to control their effort and catch per unit effort (CPUE) as a means to limit mortality. Exemptions from many of these controls, which have been granted to sectors, may increase the CPUE of sector participants. As a result, sector fishermen may have additional time that they could direct towards non-groundfish stocks, resulting in redirection of effort into other fisheries. Additionally, to maximize efficiency, fishermen within a single sector may be more likely to allocate fishing efforts such that some vessels do not fish at all. This is referred to as fleet consolidation.

Both redirection and consolidation have been observed when management regimes for fisheries outside the Northeast US shifted toward a catch share management regime such as sectors. For example, research following the rationalization of the halibut and sablefish fisheries by the North Pacific Fishery Management Council found individuals who received enough quota shares were able to continue fishing with less competition, greater economic certainty, and over a longer fishing season (Matulich & Clark 2001). However, individuals who did not receive enough of a catch share either bought or leased catch shares from other fishermen or sold their quota. Similarly, one year after implementation of the Bering Sea-Aleutian Island crab fishery Individual Transferable Quota (ITQ), a study found that about half of the vessels that fished the 2004/2005 Bering Sea Snow Crab fishery did not fish the following year. However, research on the ITQ plan for the British Columbia halibut fishery found efficiency gains were greatest during the first round of consolidation, and little incentive to increase efficiency (or continue consolidation) existed afterward (Pinkerton & Edwards 2009).

6.6.8 Regulated Groundfish Stock Catch

The Northeast Multispecies FMP specifies Annual Catch Limits (ACLs) for 20 stocks. Exceeding an ACL for a stock results in the implementation of Accountability Measures (AMs) to prevent overfishing. The ACL is sub-divided into different components. Those components that are subject to AMs are referred to as sub-ACLs. There are also components of the fishery that are not subject to AMs. These include state waters catches that are outside of federal jurisdiction, and a category referred to as “other sub-components” that combines small catches from various fisheries.

Table 47 - FY2018 Northeast Multispecies Percent of Annual Catch Limit Caught (%).

Stock	Components with ACLs and sub-ACLs: With Accountability Measures (AMs)								Sub-components: No AMs	
	Total	Groundfish Fishery	Sector	Common Pool	Recreational	Midwater Trawl Herring Fishery	Scallop Fishery	Small Mesh Fisheries	State Water	Other
	A to H	A+B+C	A	B	C	D	E	F	G	H
GB Cod	58.4	61.6	71.1	26.0					50.2	29.0
GOM Cod	75.7	75.7	86.7	48.8	66.8				80.7	51.8
GB Haddock	11.5	11.5	11.6	1.4		6.5			3.5	24.6
GOM Haddock	29.1	28.6	32.8	33.8	17.7	-			54.1	94.1
GB Yellowtail Flounder	19.7	14.7	14.9	-			87.5	2.5	NA	NA
SNE Yellowtail Flounder	22.3	19.6	19.9	18.1			79.7		9.8	20.5
CC/GOM Yellowtail Flounder	52.0	42.8	43.3	32.3					108.6	70.8
Plaice	69.6	68.3	68.6	49.1					66.9	131.7
Witch Flounder	95.6	95.6	97.9	96.7					66.6	112.7
GB Winter Flounder	59.1	57.5	57.9	-					NA	79.3
GOM Winter Flounder	54.6	25.7	26.7	6.4					200.9	189.4
SNE/MA Winter Flounder	56.9	48.4	50.1	35.6					21.8	120.5
Redfish	48.9	49.9	50.1	2.3					2.2	3.8
White Hake	75.6	76.7	77.2	8.1					1.3	54.1
Pollock	10.9	9.3	9.4	2.2					119.7	54.0
Northern Windowpane	65.9	52.8	NA	NA			123.7		20.3	22.9
Southern Windowpane	99.5	125.4	NA	NA			99.5		93.1	94.0
Ocean Pout	44.8	18.2	NA	NA					14.5	157.2
Halibut	103.3	91.9	NA	NA					147.4	80.9
Wolffish	1.9	1.8	NA	NA					3.9	5.5

Source: NMFS Greater Atlantic Regional Fisheries Office, November 22, 2019, run date of July 22, 2019

Table 48 - FY 2018 Northeast Multispecies Total Catch (mt).

Stock	**Total Catch**	Groundfish Fishery	Sector	Common Pool	Recreational	Midwater Trawl Herring Fishery	Scallop Fishery[1]	Small Mesh Fisheries	State Water	Other
	A to H	A+B+C	A	B	C	D	E	F	G	H
GB Cod	887.3	837.9	831.6	6.3					8.0	41.5
GOM Cod	504.5	461.9	309.2	5.8	146.9				37.9	4.7
GB Haddock	5,324.3	5,143.7	5,139.2	4.4		43.9			17.1	119.7
GOM Haddock	3,605.9	3,465.1	2,837.1	33.0	595.0	-			51.4	89.4
GB Yellowtail Flounder	40.5	27.6	27.6	-			12.7	0.1	-	0.0
SNE/MA Yellowtail Flounder	14.7	8.5	7.0	1.5			2.6		0.2	3.5
CC/GOM Yellowtail Flounder	254.7	170.3	164.8	5.5					55.4	29.0
Plaice	1,147.9	1,078.4	1,064.7	13.7					23.4	46.1
Witch Flounder	906.1	811.8	794.1	17.7					26.6	67.6
GB Winter Flounder	465.1	419.9	419.9	-					-	45.2
GOM Winter Flounder	233.9	91.7	90.6	1.1					134.6	7.6
SNE/MA Winter Flounder	398.0	250.7	228.7	22.0					15.9	131.3
Redfish	5,369.1	5,362.1	5,360.9	1.2					2.6	4.4
White Hake	2,113.1	2,097.1	2,095.4	1.7					0.4	15.7
Pollock	4,179.1	3,480.8	3,475.8	5.0					481.1	217.3
Northern Windowpane	56.7	33.3	33.0	0.3			22.3		0.4	0.7
Southern Windowpane	454.7	66.5	49.7	16.8			157.1		26.1	205.0
Ocean Pout	53.7	17.1	17.0	0.1					0.4	36.2
Halibut	103.3	70.8	70.1	0.7					31.0	1.6
Wolffish	1.6	1.5	1.4	0.1					0.0	0.1

[1] Based on scallop fishing year April 2018 through March 2019
Values in metric tons of live weight
Sector and common pool include estimate of missing dealer reports
Source: NMFS Greater Atlantic Regional Fisheries Office, November 22, 2019, run date of July 22, 2019

Any value for a non-allocated species may include landings of that stock or misreporting of species and/or stock area. These are northern windowpane, southern windowpane, ocean pout, halibut, and wolffish.

Table 49 - FY2018 Northeast Multispecies Other Sub-Component Catch Detail (mt).

Stock	Total	SCALLOP[1]	FLUKE	HAGFISH	HERRING	LOBSTER/ CRAB[2]	MACKEREL	MENHADEN	MONKFISH	REDCRAB	RESEARCH
GB Cod	41.5	7.6	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
GOM Cod	4.7	0.3	0.0	0.0	0.3	0.0	-	-	0.1	-	3.5
GB Haddock	119.7	13.4	2.8	-	0.5*	-	0.9	0.0	0.3	-	0.5
GOM Haddock	89.4	0.0	0.0	0.7	2.8*	-	0.2	-	0.0	-	20.7
GB Yellowtail Flounder	0.0	-*	0.0	0.0	0.0*	-	-	-	-	0.0	-
SNE Yellowtail Flounder	3.5	-*	0.4	-	0.0	-	0.0	0.0	0.3	-	0.0
CC/GOM Yellowtail Flounder	29.0	11.8	0.0	0.2	1.0	-	-	-	0.0	-	1.3
American Plaice	46.1	25.7	0.0	-	0.1	-	0.2	0.0	0.0	-	1.2
Witch Flounder	67.6	31.7	1.0	0.0	0.2	-	0.3	0.0	0.1	0.0	0.5
GB Winter Flounder	45.2	34.8	0.0	0.0	0.9	-	-	-	-	0.0	-
GOM Winter Flounder	7.6	2.7	0.0	0.0	0.9	0.0	-	-	0.0	-	0.9
SNE Winter Flounder	131.3	52.5	3.8	0.0	0.3	0.0	0.6	0.0	0.5	0.0	0.0
Redfish	4.4	0.0	0.0	-	0.0	-	0.0	0.0	0.0	-	3.5
White Hake	15.7	1.9	0.6	0.0	0.1	0.0	0.1	0.0	0.1	0.0	2.0
Pollock	217.3	0.4	-	-	0.0	-	0.0	0.0	0.3	-	0.9
Northern Windowpane	0.7	-*	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0
Southern Windowpane	205.0	-*	23.6	-	0.5	-	0.9	0.0	1.1	-	0.0
Ocean Pout	36.2	4.8	0.7	0.0	0.2	-	0.2	0.0	0.0	0.1	0.0
Halibut	1.6	-	-	-	0.0	0.8	0.0	0.0	0.2	-	0.1
Wolffish	0.1	0.0	0.0	-	0.0	-	0.0	0.0	0.0	-	0.0

¹ Based on scallop fishing year April 2018 through March 2019

² Landings only. Discard estimates not applicable. Lobster/crab discards were not attributed to the ACL, consistent with the most recent assessments for these stocks used to set the respective quotas.

*Some or all catch attributed to separate sub-ACL as shown in Tables 1 through 5, and so is not included above.

Values in metric tons of live weight

Source: NMFS Greater Atlantic Regional Fisheries Office, November 22, 2019, run date of September 17, 2019

Table 49 Continued.

Stock	Total	SCUP	SHRIMP	SQUID	SQUID/ WHITING	SURFCLAM	WHELK/ CONCH	WHITING	UNCATEGORIZED	RECREATIONAL
GB Cod	41.5	0.1	0.0	0.8	0.1	0.0	0.0	0.0	0.7	31.6
GOM Cod	4.7	-	-	0.0	0.0	0.0	0.0	0.0	0.3	-*
GB Haddock	119.7	2.9	0.1	73.3	7.2	1.0	-	0.2	16.8	
GOM Haddock	89.4	-	-	0.0	4.2	0.2	0.1	5.5	55.0	-*
GB Yellowtail Flounder	0.0	0.0	-*	0.0*	0.0	-	-	-	0.0*	
SNE Yellowtail Flounder	3.5	0.4	0.0	1.3	0.1	0.0	-	0.0	0.9	
CC/GOM Yellowtail Flounder	29.0	-	-	0.9	7.5	0.1	0.0	2.5	3.6	
American Plaice	46.1	0.0	0.0	14.0	1.4	0.2	-	0.1	3.0	
Witch Flounder	67.6	1.0	0.0	23.9	2.4	0.3	0.0	0.2	6.1	
GB Winter Flounder	45.2	0.0	-	4.1	5.3	-	-	-	0.0	
GOM Winter Flounder	7.6	-	-	0.0	0.2	0.0	0.0	0.3	0.8	1.8
SNE Winter Flounder	131.3	3.5	0.1	47.9	3.2	0.8	0.0	0.1	14.1	4.1
Redfish	4.4	0.0	0.0	0.6	0.1	0.0	-	0.0	0.2	
White Hake	15.7	0.6	0.0	6.2	0.7	0.1	0.0	0.0	3.3	
Pollock	217.3	-	0.0	0.6	0.1	0.0	-	0.0	0.4	214.7
Northern Windowpane	0.7	0.0	-	0.1	0.2	0.0	0.0	0.0	0.3	
Southern Windowpane	205.0	24.8	0.1	98.7	7.2	2.5	-	0.2	45.2	
Ocean Pout	36.2	0.8	0.0	21.2	2.2	0.3	0.1	0.2	5.3	
Halibut	1.6	-	0.0	0.3	0.1	0.0	-	0.0	0.2	
Wolffish	0.1	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	

Values in metric tons of live weight
*Some or all catch attributed to separate sub-ACL as shown in Tables 1 through 5, and so is not included above.
Source: NMFS Greater Atlantic Regional Fisheries Office, November 22, 2019, run date of September 17, 2019

6.6.9 Fishery Sub-Components

6.6.9.1 Sector Harvesting Component [*to be updated*]

In FY2010, the sector vessels landed the overwhelming majority of groundfish landed. Each sector receives a total amount of fish it can harvest for each stock, its Annual Catch Entitlement (ACE). Since the ACE is dependent on the amount of the ACL in a given fishing year, the ACE may be higher or lower from year to year even if the sector's membership remains the same. There have been substantial shifts in commercial groundfish sub-ACLs for various stocks between FY2010 and FY2015. There has been a general decrease in trips, and catch for sector vessels, and there has been a shift in effort out of the groundfish fishery into other fisheries. However, these changes may correlate to a certain extent with the decrease in ACL.

Combined, 138.7 million (live) pounds of ACE were allotted to the sectors in 2015 but only 47.1 million (live) pounds were landed. Of the 16 ACEs allocated to sectors in 2015, 5 stocks approached or exceeded the catch limit (>80% conversion) set by the total allocated ACE (Table 50). This is an increase from 2014 when the fleet caught over 80% of the allocation for 2 stocks. Overall, the fleet landed 34% of the total allocated ACE in 2015. As has been the case in previous years, Georges Bank haddock, particularly East GB haddock, accounted for a majority of the unrealized landings. East GB haddock comprises almost 24% of total allocated ACE, yet only 5% of total catch. In general, total allocations have decreased since 2010 and total catch has never been above 40% of the allocation.

Table 50 – Annual catch entitlement (ACE), catch, and utilization (live pounds) [*to be updated*].

	2010			2011			2012		
	Allocated ACE	Sector Catch	% Caught	Allocated ACE*	Sector Catch	% Caught	Allocated ACE*	Sector Catch	% Caught
GB Cod East	717,431	568,399	79.2%	431,348	357,402	82.9%	350,826	145,249	41.4%
GB Cod West	6,563,092	5,593,020	85.2%	9,544,288	6,826,211	71.5%	10,542,396	3,360,445	31.9%
GOM Cod	9,540,380	8,074,730	84.6%	11,357,667	9,663,695	85.1%	9,008,547	4,798,617	53.3%
GB Haddock East	26,262,687	4,131,306	15.7%	21,122,567	2,343,807	11.1%	15,126,206	813,955	5.4%
GB Haddock West	62,331,174	14,118,062	22.7%	54,741,822	6,191,370	11.3%	51,898,287	1,825,266	3.5%
GOM Haddock	1,761,196	845,909	48.0%	1,871,947	1,082,224	57.8%	1,599,126	539,838	33.8%
GB Yellowtail Flounder	1,770,443	1,637,353	92.5%	2,474,650	2,194,655	88.7%	802,645	472,983	58.9%
SNE/MA Yellowtail	517,366	335,628	64.9%	941,753	824,232	87.5%	1,422,806	942,096	66.2%
CC/GOM Yellowtail	1,608,077	1,268,597	78.9%	2,169,507	1,792,853	82.6%	2,448,231	2,100,705	85.8%
American Plaice	6,058,141	3,355,510	55.4%	7,302,366	3,614,121	49.5%	7,771,243	3,528,323	45.4%
Witch Flounder	1,824,114	1,568,774	86.0%	2,847,243	2,205,548	77.5%	3,409,449	2,162,764	63.4%
GB Winter Flounder	4,018,487	3,081,050	76.7%	4,796,100	4,261,052	88.8%	7,752,474	4,255,918	54.9%
GOM Winter Flounder	293,728	186,156	63.4%	716,979	351,182	49.0%	1,590,291	568,974	35.8%
SNE Winter Flounder	Not			Not allocated			Not allocated		
Redfish	14,894,611	4,717,742	31.7%	18,034,598	6,016,717	33.4%	19,933,111	9,748,226	48.9%
White Hake	5,522,667	5,023,212	91.0%	7,038,737	6,690,235	95.0%	7,527,504	5,397,291	71.7%
Atlantic Pollock	35,666,736	12,191,019	34.2%	34,096,301	16,743,220	49.1%	30,670,578	14,075,466	45.9%
Grand Total	**179,350,330**	**66,696,468**	**37.2%**	**179,487,873**	**71,158,525**	**39.6%**	**171,853,720**	**54,736,115**	**31.9%**

Table 50 cont.

	2013			2014			2015		
	Allocated ACE*	Sector Catch	% Caught	Allocated ACE*	Sector Catch	% Caught	Allocated ACE*	Sector Catch	% Caught
GB Cod East	199,316	73,459	36.9%	320,115	151,481	47.3%	267,438	180,790	67.6%
GB Cod West	4,701,617	3,323,371	70.7%	3,711,231	2,856,702	77.0%	3,794,124	3,348,94	88.3%
GOM Cod	1,932,983	1,614,154	83.5%	1,942,248	1,438,207	74.0%	487,714	400,325	82.1%
GB Haddock East	8,249,374	1,276,536	15.5%	20,842,603	3,386,572	16.2%	33,169,495	2,332,37	7.0%
GB Haddock West	55,258,296	5,288,353	9.6%	18,772,954	8,619,232	45.9%	16,937,341	8,854,75	52.3%
GOM Haddock	549,390	372,967	67.9%	990,983	712,427	71.9%	2,176,822	1,601,08	73.6%
GB Yellowtail Flounder	336,520	123,102	36.6%	552,360	137,458	24.9%	438,775	84,653	19.3%
SNE/MA Yellowtail	1,203,202	625,321	52.0%	1,095,787	687,783	62.8%	1,090,289	384,410	35.3%
CC/GOM Yellowtail	1,245,854	830,842	66.7%	1,075,286	548,892	51.0%	1,016,665	819,382	80.6%
American Plaice	3,770,923	3,068,524	81.4%	3,150,789	2,847,669	90.4%	3,208,080	3,011,60	93.9%
Witch Flounder	1,334,426	1,409,406	105.6%	1,243,356	1,132,978	91.1%	1,384,796	1,153,36	83.3%
GB Winter Flounder	8,457,031	3,796,413	44.9%	7,630,025	2,533,764	33.2%	4,257,628	1,915,35	45.0%
GOM Winter Flounder	1,666,641	370,582	22.2%	1,589,104	272,652	17.2%	862,903	259,179	30.0%
SNE Winter Flounder	2,367,906	1,477,347	62.4%	2,483,812	1,078,323	43.4%	2,679,320	1,286,15	48.0%
Redfish	24,061,105	8,826,237	36.7%	24,420,595	10,361,980	42.4%	25,431,305	11,649,8	45.8%
White Hake	9,130,460	4,513,217	49.4%	9,861,411	3,840,528	38.9%	10,003,287	3,524,83	35.2%
Atlantic Pollock	30,933,568	10,755,436	34.8%	30,498,020	8,753,123	28.7%	31,543,570	6,342,46	20.1%
Grand Total	**155,398,612**	**47,745,266**	**30.7%**	**130,180,679**	**49,359,772**	**37.9%**	**138,749,552**	**47,149,5**	**34.0%**

*includes sector carryover
Catch amounts updated using the most recent available data.

Source: NMFS Greater Atlantic Regional Fisheries Office, Summary Tables for FY 2015 Northeast Multispecies Fishery, Accessed February 2018 (Table 31).

6.6.9.1.1 Trends in the sector fishery

This section summarizes data for vessels participating in groundfish sectors to help characterize fishing activity as well as basic information about the vessels and homeports. This section was specifically added to this action because it is important to understand the amount of time a vessel spends fishing, or days absent when considering catch monitoring. Vessels that make more trips under the groundfish fishery FMP, and/or fish for more time, will experience higher monitoring costs than those fishing less. Table 51 and Figure 8 show the number of vessels participating in this fishery by fishing year, disaggregated by categories of time spent fishing, while Table 52 shows the number of trips made under each of these categories. Since 2010, the overall number of active groundfish vessels has declined from just under 300 vessels to under 200 in 2018, but the fleet has remained relatively diverse in terms of activity levels measured in days absent.

Table 51 - Number of active vessels subject to at-sea monitoring requirements, by days absent category and fishing year.

FY	<=5	>5,<=20	>20,<=5	>50,<=8	>80,<=1	>160	N
2010	30	65	87	28	51	38	299
2011	13	62	81	35	45	62	298
2012	27	57	81	35	48	53	301
2013	24	55	58	24	42	42	245
2014	18	53	44	25	48	40	228
2015	18	49	50	18	41	37	213
2016	37	44	41	21	37	29	209
2017	30	48	42	19	22	37	198
2018	24	32	49	15	38	21	179

Figure 8 - Number of active vessels subject to at-sea monitoring requirements, by days absent category and fishing year.

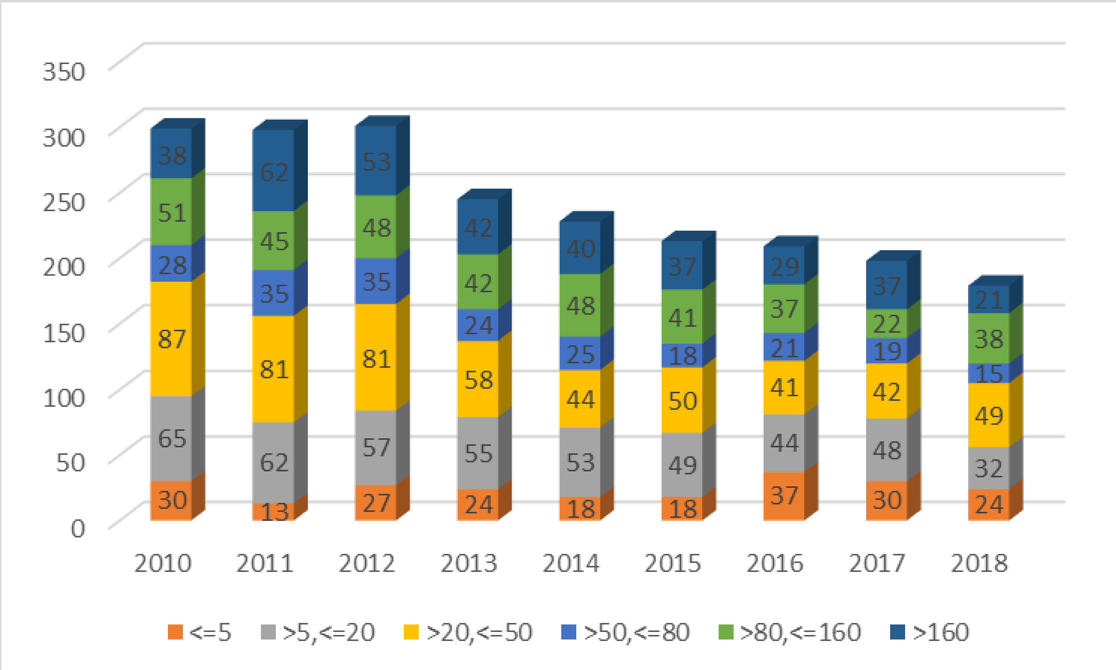


Table 52 - Number of trips by vessels subject to at-sea monitoring requirements, by days absent category and fishing year.

FY	<=5	>5,<=20	>20,<=50	>50,<=80	>80,<=160	>160	N Trips
2010	183	1,569	4,044	1,035	2,587	1,361	10,779
2011	65	1,384	3,791	2,390	2,549	3,211	13,390
2012	237	1,370	3,784	2,096	2,223	3,171	12,881
2013	226	1,293	2,072	1,340	1,931	2,248	9,110
2014	384	1,184	1,847	1,675	1,838	1,744	8,672
2015	79	1,025	2,178	633	2,043	1,434	7,392
2016	163	909	1,549	839	1,616	1,431	6,507
2017	139	969	1,986	725	1,170	1,768	6,757
2018	99	624	2,451	1,049	1,894	1,018	7,135

Amendment 16 to the Groundfish FMP requires that sectors are responsible for the costs of monitoring and therefore sector-level costs are estimated. Table 57 and Table 58 show the number of vessels and trips made by vessels enrolled in each sector, by fishing year. The economic analyses in this document considers potential impacts by various metrics. Therefore, summary tables have been included here by vessel size class, vessel home port and, in some cases, trip landing port. The following tables (Table 53 - Table 60) summarize trends across these metrics, and the economic analyses presents potential costs of monitoring for these same metrics.

Table 53 - Number of active vessels subject to at-sea monitoring requirements, by home port and fishing year.

Home port	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT PORTS	3	c	3	3	4	3	3	3	c
OTHER MA PORTS	39	42	41	27	23	24	21	18	22
BOSTON	32	32	28	25	26	24	25	23	23
CHATHAM	29	30	29	23	20	22	22	26	25
GLOUCESTER	59	54	54	45	43	39	39	38	34
NEW BEDFORD	29	32	32	28	30	30	29	28	13
OTHER ME PORTS	21	23	26	17	14	10	10	12	13
PORTLAND	14	15	16	14	12	10	10	10	9
NH PORTS	25	22	20	18	15	11	12	11	12
NJ PORTS	1	1	2	2	2	0	0	0	0
NY PORTS	8	9	11	8	8	9	12	5	5
OTHER RI PORTS	6	4	6	7	6	5	4	4	3
POINT JUDITH	28	27	31	27	22	25	22	19	17
OTHER NORTHEAST PORTS	5	5	2	1	3	1	0	1	1
N Vessels	**299**	**298**	**301**	**245**	**228**	**213**	**209**	**198**	**179**

c – confidential data, less than three vessels

Table 54 - Number of trips by vessels subject to at-sea monitoring requirements, by vessel home port and fishing year.

Home port	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT PORTS	41	37	56	58	58	50	42	35	51
OTHER MA PORTS	1,498	1,884	1,828	797	596	621	459	597	598
BOSTON	946	1,129	1,078	938	994	847	714	680	670
CHATHAM	1,725	2,271	2,163	1,710	1,872	1,598	1,639	1,767	1,932
GLOUCESTER	2,724	3,517	3,089	1,768	1,668	1,502	1,281	1,337	1,490
N. BEDFORD	574	588	589	623	685	620	551	372	317
OTHER ME PORTS	701	938	958	480	469	317	265	360	472
PORTLAND	399	399	389	419	275	234	250	264	146
NH PORTS	1,354	1,666	1,668	1,092	902	548	403	432	587
NJ PORTS	3	3	6	25	18	0	0	0	0
NY PORTS	43	60	113	211	299	196	223	196	191
OTHER RI PORTS	99	72	105	147	135	71	67	45	16
POINT JUDITH	628	755	806	800	657	766	613	671	629
OTHER NORTHEAST PORTS	44	71	33	42	44	22	0	1	36
N Trips	**10,779**	**13,390**	**12,881**	**9,110**	**8,672**	**7,392**	**6,507**	**6,757**	**7,135**

Table 55 - Number of active vessels subject to at-sea monitoring requirements, by vessel size class and fishing year.

FY	<30'	30'to<50'	50'to<75'	75'+	N Vessels
2010	0	152	95	52	299
2011	1	147	97	53	298
2012	1	149	99	52	301
2013	1	115	83	46	245
2014	1	100	83	44	228
2015	0	89	80	44	213
2016	0	93	72	44	209
2017	0	95	61	42	198
2018	0	97	54	28	179

Table 56 - Number of trips by vessels subject to at-sea monitoring requirements, by vessel size class and fishing year.

FY	<30'	30'to<50'	50'to<75'	75'+	N Trips
2010	0	7,306	2,481	992	10,779
2011	15	9,391	2,999	985	13,390
2012	6	8,819	3,070	986	12,881
2013	8	5,671	2,455	976	9,110
2014	4	5,416	2,212	1,040	8,672
2015	0	4,242	2,178	972	7,392
2016	0	3,815	1,736	956	6,507
2017	0	4,123	1,803	831	6,757
2018	0	4,696	1,740	699	7,135

Table 57 - Number of active vessels subject to at-sea monitoring requirements, by sector and fishing year.

Sector Name	2010	2011	2012	2013	2014	2015	2016	2017	2018
Northeast Fishery Sector II	40	37	38	30	28	25	26	26	25
Georges Bank Cod Fixed Gear Sector	30	28	28	22	19	23	20	24	24
Sustainable Harvest Sector	38	40	41	39	39	29	27	23	24
Maine Coast Community Sector	0	0	0	13	11	10	10	14	15
Northeast Fishery Sector V	28	22	23	22	19	20	22	15	15
Northeast Fishery Sector XIII	22	24	30	23	24	21	20	18	15
Northeast Fishery Sector XI	23	19	17	15	17	12	12	12	11
Northeast Fishery Sector III	34	32	30	25	21	15	15	14	10
Northeast Fishery Sector VIII	7	8	6	4	5	5	5	4	8
Sustainable Harvest Sector - Inshore	0	0	0	0	0	5	8	7	8
Northeast Fishery Sector VI	5	4	4	5	4	5	6	6	7
Northeast Fishery Sector X	19	22	21	11	9	9	5	4	7
Northeast Fishery Sector XII	3	6	6	5	0	0	5	6	7
Northeast Coastal Communities Sector	2	4	6	2	1	2	3	2	2
Northeast Fishery Sector VII	11	10	9	8	10	12	6	5	1
Northeast Fishery Sector IX	15	19	22	21	21	20	19	18	0
Port Clyde Community Groundfish Sector	16	17	18	0	0	0	0	0	0
Tristate Sector	6	6	2	0	0	0	0	0	0
n_vessels	**299**	**298**	**301**	**245**	**228**	**213**	**209**	**198**	**179**

Table 58 - Number of trips by vessels subject to at-sea monitoring requirements, by sector and fishing year.

Sector Name	2010	2011	2012	2013	2014	2015	2016	2017	2018
Georges Bank Cod Fixed Gear Sector	1,823	2,113	1,939	1,469	1,687	1,542	1,663	1,731	1,887
Northeast Fishery Sector II	1,495	2,028	1,874	988	746	902	947	1,141	1,320
Northeast Fishery Sector V	596	588	590	832	797	779	669	732	687
Sustainable Harvest Sector	995	1,001	1,178	1,122	1,072	805	701	636	577
Northeast Fishery Sector XI	1,332	1,505	1,559	1,065	1,086	629	465	478	569
Northeast Fishery Sector XII	57	269	302	201	0	0	396	410	422
Maine Coast Community Sector	0	0	0	432	453	248	136	259	338
Sustainable Harvest Sector - Inshore	0	0	0	0	0	160	143	231	263
Northeast Fishery Sector XIII	251	375	482	333	315	264	254	222	247
Northeast Fishery Sector III	2,208	2,753	2,162	1,176	1,097	647	393	247	218
Northeast Fishery Sector VIII	147	109	113	99	128	126	135	125	209
Northeast Coastal Communities Sector	11	73	20	10	4	12	14	112	175
Northeast Fishery Sector VI	107	121	118	125	95	90	67	112	143
Northeast Fishery Sector X	635	1,004	1,162	591	385	495	44	30	79
Northeast Fishery Sector VII	290	318	270	230	359	310	153	140	1
Northeast Fishery Sector IX	287	369	373	437	448	383	327	151	0
Port Clyde Community Groundfish Sector	464	714	625	0	0	0	0	0	0
Tristate Sector	81	50	114	0	0	0	0	0	0
n_trips	**10,779**	**13,390**	**12,881**	**9,110**	**8,672**	**7,392**	**6,507**	**6,757**	**7,135**

Table 59 - Number of active vessels subject to at-sea monitoring requirements, landing in port groups by fishing year (note: vessels may land in multiple ports).

Trip Port	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT PORTS	9	10	11	11	10	11	7	6	5
OTHER MA PORTS	41	39	48	34	32	34	48	41	35
BOSTON	25	24	20	19	23	21	20	19	21
CHATHAM	29	30	28	23	19	27	22	27	26
GLOUCESTER	102	95	90	77	66	61	60	60	55
NEW BEDFORD	75	78	78	56	54	70	54	48	26
OTHER ME PORTS	13	13	20	9	7	4	6	9	8
PORTLAND	26	39	40	29	31	26	26	23	29
NH PORTS	26	25	23	16	14	10	9	11	13
NJ PORTS	2	3	2	7	7	8	2	4	2
NY PORTS	8	8	10	8	7	7	11	6	5
OTHER RI PORTS	3	3	4	4	6	2	1	1	2
POINT JUDITH	44	38	46	41	36	36	33	25	23
OTHER NORTHEAST PORTS	8	8	15	19	18	14	11	9	5

Table 60 - Number of trips by vessels subject to at-sea monitoring requirements, landing in port groups by fishing year (note: trips may land in multiple ports).

Trip Port	2010	2011	2012	2013	2014	2015	2016	2017	2018
CT PORTS	68	107	138	130	112	101	61	66	98
OTHER MA PORTS	912	1,164	1,400	810	590	754	664	706	729
BOSTON	462	534	499	435	490	436	367	425	461
CHATHAM	1,709	2,092	1,839	1,268	1,542	1,356	1,476	1,480	1,766
GLOUCESTER	3,978	4,986	4,308	2,375	1,928	1,792	1,588	1,753	1,856
NEW BEDFORD	1,062	1,229	1,205	1,012	1,161	1,132	980	746	452
OTHER ME PORTS	257	383	416	147	182	79	56	173	239
PORTLAND	432	707	745	740	689	460	362	400	425
NH PORTS	1,209	1,520	1,668	1,088	958	531	414	478	597
NJ PORTS	21	30	19	37	39	26	7	8	4
NY PORTS	64	60	101	209	277	176	219	207	196
OTHER RI PORTS	23	69	54	48	23	16	29	24	4
POINT JUDITH	702	829	931	947	880	877	684	671	660
OTHER NORTHEAST PORTS	120	141	116	131	102	77	32	17	14

6.6.9.2 Common Pool Harvesting Component

With the adoption of Amendment 16, most commercial groundfish fishing activity occurs under sector management regulations. Some vessels have elected to not join sectors, and continue to fish under the effort control system. Collectively, this part of the fishery is referred to as the "common pool." These vessels fish under both limited access and open access groundfish fishing permits. Common pool vessels accounted for only a small amount of groundfish catch in FY2018 (Table 15).

Groundfish landings and revenue from common pool vessels have fluctuated over time (Table 15). Common pool vessels with limited access permits landed 1.2M lbs. (landed lbs.) of regulated groundfish in FY2010, worth $2.2M in ex-vessel revenues (Table 15). Landings declined to 445K lbs., worth about $815,000 in FY2011and declined again in FY2012 to 234K lbs., worth $503,000. In FY2013, groundfish landings and revenue from common pool vessels rose to 595Klbs, worth about $1.1M. In FY2014, groundfish landings and revenue from common pool vessels fell to 490Klbs., worth $923,000, followed by a rise in FY2015 to 670Klbs, worth $1.3M. Groundfish landings and revenue from common pool vessels have fallen in recent years, to 328Klbs. in FY2016, worth $843,000, and to the lowest point in FY2017, 186Klbs., worth $448,000.

6.6.9.3 Recreational Harvesting Component

The recreational fishery includes private anglers, party boat operators, and charter vessel operators. Several groundfish stocks are targeted by the recreational fishery, including GOM cod, GOM haddock, pollock, GOM winter flounder, and GB cod. GB haddock is targeted as well, but to a lesser extent. SNE/MA winter flounder and redfish are also target species. Amendment 16 (Section 6.2.5, NEFMC 2009) included a detailed overview of recreational fishing activity.

Table 61 provides a breakdown of the number of vessels active in the for-hire component of the recreational fishery for FY 1998 to FY 2018.

Table 61 - For-hire recreational vessels catching cod or haddock from the Gulf of Maine.

Fishing Year	Party	Charter	Total*
1998	52	108	137
1999	53	100	129
2000	48	108	130
2001	63	117	153
2002	43	127	152
2003	58	130	164
2004	63	127	164
2005	57	133	165
2006	65	130	163
2007	51	128	153
2008	55	129	154
2009	53	130	161
2010	53	140	167
2011	46	127	150
2012	43	109	133
2013	40	114	134
2014	39	103	119
2015	34	74	92
2016	37	71	88
2017	52	59	91
2018	43	89	95

Notes: *Total may not sum due to vessels taking both categories of trips during the fishing year.

Based on vessel reporting via vessel log book.

Vessels landing or discarding cod or haddock from Gulf of Maine statistical areas based on vessel log book.

Source: NMFS Greater Atlantic Regional Fisheries Office, January 2020.

6.6.10 Groundfish Monitoring

6.6.10.1 Summary of Types of Groundfish Monitoring Data in the Current Monitoring Program

The current groundfish monitoring program collects fishery-dependent data from multiple sources including the vessel monitoring system (VMS), the interactive voice response (IVR) system, vessel trip reports (VTR), dealer reports, industry-funded at-sea monitors, and Northeast Fishery Observer Program (NEFOP) observers. Most groundfish vessels are required to have a VMS unit, although exemptions exist for a small proportion of the fleet (handgear B vessels, common pool small vessel category vessels fishing in a single broad stock area, and handgear A vessels fishing in a single stock area). Vessels exempt from the VMS requirement, or fishing any portion of their trip inside the VMS demarcation line, provide trip-level information via IVR rather than VMS. All groundfish vessels are required to submit VTRs for all trips on a weekly basis. All catch sold by a federally permitted vessel must be sold to a federally permitted dealer and dealers must submit reports on a weekly basis. As a result, dealer reports are considered a census of landings (with the exception of catch kept for home consumption or bait, misreported landings, or unreported landings). The at-sea monitoring program is specific to vessels fishing under the provisions of a sector operations plan, but all vessels may be assigned a NEFOP observer as part of the standardized bycatch reporting methodology (SBRM). Additionally, there are daily, weekly, and annual reporting requirements at the sector level. Collectively, these data sources are used by sectors to manage their operations; by GARFO to manage the common pool in-season; by GARFO to monitor ABCs, ACLs, and ACEs; by the NEFSC to conduct stock assessments; and by the NEFMC to manage the fishery.

VMS provides declarations of intent (fishery, area, gear, sector exemptions), positional information, real-time catch estimates (daily catch reports), and trip-level catch estimates (trip catch reports, trip end hails). The IVR system provides declarations of intent for vessels without VMS, or fishing inside the demarcation line, and allows declarations of blocks of time out of the fishery (spawning blocks, gillnet blocks). Fishermen also submit VTRs that include information on: the vessel, gear used, area fished, fishing effort, catch amounts (kept and discarded), dealers to whom catch was sold, and disposition of any catch not sold. VTR information is recorded at the sub-trip level (a new VTR is filled out each time the vessel changes statistical area, gear type, or mesh size during a trip), and VTRs are submitted weekly. Dealers report landings at the trip level using the VTR serial number to link dealer and vessel data for the same trip. At-sea monitors collect information on: gear type; gear size; gear amount; effort information including dates; times, and locations; catch information including species, market category, lengths, weights, disposition and reason, and catch estimation method; and information on takes of protected species. Observers providing coverage under the SBRM collect the same information as at-sea monitors, but also collect additional social and economic information; more detailed information on gear construction and configuration; bait; environmental conditions; marine mammal sightings; and additional biological information (sex, age, biological samples). Table 62 below contains a comparison of information collected by at-sea monitors and observers, and notes what information from those collections is available to sector managers to download from the Sector Information Management Module (SIMM).

Table 62 - Summary of the data collected and reported on groundfish trips.

Data Set	ASM Collection	Additional NEFOP Collection	SIMM Reporting
Vessel and Trip Information	Trip identifier, program code, sector/fleet, vessel information, ports and dates sailed and landed, trip costs, gear type used, target species	Home port, trip duration, crew size, fishing time lost, gear onboard and soaking, captain experience	All ASM fields
Trawl Gear Information	Gear code, gear number, net descriptors, codend and liner mesh sizes, excluder/separator and escape outlet presence	Doors, kites, construction material, fishing circle, length measurements, strengthener, chafing gear, ground gear, sweep gear, floats, gear mounted electronics details, excluder/ separator and escape outlet details	Gear code, gear number, mesh size category
Gillnet Gear Information	Gear code, gear number, number of nets, net length, net height, tie downs, marine mammal deterrents, mesh size	Hanging ratio, twine size, floats and floatline, anchors and leadline, spaces, droplines, net color, surface system, buoyline, groundline, weak links	Gear code, gear number, mesh size category
Longline Gear Information	Gear code, gear number, number of hooks, hook brand, hook model, hook size	Sections, mainline, leaders, anchors, gangions, surface system, buoyline, groundline, weak links, swivels, radar reflectors	Gear code, gear number

Data Set	ASM Collection	Additional NEFOP Collection	SIMM Reporting
Haul Information	Haul number, gear code, gear number, haul observed, weather, wave height, gear condition, target species, soak duration; Dates, times, and locations: haul begin and end	On effort, marine mammal watch, catch exist, wind speed and direction, water temperature, depth, set method, set/tow speed, number of turns, wire out, bait; Dates, times, and locations: fixed gear set, mobile gear fishing begin and gear onboard	Haul number, gear code, haul observed, target species, statistical area, soak duration
Catch Information	Species name, market, weight, disposition (kept or discard) and reason, catch estimation method	Same as ASM	Species, market, stock area, weight, disposition (kept or discard), calculated live weight
Biological Sampling	Lengths: Species name, disposition and reason, sample weight, animal length, number at length	Lengths: sex, age sample type and number Age structures: scales, otoliths, vertebrae, and/or heads (species dependent)	None
Protected Species Interactions	Takes: Animal number, haul number, tag number (applied or existing), species name, entanglement situation, animal condition	Takes: Net number/position, time taken, pinger condition code, sex, sampling measurements, body temperature (mammals) Sightings: Event type, position, haul number, location, weather, wave height, species name, number of animals, how sighted, animal condition, animal behavior	Harbor porpoise takes: Porpoise number, tag number, entanglement situation, animal condition, location

Source: FSB 2015 Data Collection document

At the sector level, each sector must submit weekly ACE status reports (which become daily when 90 percent of a sector's ACE for a stock has been harvested) that summarize sector ACE balances. Sectors also submit a weekly detail report that provides sub-trip level details for each trip by each sector vessel. Detail reports combine data from VTR, dealer, ASM, and observer programs to calculate catch (landings and discards) for each trip by sector vessels as the basis for ACE monitoring. Sectors also submit a weekly trip issue report containing compliance or enforcement concerns, sector enforcement issues, enforcement actions, and incident or compliance reports. Each report is revised and expanded in subsequent iterations and is used to manage the sector and to reconcile data with NMFS. Details of the contents of each report can be found in the Sector Report Guide for Fishing Year 2019: https://www.fisheries.noaa.gov/new-england-mid-atlantic/commercial-fishing/fishing-year-2019-sectors.

Amendment 13 established the requirement that sectors submit annual year-end reports, and Amendment 16 expanded on those requirements. Current regulations require that approved sectors must submit an annual year-end report to NMFS and the Council, within 60 days of the end of the fishing year that summarizes the fishing activities of its members, including harvest levels of all species by sector vessels (landings and discards by gear type), enforcement actions, and other relevant information required to evaluate the performance of the sector. However, due to the time reconciliation takes, in the NMFS year-end report guidance the due date for the report is set as 14 days after the date final data tables are provided to the sectors by NMFS. The regulations require that the annual report must report the number of sector vessels that fished for regulated groundfish and the permit numbers of those vessels (except when this would violate protection of confidentiality), the number of vessels that fished for other species, the method used to estimate discards, the landing ports used by sector vessels while landing regulated groundfish, and any other information requested by the Regional Administrator. The annual report is intended to provide information necessary to evaluate the biological, economic, and social impacts of sectors and their fishing operations.

NMFS provides sectors with a guidance document detailing additional information required in the annual report, consistent with the regulatory authority, and specifications for submitting the report.[23] Sector annual year-end reports comprise two files: a MS Word file for descriptive information and a MS Excel file for table data. Details of the descriptive information files and table data files can be found in the year-end report guidance:
https://archive.fisheries.noaa.gov/garfo/sustainable/species/multispecies/sector/sector_yer_guide_fy_2017_rev8_0_1.pdf
The source data for these tables come from various inputs including but not limited to VTRs, dealer reports, VMS catch reports, and Permits; these source data have been processed for quality by NMFS.

The Fishery Data for Stock Assessment Working Group Report (see Appendix II) provides a more detailed summary of the data components used in groundfish assessments, including the fishery-dependent and fishery-independent data sources that contribute to each of those data components and a description of the information provided by these data sources. Table 3 from that document is included below as a reference (Table 63).

[23] Preparing the Northeast Multispecies Sector Annual Year-end Report, 2017, GARFO, https://archive.fisheries.noaa.gov/garfo/sustainable/species/multispecies/sector/sector_yer_guide_fy_2017_rev8_0_1.pdf

Table 63 - A general description of data components used in SAW/SARC assessments, the data sources that contribute to each of those components, and a description of the information provided by those data sources.

Data Component	Source	Description
Fishery-Dependent		
Commercial landings at age	Dealer reports VTR Port biological samples	Landings Area allocation Lengths and ages
Commercial discards at age	ASM NEFOP NEFSC surveys Port biological samples	Discards Discards Borrowed age-length keys Borrowed age-length keys
Recreational landings at age	Angler intercept survey Coastal household survey NEFSC surveys Port biological samples	Landings Angler effort Borrowed age-length keys Borrowed age-length keys
Recreational discards at age	Angler intercept survey Coastal household survey NEFSC surveys Port biological samples	Discards Angler effort Borrowed age-length keys Borrowed age-length keys
Catch weights at age	Port biological samples NEFSC surveys	Lengths and ages Length-weight relationship
Fishery-Independent		
Indices at age	NEFSC surveys	Survey catch Survey effort Lengths and ages
	State surveys	Survey catch Survey effort Lengths and ages
Maturity	NEFSC surveys	Maturity

Data Component	Source	Description
Natural mortality	Varies by stock	Natural mortality

Notes: Age data typically are not available for commercial discards or recreational landings and discards. Therefore, age-length keys are borrowed from other sources for those components. The Canadian Department of Fisheries and Oceans (DFO) provides Canadian catch and survey indices. Source: Fishery Data for Stock Assessment Working Group Report, February 2020, Table 3

The various data collection and reporting requirements have been developed, implemented, and modified over time. Amendment 13 adopted the concept that sectors are responsible for monitoring sector catch, but provided few details for that requirement. Amendment 16 was a major overhaul of the monitoring system and included additional details for the sector monitoring program. Amendment 16 also created a dockside monitoring program for sectors and common pool vessels to verify landings of a vessel at the time it is weighed by a dealer and to certify the landing weights are accurate as reported on the dealer report (see section 6.6.10.1.1 'Summary of Types of Groundfish Monitoring Data in the Previous Dockside Monitoring Program').

Framework 45 modified the dockside and at-sea monitoring programs. This action exempted vessels issued a handgear A, handgear B, or small vessel category permit from the dockside monitoring requirement, but also implemented a requirement that dockside monitors inspect fish holds. However, NMFS disapproved a Framework 45 measure to delay industry responsibility for at-sea monitoring costs. Framework 48 eliminated the dockside monitoring requirement and clarified the goals and performance standards for groundfish monitoring programs. NMFS approved the removal of the dockside monitoring program because it believed at that time that dealer reporting combined with dockside intercepts by enforcement personnel were sufficient to ensure reliable landings data.

Framework 48 also included provisions for cost-sharing of monitoring costs between the industry and NMFS, and a provision to delay industry responsibility for funding at-sea monitoring until fishing year 2014, but those provisions were not approved by NMFS. NMFS disapproved a delay in industry's responsibility to fund monitoring in both Framework 45 and Framework 48 because it determined the delay would be inconsistent with the requirements of the FMP and the Magnuson-Stevens Act. NMFS determined in those actions that relying on NMFS appropriations to determine at-sea monitoring coverage rates would not ensure sufficient coverage to monitor sector ACEs or to meet the purpose and goals of the sector monitoring program. NMFS concluded that if sector at-sea monitoring depended on NMFS funding alone, and that funding fell short of required coverage levels, NMFS would not be able to reliably estimate total catch, undermining the effectiveness of ACLs and sector ACEs to prevent overfishing and facilitate the rebuilding of groundfish stocks as required by National Standard 1 and section 303(a)(1) of the Magnuson-Stevens Act. NMFS disapproved the cost sharing provision in Framework 48 because it was not consistent with the Anti-Deficiency Act and other appropriations laws that prohibit Federal agencies from obligating the Federal government except through appropriations and prohibit sharing the payment of government obligations with private entities.

Framework 55 adjusted the ASM program to ensure the likelihood that discards for all groundfish stocks are monitored at a 30-percent coefficient of variation while making the program more cost effective. The changes in Framework 55 removed ASM coverage for a certain subset of sector trips, use multiple years of discard information to predict ASM coverage levels, and based the target coverage level on the predictions for stocks that would be at a higher risk for an error in the discard estimate. None of the adjustments removed the requirement under Amendment 16 and Framework 48 to ensure sufficient ASM coverage to achieve a 30-percent CV for all stocks, nor the requirement to monitor catch sufficiently to prevent overfishing.

The primary goal of the groundfish sector at-sea monitoring program is to verify area fished, catch, and discards by species, by gear type; and meeting these primary goals should be done in the most cost effective means practicable (FW 55). All other goals and objectives of groundfish monitoring programs at §648.11(l) are considered equally-weighted secondary goals. The goals and objectives of the groundfish monitoring program are included in Section 3.3 of this action.

6.6.10.1.1 Groundfish Monitoring Data in Previous Dockside Monitoring Program

The dockside monitoring program in Amendment 16 was created to verify landings of a vessel at the time it is weighed by a dealer and to certify the landing weights are accurate as reported on the dealer report. Trip start hails and trip end hails were required to coordinate the deployment of dockside or roving monitors. Dockside monitors met vessels upon landing and validated the dealer report and/or offload to a truck. The dockside monitoring program was also to apply to common pool vessels beginning in 2013 when the trimester TAC and associated AMs became effective.

Dealer-reported fish weights are used as the principle source to monitor commercial landings. Dockside monitor reports recorded the dealer weights observed by the monitor. Monitoring providers were required to keep an electronic record of the information collected and make that available to NMFS. However, in practice the information were stored as digital scans of paper documents, rather than formatted data in a queriable database, which reduced the utility of the information.

Dockside monitors collected copies of vessel VTRs; recorded whether dealer scales were certified by the state; observed and recorded whether ice and fish tote weights were tared by the dealer before catch was added or obtained the estimated weight of ice and fish tote used by the dealer; recorded the captain's estimated weight of each species being retained for home use or retained on the vessel for other reasons; and either the dealer or dockside monitor recorded the weight of offloaded fish in a report signed and kept by the dockside monitor. Information was provided to sectors within 24 hours.

Trip Start and Trip End hails were implemented to facilitate the logistics of the dockside monitoring program. The hails were retained after the end of the dockside monitoring program to facilitate enforcement. All trips must submit Trip End hails, but only a subset of trips are required to submit Trip Start hails.

Trip Start hails must include vessel permit number; trip ID number in the form of the VTR serial number of the first VTR page for that trip; an estimate of the date and time of arrival to port; and any other information as instructed by the Regional Administrator. Trip End hails must include vessel permit number; VTR serial number; intended offloading location(s), including the dealer name/offload location, port/harbor, and state for the first dealer/facility where the vessel intends to offload catch and the port/harbor, and state for the second dealer/facility where the vessel intends to offload catch; estimated date/time of arrival; estimated date/time of offload; and the estimated total amount of all species retained, including species managed by other fishery management plans, on board at the time the vessel first offloads its catch from a particular trip.

See Appendix III (Groundfish PDT Dockside Monitoring Discussion Paper) for more information on the previous DSM program, as well as case studies of DSM programs in other regions, and discussion from the PDT on considerations for developing a DSM program.

6.6.10.1.2 Current Dockside Monitoring Program Data

As more fully described in Appendix IV (Electronic Monitoring Programs in the Northeast Multispecies (Groundfish) Fishery), NMFS is operating a DSM program as part of an exempted fishing permit (EFP) for a project developing a maximized retention in conjunction with electronic monitoring (EM). Dockside monitors have three primary functions: (1) Inspect fish holds to ensure complete offload of catch; (2) conduct biological sampling on undersized groundfish catch; and (3) verify dealer weights. Data from the DSM program is used to estimate discards for sector management and is included in the 2019 stock assessments.

6.6.10.1.3 Electronic Monitoring Data

Amendment 16 authorized the use of EM in place of actual observers if NMFS deems the technology sufficient for a specific trip type based on gear type and area fished. NMFS has issued multiple EFPs to interested stakeholders since fishing year 2013 to develop EM technologies and explore implementation of EM. These EFPs allow commercial vessels to use EM as part of official catch monitoring protocols, facilitating the development of fleet-wide implementation. As more fully described in Appendix IV, the two primary approaches to EM being developed for groundfish are an audit model and a maximized retention model. The Nature Conservancy, one of the project partners for the audit model, completed a cost report in 2019.[24]

At the core of the protocols is a multi-camera video system used to record vessel operations that follow predefined catch handling procedures. The recorded video is then reviewed by trained video reviewers to determine whether the catch handling procedures were followed (e.g., regulatory compliance) and, for audit-model protocols, to annotate the size/weight of groundfish species discarded. Vessel captains are required to report haul-level effort and catch information (including discards) through electronic Vessel Trip Reports (eVTR), producing finer-scale fishery-dependent data useful for science and management. Video footage is used to track discard and catch retention compliance for both models. Vessels in the audit program use discards reported on eVTRs that are confirmed with the video footage. Vessels in the maximized retention model have discard estimates derived from dockside monitoring. Discard information from EM vessels is used for sector management and the dockside monitoring data from the maximized retention model is included in the 2019 stock assessments.

6.6.10.2 Summary of Monitoring Coverage Rates

Minimum monitoring coverage levels for the Northeast multispecies (groundfish) sector fishery must meet the coefficient of variation as specified in the Standardized Bycatch Reporting Methodology (SBRM). The total monitoring coverage for the Northeast multispecies sector fishery is specified to achieve the required Coefficient of Variation of 30 percent (CV30) or better precision of the discard estimates for each Northeast multispecies stock for all sectors and gears combined, using the same target coverage level for each sector. GARFO's Analysis and Program Support Division, in consultation with

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[24] TNC and CapLog Group LLC, Projected Cost of Providing Electronic Monitoring to 100 Vessels in the New England Groundfish Fishery, April 2019: https://s3.amazonaws.com/nefmc.org/3c_TNC-EM-Cost-Assessment-Report-Submission-to-NEFMC-4_10_19.pdf

Sustainable Fisheries Division staff, performs analysis to recommend the total monitoring coverage for Northeast multispecies sectors annually. The recommended coverage level is expected to sufficiently monitor and enforce catch levels for Northeast multispecies sectors each year. The recommendation relies on an analysis of past performance to provide a reasonable expectation of meeting the requirement of achieving the CV30 or better precision at the overall stock level for each groundfish stock. For further information on this analysis, see the "Summary of Analyses Conducted to Determine At-Sea Monitoring Requirements for Multispecies Sectors FY2019": https://www.greateratlantic.fisheries.noaa.gov/aps/monitoring/nemultispecies.html

As described above in Section 6.6.10.1, the Fisheries Sampling Branch (FSB) at the Northeast Fisheries Science Center manages two separate but related monitoring programs: the Northeast Fisheries Observer Program (NEFOP) and the At-Sea Monitoring (ASM) Program. The coverage level recommendation specifies the "total monitoring coverage," whether provided by NEFOP or ASM. Coverage from NEFOP is combined with coverage by ASM to achieve the total monitoring coverage level. Sectors are required to design, implement, and pay their costs for any portion of the coverage not funded by the agency through NEFOP coverage. In previous years, FSB has provided GARFO with an estimate of the NEFOP coverage they expect to provide sector vessels in the upcoming fishing year. Beginning in FY 2019, however, NMFS initiated use of a new method for selecting groundfish fishing trips for NEFOP observation which will still implement the combined target coverage level for the groundfish fishery, but uses the SBRM fleet-based stratification to allocate NEFOP coverage rather than a flat rate across sectors. Differences in the sectors' SBRM fleet type compositions result in differential NEFOP coverage levels across sectors, and so an overall estimate of NEFOP coverage for sectors is unavailable.

As described above in section 6.6.10.1, the monitoring requirements for Northeast multispecies sectors have been modified several times since they were established in Amendment 16 to the Northeast Multispecies Fishery Management Plan, most recently in Framework 55, which became effective on May 1, 2016. The updated regulations at 50 C.F.R. § 648.87(b)(1)(v)(B)(1)(i) govern the monitoring coverage levels that may be required to monitor sector operations, to the extent practicable, to reliably estimate overall catch by sector vessels. These regulations require NMFS to specify coverage levels sufficient to at least achieve a CV of 30 at the overall stock level for each groundfish stock. NMFS is required to use the most recent 3-year average of the total required coverage level necessary to achieve the CV30 threshold. The target coverage level is the maximum stock-specific rate after considering criteria that allow for removing healthy stocks (no overfishing occurring and not overfished) with low relative catch and discards (<75% catch of previous year's sector sub-ACL or <10% discards) from being used to determine the coverage rate. If the target coverage level resulting from this screening is too low to achieve the CV30 standard, NMFS may set a different target coverage level to achieve the required standard.

When determining what stock-specific rate is necessary, NMFS is required to take into account the primary goal of the at-sea monitoring program of verifying area fished and catch and discards by species and gear type by the most cost-effective means practicable. Other considerations include the equally weighted secondary groundfish monitoring goals and objectives, the MSA's national standards, and any other relevant factors. The total monitoring coverage ultimately should reasonably produce catch estimates that are accurate enough to ensure that overfishing is prevented while there is sufficient fishing opportunity to achieve optimum yield. To that end, additional uncertainty buffers are established when setting ACLs to help make up for any lack of absolute precision and accuracy in estimating overall catch by sector vessels.

While a total monitoring coverage target level is expected to meet the CV30 standard on discard estimates, there is no guarantee that the required coverage level will be met or result in a 30-percent CV across all stocks due to changes in fishing effort and observed fishing activity that may happen in a given fishing year. Due to fluctuations in fishing activity over the year, it is difficult to deploy observers throughout the year and ensure that target coverage levels are attained. Additionally, Pre-Trip Notification System (PTNS) non-compliance is another reason why target coverage levels may not be attained. As Table 64 indicates, the realized level of coverage was below the target for most years, aside from FY 2016.

The timeline for when total monitoring coverage level information is available has varied over time (Table 64). Currently, NMFS publishes the total monitoring coverage level once the necessary analysis is completed. Typically, analysis to determine the total at-sea monitoring coverage level has been available sooner than the SBRM analysis used to determine the NEFOP coverage level.

Current regulations set December 1 as the deadline for sectors to submit preliminary rosters, but grant NMFS flexibility to set a different date. For example, in FY 2013, managers asked for a later date, and they agreed on March 29, 2013. Beginning in FY 2014, NMFS established a standard deadline of four weeks after potential sector contribution (PSC) letters are sent out, although in several years, there have been agreed-upon extensions. There have been several years when the date sector rosters were due occurred before the date the total monitoring coverage rate was announced (Table 64) which can complicate groundfish fishery participant's business planning as the decision of whether or not to participate in sectors for the upcoming fishing year may be influenced by the monitoring coverage rate for a given year.

Table 64 - Target and realized observer (NEFOP and ASM) coverage levels for the groundfish fishery and dates when analyses to determine coverage rates available for Fishing Years 2010-2020.

Fishing Year	NEFOP target coverage level	ASM target coverage level	Total target coverage level	Realized coverage level	Date analysis posted by GARFO to determine total coverage rate	Date total coverage rate announced	Date sector rosters were due
FY 2010	8 %	30 %	38 %	32 %			
FY 2011	8 %	30 %	38 %	27 %			12/1/2010
FY 2012	8 %	17 %	25 %	22 %			12/1/2011
FY 2013	8 %	14 %	22 %	20 %	4/12/2013	3/14/2013	3/29/2013
FY 2014	8 %	18 %	26 %	25.7 %	2/21/2014	2/18/2014	3/6/2014
FY 2015	4 %	20 %	24 %	19.8 %	3/2/2015	2/26/2015	2/25/2015
FY 2016	4 %	10 %	14 %	14.8 %	5/6/2016	3/22/2016	3/15/2016
FY 2017	8 %	8 %	16 %	17.3 %	3/15/2017	3/15/2017	3/16/2017
FY 2018	5 %	10 %	15 %	14.6 %	1/25/2018	1/25/2018	3/26/2018
FY 2019	N/A†	N/A†	31 %	N/A*	3/28/2019	3/28/2019	3/8/2019
FY 2020	N/A†	N/A†	40 %	N/A*	1/28/2020	1/28/2020	3/16/2020

"N/A" indicates that the information is not available.
† NEFOP rates are stratum-specific starting in FY 2019.
*Realized coverage not available; fishing year still underway.

Source: Summary of analyses conducted to determine at-sea monitoring requirements for multispecies sectors, FY2020, GARFO; and personal communication with GARFO staff

6.6.10.3 Funding for At-Sea Monitoring Coverage

Beginning in 2012, Amendment 16 required that the at-sea monitoring program would be industry funded. However, since then NMFS has had sufficient funding to be able to pay for all or some of industry's sampling costs of the groundfish at-sea monitoring program. From May 1, 2010, through Mach 1, 2016, federal appropriations were available to fully fund industry's monitoring costs for dockside monitoring and at-sea monitoring. Since that time, industry has directly contracted with and paid monitoring providers at-sea monitoring services, but all or a portion of those costs have been reimbursed by the Atlantic States Marine Fisheries Commission through a grant from NMFS. From FY 2012 through FY 2014, NMFS fully covered the sampling costs for the at-sea monitoring program. In FY 2015, NMFS fully covered sampling costs for the at-sea monitoring program until funds were expended in March 2016, at which point industry became responsible for the cost of at-sea monitoring. From July 2016 through April 2018, NMFS partially reimbursed sector participants for at-sea monitoring costs through a grant with the Atlantic States Marine Fisheries Commission (ASMFC). Sectors were reimbursed 85% of their ASM costs for July 2016-April 2017. For FY 2017, sectors were reimbursed 60% of their ASM costs. At the end of the 2017 fishing year, there were remaining funds from the original grant, and to fully disburse those funds, sectors were reimbursed the remainder, effectively bringing the 2017 reimbursement rate for ASM-covered trips up to approximately 85%.

For FY 2018 and FY 2019, NMFS has reimbursed industry for 100 percent of its at-sea monitoring costs through a grant with the ASMFC. Congress provided $10.3 million for groundfish at-sea monitoring in NMFS' 2018, 2019, and 2020 appropriations. This funding is sufficient to continue reimbursing sectors for 100 percent of their monitoring costs in fishing year 2020. Additionally, in a November 26, 2019, letter, NMFS announced that, subject to available funding, industry review costs for an EM audit model would be reimbursable in years 1 and 2, and that in years 3 and beyond NMFS would reimburse the costs of the minimum review rate with industry paying for any addition review. These reimbursements through federal appropriations provide additional economic stability for sector vessels for the near term, but it is unknown whether Congressional appropriations to cover industry's monitoring costs will continue. It is anticipated that once these appropriated funds are used, sampling costs of at-sea monitoring would be fully paid for by industry, unless additional NMFS funds are available.

6.6.10.4 Issues with Current Groundfish Monitoring Program

Amendment 16 to the Groundfish FMP implemented monitoring and enforcement provisions for sector fishing activity, which is primarily controlled by limits on how much the sector can catch – ACE. These are "hard" limits- sectors must stop fishing before they exceed these limits. There are two components to catch – landings and discards. In order to ensure that sector catches are actually limited to the ACE, both landings and discards must be accurately monitored. To increase confidence that sector catches are accurate Amendment 16 implemented the requirement that sectors land all legal-sized fish to discourage sectors from discarding catches to avoid exceeding ACE. Amendment 16 reported that while admittedly difficult to monitor or enforce, this measure does encourage sectors to land all catch of legal-size. If adhered to, this measure may reduce discards of legal fish. Amendment 16 also required that sectors are able to prove they can attribute landings to a specific stock area, in order to reduce the likelihood sector catches will be applied to the wrong stock. If adhered to, this could lead to indirect biological benefits as improved attribution of catch to stock areas may lead to better management and assessment of the stocks.

The current groundfish monitoring program collects fishery-dependent data from multiple sources including the vessel monitoring system (VMS), the interactive voice response (IVR) system, vessel trip reports (VTR), dealer reports, industry-funded at-sea monitors (ASM), and Northeast Fishery Observer Program (NEFOP) observers (see Section 6.6.10). The current monitoring system includes these uncertainties:

- Unreported and misreported catches (landings and discards) by species/stock
- Disagreement between data sources (vessel trip reports [VTR]/Dealer; VTRs/vessel monitoring system [VMS])
- The majority of analytical groundfish stock assessments contain a retrospective pattern, which may be caused in part by missing catch. Some analytical stock assessment models have been rejected, and missing catch may have contributed in part to the poor performance of those stock assessments.
- Lack of an independent verification of landings may lead to catch reporting conspiracy/collusion between a dealer and a vessel, and has occurred
- Fishermen behave differently when observers are on-board, and
- Incentives exist in any quota-based system for misreporting/non-reporting of catch (landings and discards).

<u>Discrepancies in catch reporting</u>

The measurement of fishing effort and estimation of catch are subject to a variety of errors that can compromise accuracy. Because fish are not equally distributed throughout the ocean, it is impossible to know exactly where they are caught during a fishing trip. Self-reported activity may provide a useful approximation to true activity but will be affected by competing objectives. Without incentives to report accurately or efforts to correct the record, some information may be particularly unreliable (e.g., discarded catch).

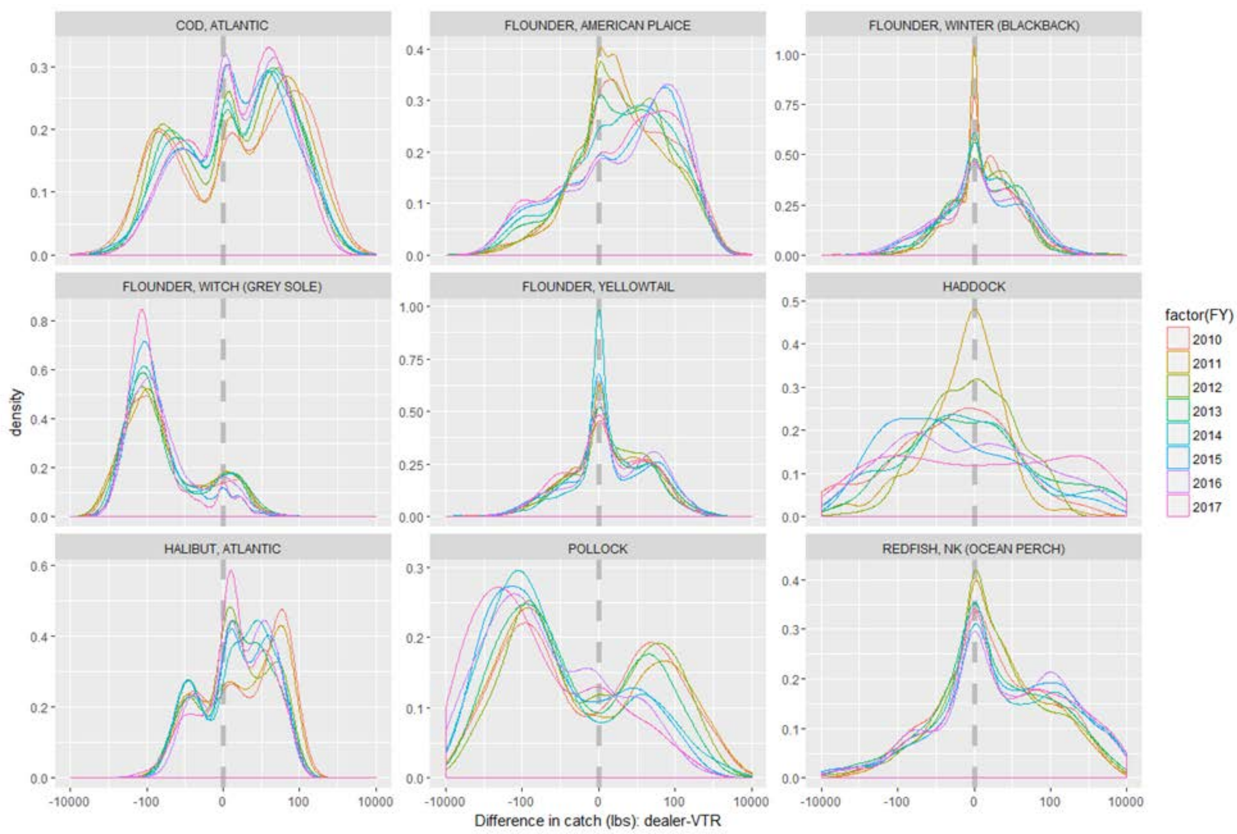
Statistical area fished - While the technology exists to record a spatial coordinate the moment gear is pulled onboard, we rely on self-reported location for apportioning catch to stock areas. Palmer (2017) identified discrepancies between stock-area apportioning of catch as reported on vessel trip reports (VTRs) with that as estimated by vessel monitoring system (VMS) data; the latter provided an approximation of the spatial distribution of fishing effort according to vessel speed. The differences were most pronounced starting in 2010 with implementation of the quota-based system for groundfish, after which incentives for misreporting of quota-limited stocks increased. Palmer (2017) suggested that while overall error was small and unlikely to substantially impact resource monitoring, the error could be particularly large in certain years for some individual stocks. Additionally, the error was disproportionately attributed to a small number of vessels, but these vessels tend to be the larger, higher volume trip vessels. Palmer’s finding suggest potential misreporting could be reduced with improved catch monitoring. An analysis conducted by the U.S. Coast Guard also investigated possible stock area misreporting.[25] The analysis identified possible instances of stock area misreporting, and Coast Guard boardings were conducted on vessels suspected of misreporting to confirm these instances. The analyses and boardings are ongoing.

[25] Presentation, “Stock Area Analysis and Misreporting Investigation”, US Coast Guard, December 2019: https://s3.amazonaws.com/nefmc.org/CG-Stock-Area-Misreporting-12-3-Slides.pdf

Kept catch - Even with reasonable diligence, self-reported catch is unlikely to exactly match the weight reported by a dealer using scales on land. Among many possibilities, accuracy could be affected by differences in how species are dressed and stored. Delayed recording of the catch could result in poor recollection of catch amounts. And visual estimation can have worse precision than other methods depending on the total amount of the catch. Further, the weight of fish changes based on the method of storage (e.g., seawater slurry v. iced) and dealers often make deductions from measured weights to account for assumed weights of totes, ice, and slime.

The differences in reported species catch between the dealer and the VTR (minus bait/home consumption) were calculated for all groundfish trips during 2010–2017 using the Data Matching & Identification System (DMIS) database. The results for 9 allocated species are illustrated as density plots (a continuous version of a histogram), with the difference in pounds (dealer - VTR) plotted on the log-10 scale. Figure 9 illustrates density distributions of the differences (log10-transformed live pounds) in landings amount (dealer – VTR) across 9 allocated groundfish species from the 2010–2017 fishing years. Density that falls to the left of 0 indicates *over*-reported catch (VTR > dealer), while density on the right of 0 indicates *under*-reported catch (VTR < dealer), under the assumption that dealer amounts were accurate. Patterns differ across species, and for some species, across years.

Figure 9- Density distributions of the differences (log10-transformed live pounds) in landings amount (dealer – VTR) across 9 allocated groundfish species from the 2010–2017 fishing years.



Analytical stock assessment models for New England groundfish often have retrospective patterns, which may be caused by missing catch (landings and discards).

Retrospective patterns are systematic changes in estimates of population size or fishing mortality, which arise in analytical assessment models as more years of data are added to the model (Hurtado-Ferro et al., 2015; Miller and Legault, 2017). Retrospective error in the models occur when there is an underlying conflict among the trends in the input data (estimated removals and indices of abundance, along with size or age structure trends) in conjunction with the input biological information (life history) with the species/stock within the model. Retrospective patterns are a major concern for sustainable fisheries management. For example, when an assessment consistently overestimates stock biomass and underestimates F (the common trend for New England groundfish), catch advice (which is meant to be precautionary) may be set at levels that are too high, leading a subsequent assessment to estimate that overfishing has been occurring (e.g. GB cod). This is especially problematic for New England fisheries, where assessments are typically not performed annually, and projection results are used to set catch levels for the next two to five years into the future and up to 10 years when considering rebuilding projections. At the GARM 3 benchmark assessments in 2008, it was determined that the models were not acceptable for catch advice without accounting for the retrospective issues. Two approaches were examined at GARM 3 to approximate the bias and adjust for it within the projections for catch advice (OFLs, ABCs) - splitting surveys or making adjustments. Retrospective adjustments (rho adjustments) are applied to terminal estimates of SSB and F in assessment models for New England groundfish for the recommended status determination, and the adjustments are made to the t+1 numbers at age within the projections when the retrospective bias falls outside of the 90% confident intervals of the model uncertainty estimates. These adjustments are intended to account for the magnitude of retrospective pattern, and to provide appropriate management advice.

During the 2017 Operational Assessments, 11 groundfish stocks were assessed using an age-structured analytical assessment model (e.g., VPA or ASAP). Major retrospective patterns (rho-adjusted values of F and SSB outside of 90% confidence regions for model estimates) were present in 8 of the 11 analytical assessments (See Table 9 of NEFSC 2017[26] for a full description). During the 2019 Operational Assessments, every analytical model exhibited a retrospective pattern. These major retrospective patterns required a retrospective (“rho”) adjustment (at the discretion of the peer review panel). In all cases except for one, the retrospective adjustments lead to a more pessimistic perception of resource productivity (i.e., lower biomass and increased F), and in some cases resulted in changes to designations of stock status (e.g., from not overfished to overfished).

It should also be noted that some regional groundfish stocks which were formerly assessed using an analytical assessment model (e.g., GB cod, witch flounder, GB yellowtail flounder) are now assessed using an empirical approach. For these stocks, the analytical assessment models were rejected during prior peer reviews, in part due to the magnitude of retrospective error that were present in the models.

Analytical stock assessment models generally need to make a number of simplifying assumptions in order to reduce the number of parameters that are estimated in the model. For example, these models assume that important parameters such as natural mortality, catchability, and sometimes selectivity are constant

[26] Northeast Fisheries Science Center (NEFSC). 2017. Operational Assessment of 19 Northeast Groundfish Stocks, Updated Through 2016. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-17; 259 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/

over time. In addition, the projections also assume that growth is constant into the future. However, if any of these parameters change over time in a consistent manner, it can lead to a retrospective pattern in the model. Retrospective patterns in analytical stock assessments can be caused by a number of factors including: changes in survey catchability (resource availability and/or gear efficiency), changes in natural mortality, or unreported catch (Hurtado-Ferro et al, 2015[27]; NEFSC, 2017). To a lesser extent, retrospective patterns can also arise to due to changes in fishery selectivity or growth, although nearly all analytical assessment models for groundfish attempt to account for these changes. Unfortunately, the true cause of the retrospective pattern is never known in practice (Miller and Legault, 2017[28]). In the case of New England groundfish, several factors may be acting in concert to contribute to the retrospective patterns, which confounds efforts to identify a single unifying cause. However, the persistence of retrospective patterns across the majority of groundfish assessment suggests that there may be a common, regional-scale driver(s) that is responsible for the retrospective patterns.

Missing catch (landings and discards) has often been implicated as a potential cause of the retrospective pattern in groundfish assessments (see NEFSC, 2017), and some assessment scientists have attempted to quantify the magnitude of missing catch that is needed to "fix" the retrospective effort in the model. For example, during the 2016 witch flounder assessment (SAW 62), it was estimated that the magnitude of reported witch flounder catch would need to be increased by 300-500% to fix the retrospective problem in the assessment, but did not assert missing catch was the sole cause of the retrospective pattern. During the 2017 Operational Update assessments, it was estimated that the "recent catches" of Gulf of Maine cod would need to be roughly doubled in order to alleviate the retrospective pattern in the model. During the 2016 TRAC assessment, it was estimated that recent catches (or natural mortality) would need to be increased by 300 to 500% in order to remove the retrospective pattern in the VPA model that was formerly used to assess Georges Bank yellowtail flounder.

Trawl fisheries in New England are required to use large mesh codends, which are designed to reduce the capture and retention of sub-legal fish. Some proportion of fish which encounter a trawl net, but are not ultimately retained by the gear, may suffer acute or delayed mortality. This is referred to as "escapee mortality." Escapee mortality is a form of missing catch, and may contribute to the retrospective pattern in some assessments. However, neither the current monitoring system, nor any of the alternatives under consideration would enable the magnitude of escapee mortality to be quantified.

It is interesting to note that retrospective errors are present in assessment models for stocks that are considered to be constraining to the fishery (e.g., GB cod, plaice), where the incentive to misreport or underreport catches would be particularly strong. At the same time, retrospective errors are also present in assessments for stocks with low utilization rates and relatively large quotas (e.g., pollock, redfish, and GB haddock), where the incentive to misreport landings would presumably be much lower, or perhaps even non-existent.

Missing catch may be contributing to the retrospective patterns that are present in the New England groundfish assessments. However, there is not sufficient evidence at this time to understand whether missing catch is the primary contributing factor to the retrospective problem. Further work is needed to

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[27] Hurtado-Ferro, F., Szuwalski, C.S., Valero, J.L., et al. 2015. Looking in the rear-view mirror: bias and retrospective patterns in integrated, age-structured stock assessment models. ICES Journal of Marine Science, 72(1): 99-110.

[28] Miller, T.J., and Legault, C.M. 2017. Statistical behavior of retrospective patterns and their effects on estimation of stock and harvest status. Fisheries Research, 186: 109-120.

determine whether non-stationarity (e.g., variable M, changing catchability, etc.) may be contributing to the retrospective patterns that are present in the stock assessments.

Catch reporting collusion between a dealer and a vessel is possible, and has occurred – no independent verification of landings

Currently, landings data for the groundfish fishery comes from dealer reports and vessel trip reports (VTRs). VTRs require that the vessel captain reports all species caught during the trip and the weight of the catch, as well as statistical areas fished and gear used. Dealer reports include data about the date a catch was landed, the name of the vessel that brought it in, the grade, species, price and weight of the fish, and the number of the trip report that corresponds to the catch. There is no independent verification of landings.

There was a dockside monitoring (DSM) program in the groundfish fishery from 2010-2011, which was intended to verify landings of a vessel at the time it is weighed by a dealer and to certify the landing weights are accurate as reported on the dealer report.[29] However, the DSM program was later discontinued in part because landings information is already provided through the dealer reporting system and by eliminating the program, sector operating costs would be reduced and redundant accounting would be avoided.[30] The Council's rationale was that as long as unreported landings do not occur, the dealer reports can be used to monitor sector landings and there is little advantage to having dockside monitors verify these reports. NMFS determined that dealer reporting combined with dockside intercepts by enforcement personnel were sufficient to monitor landings of sector catch at the time. However, after the removal of the DSM program there have been incidents of unreported and misreported landings, including collusion between vessels and dealers.

In addition to the potential for unreported and misreported landings, the lack of independent verification of landings in the groundfish fishery creates a situation in which catch reporting collusion between a dealer and a vessel is possible. The dealer reports and VTRs have intentional overlap, which allows NOAA to use the dealer reports as a check on the information vessels submit on trip reports, and vice versa. If the species and weight listed on the dealer report does not match the corresponding trip report, the discrepancy may be evidence of fraud in one or both reports. Therefore, to perpetrate an ongoing fraud regarding the species or weight of a given catch, the vessel operator and the dealer must collude. Additionally, there is that nothing prohibits a person from owning both the vessels and the wholesale dealer operation that buys fish from the vessels.

Such catch reporting collusion between a dealer and a vessel occurred in the case of United States vs. Carlos Rafael.[31] On March 30, 2017, Carlos Rafael, a.k.a. the Codfather, pleaded guilty to federal criminal charges involving falsely reporting catch information on dealer reports and vessel trip reports. Rafael, the owner of Carlos Seafood Inc., based in New Bedford, Mass., owned 32 fishing vessels and 44 permits. In September 2017, Rafael was sentenced to 46 months in prison and three years of supervised

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[29] New England Fishery Management Council. Oct. 16, 2009. Amendment 16 to the Northeast Multispecies FMP. http://s3.amazonaws.com/nefmc.org/091016_Final_Amendment_16.pdf

[30] New England Fishery Management Council. (Feb. 26, 2013). Framework 48 and EA to the Northeast Multispecies FMP. http://s3.amazonaws.com/nefmc.org/130307_FW48_Figures_Repaired.pdf

[31] United States District Court, District of Massachusetts. Sept. 20, 2017. United States of America vs. Carlos Rafael Government's Sentencing Memorandum

release.[32] A civil action against Rafael by NOAA was resolved in August 2019.[33] As a part of this settlement, NOAA has given Rafael until Dec. 31, 2020 to sell his fishing permits along with the fishing vessels he owns or controls through transactions reviewed and approved by the agency. Rafael was also required to relinquish his seafood dealer permit by Sept. 1, 2019. Additionally, 17 captains who previously worked for Rafael and were part of the civil settlement received suspensions and probationary periods of varying lengths. During the probationary periods, the captains are subject to additional monitoring requirements (e.g. more frequent VMS polling, haul-by-haul reporting.

In this particular case, Rafael owned both the vessels and the dealer, Carlos Seafood, to which those vessels sold fish. As he freely admitted to the agents, this system of vertical integration is largely what enabled Rafael to commit long-term fraud without detection: he made sure that abundant, "high quota" fish like haddock was listed on trip reports instead of what his boats actually caught, i.e., "low quota," high value fish like cod. Rafael then made sure that Carlos Seafood, Inc.'s, receipts from "buying" the fish from his boats matched the fraudulent trip reports and, more importantly, that the dealer reports he submitted weekly to NOAA matched the fraudulent trip reports as well. It should be noted that collusion between a dealer and a vessel can still occur when these are not the same owner, and that a vertically integrated dealer/vessel business does not guarantee collusion or fraud will occur.

Observed trips are not representative of unobserved trips

Section **Error! Reference source not found.**, Summary of PDT Monitoring Analyses, provides an overview of Appendix V. Briefly, the PDT prepared four analyses to support the development of Amendment 23. Specifically, PDT members analyzed discard incentives, observer effects, and landings ratios; and developed models to predict groundfish catch on unobserved trips using observed trip information (see Appendix V for more information on each analysis). These four analyses were reviewed by a subgroup of the SSC in April 2019 (see SSC sub-panel report, in Appendix V) in order to determine the scientific rigor of each approach as well as the sufficiency of each analysis to inform the development of Amendment 23 and analysis of different alternatives (see Terms of Reference, SSC sub-panel report, page 21, in Appendix V).

The overall conclusion from the PDT was that observed trips are not representative of unobserved trips. The dimensions where observed trips differ from unobserved trips include: Gulf of Maine cod catch rates, groundfish landings to effort ratios, trip duration, pounds of kept groundfish, pounds of total kept catch, and trip revenue. Documented differences in the stock landing to effort relationships reflect differences in illegal discarding of legal sized fish on unobserved trips relative to observed trips. The discard incentive model describes one mechanism to explain differences between observed and unobserved trips: the sector system increases the incentive to illegally discard legal-sized fish on unobserved trips. Discard incentives have varied across time and stock and reflect changes in the relative size of quotas and availability of fish to the fleet. After full sector implementation, the accountability of discards and the application of sector/gear specific discard rates to unobserved trips, together with the potential catch of constraining stocks, increased the incentive to not comply with retention regulations. The SSC concluded the current precision standard is not an appropriate method to set at-sea monitoring coverage levels, without at least

[32] United States Attorney's Office, District of Massachusetts. Sept. 25, 2017 news release. https://www.justice.gov/usao-ma/pr/owner-one-nation-s-largest-commercial-fishing-businesses-sentenced-falsifying-records

[33] Details of the Settlement of the Government's Civil Case Against Carlos Rafael and his Fishing Captains. August 19, 2019. NOAA memorandum

some change, because the assumption that observed trips are representative of unobserved trips is false. Further the SSC concluded that "…the analyses, taken comprehensively, create a weight of evidence that disproves the null hypothesis, namely that there is no effect from the presence of an observer on a fishing trip. In other words, the work taken collectively show that there is an observer effect, and therefore managers need to account for this when basing management off information derived from observed trips. The analyses suggest that estimates of discards on unobserved trips derived from discards rates on observe trips may not be accurate, and likely to be an underestimated reflection of actual discards." These analyses cannot quantify the differences between observed and unobserved trips in a way that allows for either a mathematical correction to the data or a survey design that resolves bias. Additional details are provided in Appendix V.

Review of International Monitoring Programs in Catch Share Managed Fisheries

The Groundfish PDT reviewed twenty-one programs during development of this action across the U.S., Canada, Iceland, Argentina, New Zealand, and Australia[34]. The programs institute different monitoring requirements for different vessel size classes, gear types, and vessels that process at sea. Nearly all of the 16 U.S. catch share programs are included, excluding just the invertebrate Surfclam and Ocean Quahog ITQs. The majority of programs reviewed use trawl gear (bottom or mid-water), but fisheries using several other gear types including pots and traps, longline, vertical line, and gillnet were included as well.

Excluding fleets that process at sea, of the 12 multispecies programs/fleets examined, only the Northeast Multispecies (groundfish) sector program did not have any form of dockside monitoring. Of the 11 programs or fleets with dockside monitoring, 5 implemented 100 percent dockside monitoring—this includes the West Coast shorebased IFQ fleet, the Alaskan Central Gulf of Alaska groundfish catcher vessel fleet, the B.C. integrated groundfish program, the Icelandic IFQ program, and Argentine IFQ programs. The remaining six programs or fleets, from the Gulf of Mexico grouper/tilefish IFQ, New Zealand, and Australia each monitor their fisheries dockside randomly, or through an annual audit. By contrast, only one of eight single species catch share programs had 100% dockside monitoring, the AFA pollock trawl catcher vessel fleet, while two programs had random inspections, and the remainder had no form of dockside monitoring, excluding inspections from law enforcement.

6.6.10.5 Summary of PDT Monitoring Analyses

The PDT prepared four analyses to support the development of Amendment 23. Specifically, PDT members analyzed discard incentives, observer effects, catch ratios, and developed models to predict groundfish catch on unobserved trips using observed trip information (see Appendix V for more information on each analysis). These four analyses were reviewed by a subgroup of the SSC in April 2019 (see SSC sub-panel report, in Appendix V) in order to determine the scientific rigor of each approach as well as the sufficiency of each analysis to inform the development of Amendment 23 and analysis of different alternatives (see Terms of Reference, SSC sub-panel report, page 21, in Appendix V).

[34] See "Memo from Groundfish PDT to Groundfish Committee re analyses for Amendment 23/Groundfish Monitoring", dated May 3, 2018; Attachment 5; https://s3.amazonaws.com/nefmc.org/7_190503-PDT-memo-to-GF-Committee-re-analyses-for-A23-with-attachments.pdf

6.6.10.5.1 Discard incentives for New England stocks

This analysis modelled the incentive to discard each allocated groundfish stock based on the economic incentives to retain or discard the catch. This analysis looks at incentives at the trip-level and from the perspective of a hired captain, or someone who is able to calculate expected costs associated with landing each individual fish as well as expected revenues. The model calculates the incentive to discard as the difference between the costs of landing and discarding each stock in each quarter of each fishing year between 2007 and 2017. Expected costs of landing include quota costs (modelled ACE lease prices), labor costs, and landing fees. Then the expected costs of discarding, specifically discarding legal sized fish which otherwise need to be retained, is the forgone revenue (ex-vessel price) as well as the probability that the illegal activity (discarding) will be discovered and the likely sanction.

Conclusions:

- Stocks landed with a positive discard incentive may indicate bias in the total catch estimate for that stock.
- In general, yellowtail flounder and cod stocks have the highest modeled discard incentives over time, but these are highly variable on a year to year basis.
    - All three (Georges Bank, Southern New England/Mid-Atlantic, and Gulf of Maine) yellowtail flounder stocks had higher discard incentives in earlier years (2010, 2012).
    - Both (Gulf of Maine and Georges Bank) cod stocks had higher discard incentives in recent years (2015-2017).
- Stocks with consistently low discard incentives include those with relatively low quota price to ex-vessel price ratios, including pollock, redfish, and Georges Bank haddock.
- Quota prices as a ratio of ex-vessel price drives modelled discard incentives. This ratio is the strongest theoretical predictor of bias.
- Utilization (catch: annual catch limit) is weakly related to quota price and varies by stock.
- The model can only identify when landings or trips comply with the discarding prohibition, even when it may not be economically rational to do so. The model cannot quantify the proportion of trips or catch that does not comply with the discarding prohibition.
- More precise estimates of quota prices will enhance the ability to model discard incentives under current conditions.
- There may be other social, cultural, or normative factors that may influence individuals' decisions to comply with discard rules that we do not account for in this analysis.

6.6.10.5.2 Observer effects in the groundfish fishery

This analysis demonstrates that fishing vessels in the groundfish fishery alter their behavior in response to human observers. The analysis looked at eight measures: namely (1) trip duration, (2) kept catch, (3) kept groundfish, (4) kept non-groundfish, (5) total revenue, (6) groundfish average price, (7) opportunity cost of quota, and (8) number of groundfish market categories included in kept catch. These measures cover a broad range of impacts that are relevant for observer-related fisheries management policy. The analyses were conducted separately for four stanzas (one pre-sector stanza and three post-sector stanzas) and also by fishing gear (gillnet and trawl).

Conclusions:

- This analysis demonstrates that fishing vessels in the Northeast multispecies (groundfish) fishery alter their behavior in response to human observers (distinct from selection bias/observer deployment effects). The analysis documents a consistent pattern of different fishing behaviors when an observer is on board.

- Data generated on observed trips are not representative of the whole fleet.
- Generally, the most pronounced effects are seen across trip duration, kept catch, kept groundfish, and trip revenue.
- Observer presence has the smallest effect on the number of groundfish market categories and non-groundfish average prices, but even in these instances differences are observed.
- The data show a trend for three key metrics, in almost all circumstances, such that when an observer is onboard, vessels appear to:
    1. Retain fewer fish,
    2. Fish for less time and,
    3. Obtain lower revenues.
- Persistent differences such as higher average groundfish prices with an observer on board (trawl vessels) and emerging differences like a greater number of market categories retained with an observer (gillnet vessels) indicate that the composition of catch on observed trips is different than unobserved trips.

6.6.10.5.3 Predicting groundfish catch in the presence of observer bias

This method used observed trips in the Gulf of Maine (GOM) stock area to model expected cod catch while accounting for typical effort attributes (e.g., total kept catch, vessel size, trip length) in addition to spatial and temporal covariance in catch. The approach creates a predictive model, which was used to predict total cod catch (kept + discarded) on observed trips, to test the performance of the model. The predictive model was then used to predict catch for unobserved trips. Both predictions were compared to the summed predictions across a fishing season to the catch estimates for sectors reported by NMFS. By modeling patterns of cod catch across space, time, and other attributes of fishing effort on observed trips, predictions of expected catch on unobserved trips were compared to the reported catch on these trips.

Conclusions:

- For gillnet trips, predicted cod catch was increasingly higher than reported catch from 2013 to 2017. Differences between predicted and reported catch on trawl trips were variable across time without an apparent trend.
- For both gear types, the proportion of total catch consisting of cod decreased over time, suggesting less targeting.
- There is some evidence that the magnitude of unreported cod catch (potentially illegal discarding) could have been >60% of reported catch on unobserved trips.
- An important caveat is that conclusions depend on validity of the model structure and predictions. If unmeasured attributes of effort (e.g. tow speed) and/or relationships between effort predictors and catch outcomes differ between observed and unobserved trips, predictions may not be valid. Differences in catch outcomes are assumed to be attributed to post-catch behavior (compliance, or lack thereof, with discarding regulations) and not pre-catch behavior (how the gear was fished).
- Results from models for pollock suggested a lack of model fit compared to those for cod, making conclusions equivocal for this species.

6.6.10.5.4 Methods to evaluate groundfish catch ratios

The objective of the study was to compare ratios of stock-specific landings to effort and total catch on observed and unobserved trips in the multispecies groundfish fishery to determine whether there is evidence of an observer effect. The hypothesis of the study was that if constraining stocks lead to illegal discards, this should be evident in differences in the stock specific ratios of landings to effort and total catch between observed and unobserved trips. The study assumes that differences are due to the observer effect (i.e., observed trips do not represent unobserved trips) and not due to the deployment effect (i.e., observers are not randomly distributed among fishing trips). Landings ratios were characterized at an aggregate level by gear type and broad stock area over an annual time step for both observed and unobserved trips.

Conclusions:

- Discrepancies exist between observed and unobserved trips, when comparing landing to effort ratios. Differences in the landing ratios between observed and unobserved trips suggest that observed trips are not representative of unobserved trips.
- This analysis assumes there are no observer deployment effects.
- For the Gulf of Maine broad stock area, this analysis demonstrates there were slightly more cod landings seen on observed trips relative to unobserved trips despite incentives to avoid cod on observed trips due to low ACLs from 2015 to 2017. This difference was consistent across effort metrics (K_{all} and DA[35]) and gear types.
- For the Offshore Georges Bank broad stock area and Inshore Georges Bank broad stock area (Statistical Reporting Area 521), more haddock are consistently landed on unobserved trips relative to observed trips. The differences in the haddock ratios may have less to do with the influences of haddock which was not constraining but perhaps more a function of other potentially constraining stocks on these trips targeting haddock.
- Documented differences in the stock landing to effort relationships reflects differences in discarding of legal sized fish on unobserved trips relative to observed trips.
- Interpretation of the magnitude of these differences is uncertain due to the potential inherent biases caused by incentives to avoid limiting stocks on observed trips.
- The magnitude of the differences in the landings to effort relationships between observed and unobserved trips is likely not an accurate estimation of the true extent of the potential missing removals.

6.6.10.5.5 Overall Conclusions

- All three analyses that compare observed and unobserved trip data conclude that observed trips are not representative of unobserved trips. The dimensions where observed trips differ from unobserved trips include:
    - Gulf of Maine cod catch rates,
    - Groundfish landings to effort ratios,
    - Trip duration,
    - Pounds of kept groundfish,
    - Pounds of total kept catch, and
    - Trip revenue.
- Documented differences in the stock landing to effort relationships reflect differences in discarding of legal sized fish on unobserved trips relative to observed trips.

[35] Kall = sum of kept catch of all species, similar to how effort is defined for discard estimation in monitoring and assessments; DA = days absent on a trip, a proxy for relative trip effort

- Despite removing Sector IX data from some of these analyses, fishery-wide bias is still demonstrated.
- The discard incentive model describes one mechanism to explain differences between observed and unobserved trips: the sector system increases the incentive to illegally discard legal-sized fish on unobserved trips.
- Discard incentives have varied across time and stock area. After full sector implementation, the accountability of discards and the application of sector/gear specific discard rates to unobserved trips, together with the potential catch of constraining stocks, increased the incentive to not comply with retention regulations.
- Given these conclusions, the current precision standard is not an appropriate method to set at-sea monitoring coverage levels because the assumption that observed trips are representative of unobserved trips is false.
- These analyses cannot quantify the differences between observed and unobserved trips in a way that allows for either a mathematical correction to the data or a survey design that resolves bias.
- Non-compliance with the requirement to land legal-sized fish of allocated stocks (excluding LUMF[36]) undermines any sampling design and should be addressed.
- While direct evidence of the incidence and magnitude of non-compliance is not captured, the documented differences in behavior are substantial enough to warrant concern that noncompliance is occurring, especially in view of incentives to be non-compliant while unobserved.
- Revisions to the monitoring program should consider ways to increase compliance or account for non-compliance. Substantially increasing the management uncertainty buffer might account for this non-compliance but would not improve our understanding of true removals and would result in foregone revenue for the fishery. Alternatively, increased monitoring and catch accounting may be one way to increase compliance and may be necessary to provide accuracy of catch.
- The analyses support more comprehensive monitoring in the fishery.

6.6.10.6 Summary of Groundfish Monitoring Cost Reports

The monitoring cost efficiency analysis (Appendix VI) provides information on the differences in the costs associated with, and the underlying qualities of, data generated by various catch monitoring technologies in the commercial groundfish fishery in the Northeast US. For at-sea catch monitoring, the analysis focuses on comparisons between cost estimates for human at-sea monitors/observers (ASM) and electronic monitoring with video recording cameras (EM), including three EM models: census, audit and compliance. An at-sea monitoring (ASM) contract costs report (Appendix VII) provides cost estimates for ASM contracts between sectors and providers, which are incorporated and modified in the monitoring cost efficiency analysis (see Appendix VI and Section 7.5.2.4.1).

6.6.10.7 Glossary of Monitoring Key Terms

The purpose of this glossary is to provide clear definitions to managers and the public on key terms commonly used in discussions of monitoring and used throughout the document.

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[36] LUMF = legal-sized un-marketable fish

Accuracy – The closeness of the estimated value of some quantity to the true value.

Bias - Systematic difference between the estimated value of some quantity and the true value being estimated.

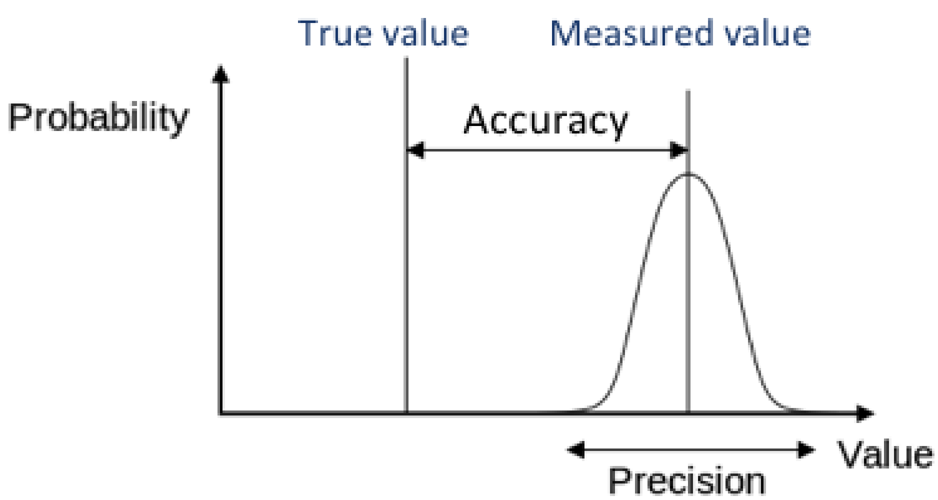
As described in the Standardized Bycatch Reporting Methodology (SBRM) Omnibus Amendment: the accuracy of the data from a sampling program rarely can be measured because the true value of the population feature being estimated is not known (which is why it is being estimated). While accuracy cannot be determined directly, an estimator can be tested for potential biases and precision with a simulated population where the truth is known. Sources of bias can be identified and reduced in the data collection program. Absent bias, precision supports accuracy; thus, bias and accuracy are used interchangeably, but bias is generally associated with the design of sampling program. Eliminating potential sources of bias improves the accuracy of the results.

Bias can be due to:

1) a statistical estimator that is not properly tuned, such that the expected value does not align with the true value
2) a sample that is not representative of the true population

In regard to SBRM, the ratio estimator used to estimate discards is an unbiased estimator of the true discard rate. Therefore, any bias in discard estimation is solely due to bias in the sampling program, such that observed trips are not representative of all trips due to various known and unknown factors.

If the degree of bias can be determined then the estimate can be adjusted for the bias to produce an estimate closer to the truth.



(Adapted from Wikipedia)

Bias in the Fishery Monitoring System:

Observer Bias: Also referred to as the 'observer effect'. Fishing activities on observed trips systematically vary from fishing activities on unobserved trips. This may be intentional or unintentional. Differences in fishing activities on observed trips versus on unobserved trips may arise due to the following: the act of knowing one is being watched results in changes in behavior (Hawthorne effect[37]); fishermen strategically altering behavior to avoid affecting the rest of the sector; costs associated with slower fish processing and handling; or increased catch accountability (quota limits more constraining).

Selection Bias: Also referred to as a 'deployment effect'. Occurs when the assignment of observers to vessels is non-random within sampling strata, resulting in a biased selection of trips across sampling strata. A *random* sampling design is one in which each sample has an equal probability of being chosen, so that a sample chosen randomly is meant to be an unbiased representation of the total population.

Discard estimation bias: When discards on observed trips are not representative of unobserved trips. Function of both observer and selection bias.

Self-reported data biases: Information from these sources may also contain errors or otherwise misrepresent information which contributes to bias. These errors may be intentional or unintentional. Examples include:

- VTRs: statistical areas fished
- Dealer reports: landings information
- VTRs: Kept catch for home consumption (not weighed out by a dealer)
- Learning curve bias: It takes time for captains to become familiar with electronic monitoring and electronic reporting, and for observers to become familiar with collecting and recording data.

Precision – (see above figure) How much estimates of the same quantity differ from each other across multiple samples, due both to sample variation and sample size.

Variability - Refers to the degree to which individual observations diverge from the mean and also how spread they are from one another (dispersion). The main measures used to assess the variability of data points in a sample are the range, mean, standard deviation, and variance.

As defined in the SBRM Omnibus Amendment: Precision is a measure of how closely repeated samples will agree to one another (i.e., the variability of the samples). The precision of a sampling program can be measured because the data collected can be compared with one another using several basic statistical methods (to calculate the variance, standard error, standard deviation, etc.). Because we can compare the samples to one another, we can calculate the variability and, hence, get a measure of the precision of the observations. In a sampling program such as the at-sea observer program, the precision of the observations can be measured and controlled by calculating measures of variability and, if necessary,

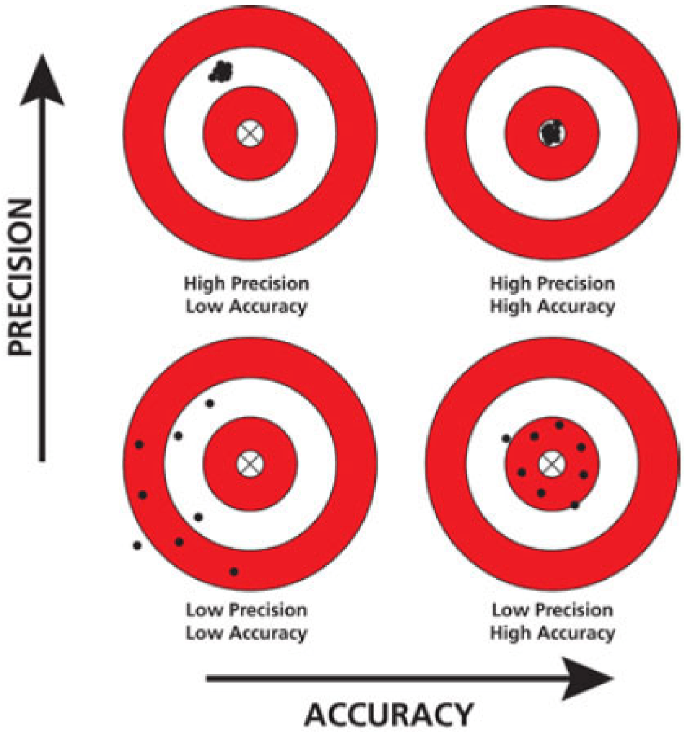
[37] Hawthorne effect describes a phenomenon in psychology when subjects behave differently when observed, which may be a result of conscious and subconscious behavior changes.

increasing the number of observations. Precision can also be increased through stratification (or changes to stratification), however, such changes may not be allowed through the mechanics of SBRM.

Coefficient of Variation – The ratio of the standard deviation to the mean. In other words, it is a measure of the extent of sample variation in relation to the mean of the population. It is useful for comparing the degree of variation from one data series to another, even if the means are drastically different from one another. In terms of an observer program, it is a standard measure of precision, calculated as the ratio of the square root of the variance of the bycatch estimate (i.e., the standard error) to the bycatch estimate itself. The higher the CV, the larger the standard error is relative to the estimate. A lower CV reflects a smaller standard error relative to the estimate.[38]

30 percent Coefficient of Variation precision standard (CV30) - Specified in the SBRM Omnibus Amendment, this performance standard for SBRM was also adopted as the current requirement for determining at-sea monitoring coverage levels. Total monitoring coverage levels for the groundfish fishery must be set so that they result in achieving the CV30 or better precision of the total discards at the overall stock level for each groundfish stock. Additionally, the current method for determining total monitoring coverage levels for the groundfish fishery applies a step to filter out healthy stocks, so that coverage levels are not driven by these stocks. Healthy stocks are defined as those in a given fishing year that are not overfished, with overfishing not occurring, according to the most recent available stock assessment, and; that in the previous fishing year less than 75 percent of the sector sub-ACL was harvested with less than 10 percent of catch comprised of discards.

[38] MAFMC/NEFMC. 2007. Northeast Region Standardized Bycatch Reporting Methodology: An omnibus amendment to the fishery management plans of the Mid-Atlantic and New England Regional Fishery Management Councils.



(from Wikipedia)

Reliability – The ability of the overall groundfish monitoring program to consistently provide an accurate estimate of total annual catch for each stock with a known level of precision. If estimates with similar accuracy and precision are achieved each year, year after year, they can be said to be reliable. In the context of a monitoring program, this refers to the consistency in quality of catch data, so that there is confidence that the monitoring program estimates each year can be used for catch accounting and stock assessment purposes. Reducing bias and improving accuracy in catch data increases reliability of the data.

Validity - The extent to which you are adequately measuring what you claim you are measuring. In the case of monitoring, validity could be in reference to the stock assessments and reliability could be in reference to the methods used to collect the data that goes into them. In other words, the sampling program could be said to produce reliable estimates, and if they are accurately representing the population they are providing for valid stock assessments.

Accountability – An obligation to be held responsible for one's actions.

In the case of a sector monitoring program, it is the concept of holding all sectors and their members to the same standards, such as matching catches with equivalent units of quota. An effective monitoring program is one designed so that each sector is confident that participants both within sectors and across all sectors are treated in a fair and equitable manner in terms of catch reporting requirements and ensuring catches do not exceed allocations. In the context of the groundfish fishery as a whole, it is being held accountable to the catch levels set by the measures of the management plan.

This includes responsibilities for vessels, sectors, and the agency. Vessels are responsible for complying with trip notification, assigned monitoring, and vessel reporting requirements. Sectors are responsible for contracting monitoring services as required and ensuring sector members comply with the vessel requirements, as well as sector-level monitoring and reporting requirements to manage allocations. NMFS is responsibility for equally and effectively administering a reporting and monitoring program that considers the impacts of the costs of the groundfish monitoring program with the tradeoffs of benefits of this program.

Amendment 16 provides the following rationale that is related to accountability:

The only fishing mortality control for sectors is the hard TAC that, if caught, results in the sector vessels not being allowed to fish. Effective management of sectors requires that catch be accurately known. This is important not only for managers but also so that each sector is confident that all sectors are being held to the same standards. The provisions in this section are designed to ensure that landings are accurately monitored.

Monitoring System Tools/Components:

<u>Dockside Monitoring (DSM):</u> Dockside monitoring is the independent verification or collection of fishery landings data. This may take several forms including:

> *Dockside monitor:* An independent party ensures that all landings are offloaded, sorted, and weighed correctly to ensure accurate catch accounting. An example of a DSM program that employs this form of DSM is the Canadian Department of Fisheries and Oceans (DFO) Maritimes Region DSM program.
>
> *Independent verification:* Catch is sorted and weighed by an independent party to ensure accurate catch accounting. An example of a DSM program that employs this form of DSM is the Canadian DFO Pacific Region DSM program.

<u>Monitoring at sea:</u> Independent third-party records fishery data while at sea.

> *Northeast Fisheries Observer Program (NEFOP):* The Northeast Fisheries Observer Program is administered over a range of commercial fisheries, including the groundfish, herring, squid, surf clam and ocean quahog, and lobster fisheries. NEFOP observers meet requirements of the Magnuson-Stevens Act and the SBRM Omnibus Amendment, the Marine Mammal Protection Act and the Endangered Species Act. The primary duty of observers is to record all kept and discarded catch, with discard information as the priority. Actual weights of catch should be collected whenever possible, with estimates or extrapolates of weights by sub-sampling as necessary. Other duties include collection of lengths of discards and kept catch of managed species, information on fishing gear, tow-by-tow information (location and time when fishing begins and ends), and detailed information on protected species interactions. Additionally, NEFOP observers collect biological samples from managed species and protected species.
>
> *At-Sea Monitoring (ASM):* The At-Sea Monitoring program is a vessel monitoring program that is specific to groundfish sector monitoring. The primary duty of at-sea monitors is to record all kept and discarded catch, with discard information as the priority. Actual weights of catch should be collected whenever possible, with estimates or extrapolates of weights by sub-sampling as

necessary. At-sea monitor duties are similar to those of NEFOP observers, with the exception that at-sea monitors do not collect biological samples and do not record the same level of detail on protected species interactions. Amendment 23 will consider changes to the ASM program.

Vessel Trip Report (VTR): Fishermen are required to fill out and submit self-reported trip reports for every trip, which provide information on when and where catch occurred. Information reported includes fishing location, time of fishing activity, gear characteristics, and estimates of catch and discards by species.

Vessel Monitoring System (VMS): Systems used to track and monitor the activities of fishing vessels.

Hailing notifications: Notifications sent prior to starting a trip (trip start hail) or at the end of a trip (trip end hail) which may include specific fishing information such as areas fished, gear type used, when and where the vessel will be landing, if the product is being trucked or where the fish is going.

Pre-Trip Notification System (PTNS): The system used to ensure groundfish vessels selected to carry observers are representative of fishing activities sufficient to meet precision requirements across sampling strata (CV30). PTNS requires fishing vessels to notify all trips at least 48 hours in advance, but no more than 10 days in advance.

Electronic Monitoring (EM): EM uses camera, sensors, and GPS on vessels to record a variety of information which may be very specific to the fishery and data needs including: vessel fishing location, fishing activity, catch, discards, and compliance with regulations.

Audit model: Where EM runs on 100% of trips and a subset of hauls or trips is reviewed to verify VTR-reported discards.

Census: Where EM runs on 100% of trips and 100% of hauls and trips are reviewed.

Maximized retention: Where EM runs on 100% of trips to verify retention of all groundfish species. For this approach, vessels would be required to land all groundfish, which would eliminate the need to monitor discards. Dockside monitoring would be used to sample all landed groundfish, which would now include fish that previously would have been sublegal.

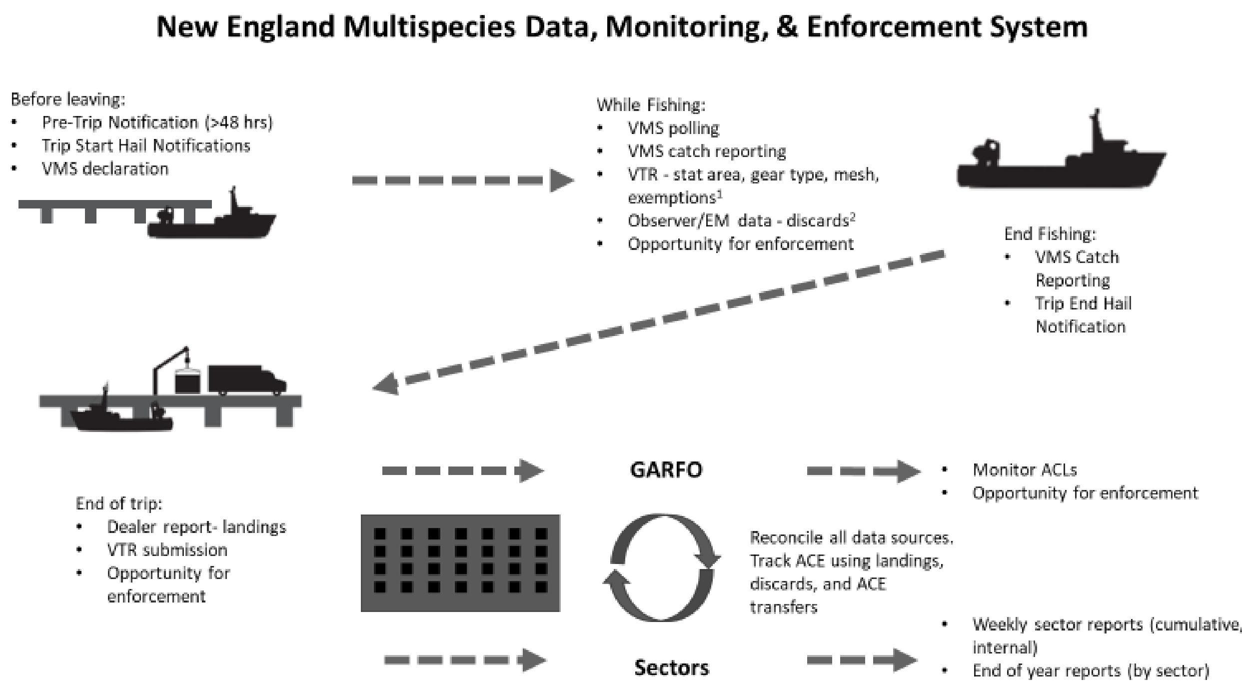
Electronic Reporting (ER): Reporting electronically, with the goal of reducing paper and lag time.

For example, eVTR, or electronic reporting of vessel trip reports. Currently eVTR is an option for vessel operators in the commercial groundfish fishery to choose to report by eVTR but is not a requirement. Additionally, dealers report electronically, and sector managers submit sector catch data electronically.

Enforcement: Enforcement agents from a variety of agencies including state fish and wildlife departments, NOAA Office of Law Enforcement, and U.S. Coast Guard may board and inspect vessels at sea or inspect landings for compliance with federal and state regulations. The purpose of enforcement activities is to inspect fishing operations for compliance with regulations and administer penalties if found in violation. This is distinct from the goals of monitoring systems, in which the purpose is to collect catch data for use in management and scientific processes. For example, the goal of the ASM program is to collect catch data for quota management, and while it may provide information useful to enforcement or

1: VTRs are used primarily in the current data system for catch monitoring by apportioning dealer reported landings and either observed or estimated discards by identifying changes in sampling strata (statistical areas, gear type, mesh size).

2: In addition to discard information, observers also collect information on protected species interactions and kept catch encourage compliance, it is not designed as an enforcement tool. However, the previous dockside monitoring program was more enforcement focused as it did not collect or generate any additional data, and only acted to notify as to whether or not the reported data was falsified.



Discards: Catch that is not landed.

Economic discards: discards of undesirable or unprofitable species. Reasons for economic discarding include quota limitations, highgrading, unmarketable (spoiled, dead, or low quality). Depending on the quota system, economic discards may be limited to certain situations, or must still be covered with sufficient quota. The current sector regulations prohibit discarding of legal-size allocated fish, except for legal-size unmarketable fish (e.g., fish damaged by slime eels, seals, or gear).

Regulatory discards: Also known as mandatory or required discards. Discards that are required under the fishery management regulations, for example for prohibited species catches or for species that do not meet size requirements.

6.6.11 Analysis to Develop Alternatives

6.6.11.1 Groundfish Landings by Port and Vessel

Background analysis of total annual groundfish landings by port to determine the landings threshold for lower coverage for low volume ports

Option A would allow for lower levels of dockside monitoring for low volume ports to act as a "spot check." To determine which ports would be considered low volume, an analysis of total annual groundfish landings by port was done. Offloads at ports that received ~98 percent of total annual groundfish landings for 2016-2018 would be monitored at 100 percent coverage. These "major" ports are those in the top nine – New Bedford, MA; Gloucester, MA; Boston, MA; Portland, ME; Chatham, MA; Point Judith, RI; Seabrook, NH; Rye, NH; and Portsmouth, NH (Figure 10). Offloads in these nine major ports would be monitored at 100 percent coverage, whether dockside monitoring is a dealer-funded program or a vessel-funded program. All other ports would be considered "low volume" as characterized by lower landings volumes, and offloads in these ports would be monitored at the lower coverage level of 20 percent. This means that ports which land approximately 2 percent of total groundfish pounds would be exempted from 100 percent coverage and would be monitored at 20 percent coverage instead, as a spot check.

Originally, when this alternative was first being developed the criteria used to determine the ports that would be considered low volume and would be subject to lower coverage were those ports with total annual groundfish landings volumes in the 5th percentile of total annual landings volume from 2016-2018. Under the 5th percentile criteria the major ports were: New Bedford, MA; Gloucester, MA; Boston, MA; and Portland, ME. However, the list of major ports was expanded to the top nine in order to address concerns about landings of individual stocks, particularly stocks of concern due to poor stock status. There are several stocks in relatively poor condition that are landed primarily in one or two ports that fall outside the list of major ports using the original criteria, such as Southern New England stocks landed in Point Judith, RI for example (Figure 11). Therefore, the criteria was expanded to shift several ports into the 100 percent dockside monitoring category to improve monitoring of landings for those stocks. This measure would include a periodic re-evaluation of what constitutes a "low volume port" based on landings volumes, to occur after two years of landings data is available and every three years after that.

Figure 10 - Proportion of total annual groundfish landings by port from FY2012-2018 for the top seven ports (Boston/Scituate combined for confidentiality; NH includes Portsmouth, Rye, and Seabrook). This option uses 2016-2018 as the qualifying period.

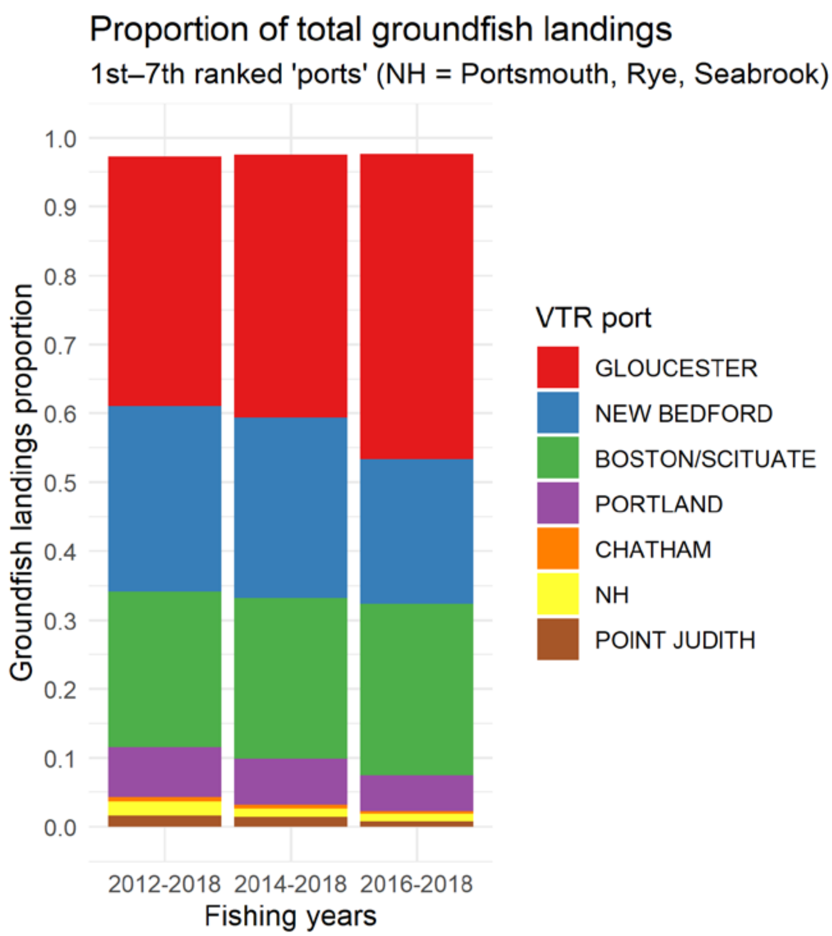
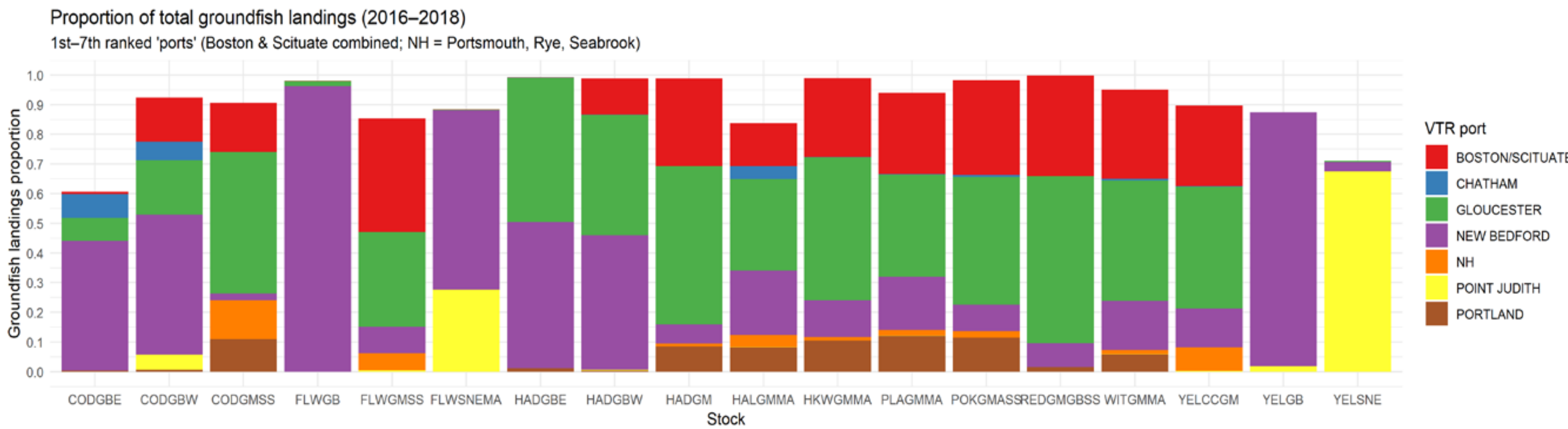


Figure 11 - Proportion of total stock landings by port area over the 2016-2018 period. Proportions do not sum to one since not all port areas are represented.



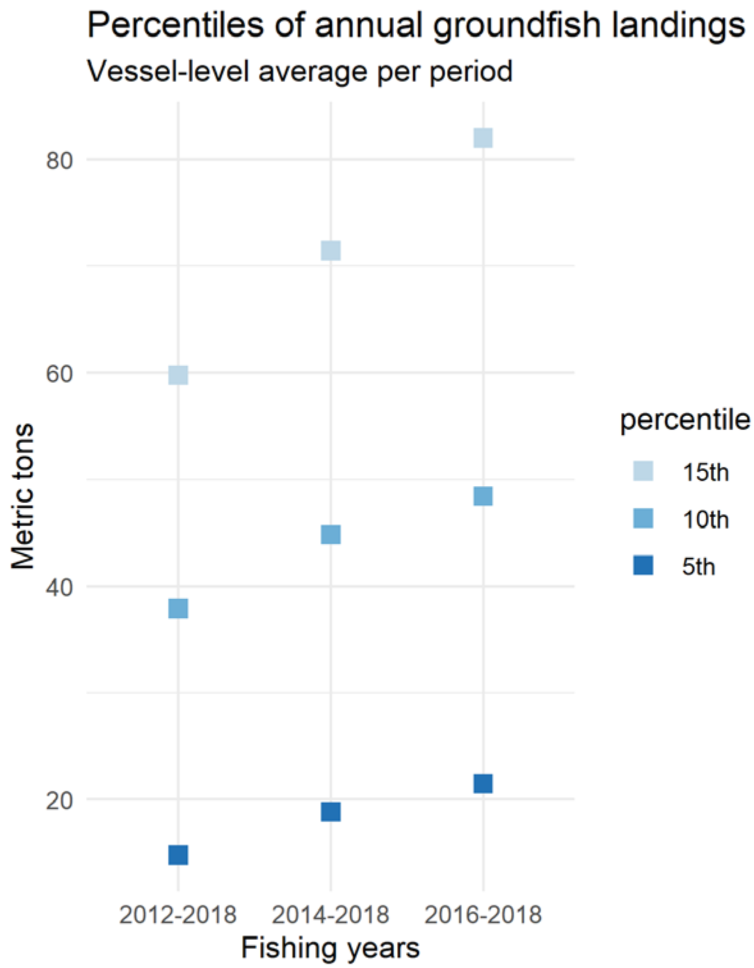
Key:

CODGBE=GB East Cod
CODGEW=GB West Cod
CODGMSS=GOM Cod
FLWGB=GB Winter Flounder
FLWGMSS=GOM Winter Flounder
FLWSNEMA=SNE/MA Winter Flounder
HADGBE=GB East Haddock
HADGBW=GB West Haddock
HADGM=GOM Haddock
HALGMMA=Atlantic Halibut
HKWGMMA=White Hake
PLAGMMA=American Plaice
POKGMASS=Pollock
REDGMGBSS=Redfish
WITGMMA=Witch Flounder
YELCCGM=CC/GOM Yellowtail Flounder
YELGB=GB Yellowtail Flounder
YELSNE=SNE/MA Yellowtail Flounder

Background analysis of total annual groundfish landings by vessel to determine the landings threshold for lower coverage for low volume vessels

Option B would allow for lower levels of dockside monitoring for low volume vessels to act as a "spot check." To determine which vessels would be considered "low volume", an analysis of total annual groundfish landings by volume was done. Vessels with total annual groundfish landings volumes in the 5th percentile of total annual landings volume for 2016-2018 were determined to be low volume and offloads from these vessels would be monitored at a lower "spot check" coverage under this option. This means that vessels which land approximately 5 to 10 percent of total groundfish pounds each year would be exempted from 100 percent dockside monitoring coverage and offloads from these vessels would be monitored at 20 percent coverage instead, as a spot check. Vessels that landed 90-95 percent of groundfish for 2012-2018 would have 100 percent of their offloads monitored. The vessels that cover ~95 percent of total groundfish landings are those that landed 46,297lbs or more annually on average from 2016-2018 (Figure 12). Offloads from vessels landing 46,297lbs or more annually, would be monitored at 100 percent coverage, whether dockside monitoring is a dealer-funded program or vessel-funded program. Offloads from vessels with annual landings volumes of less than 46,297lbs, would be monitored at the lower coverage rate of 20 percent. This measure would include a periodic re-evaluation of what constitutes a "low volume vessel" based on landings volume, to occur after two years of landings data is available and every three years after that.

Figure 12 - Percentiles of total annual groundfish landings from FY2012--2018. This option uses 2016-2018 as the qualifying period.



6.6.11.2 Groundfish Catches West of 72 Degrees 30 Minutes West Longitude and 71 Degrees 30 Minutes West Longitude

Groundfish catch west of 72 degrees 30 minutes west longitude

The PDT examined groundfish catch west of 72 degrees 30 minutes west longitude, an area at or beyond the western limits of most groundfish species. This analysis presents data on landings and discards for groundfish trips taken during 2010-2017.

The catch summaries presented here represent the best available data from a combination of vessel trip reports (VTRs), dealer reports, and both NEFOP and ASM observer records. We only used trips with a VTR-reported longitude that matched the VTR-reported statistical area, given that longitude records are prone to reporting errors.

Groundfish catch west of 72 degrees 30 minutes west longitude. Table 65 and Table 66 present the total landings and observed discards, respectively, for each groundfish stock from 2010-2017 on trips where the reported longitude was west of 72 degrees 30 minutes west longitude. Landings came from all eligible groundfish trips while discards were restricted to observed trips (NEFOP or ASM). Table 67 presents the proportion of total groundfish catch (landings + discards) in the Greater Atlantic that was caught west of 72 degrees 30 minutes west longitude during the same period.

Total groundfish catch across longitudes. Figure 13 and Figure 14 present the trip-level landings and observed discards, respectively, for each groundfish stock from 2010-2017 for trips across all longitudes. A dashed line indicates 72 degrees 30 minutes west longitude and individual trips are colored by year (with later years plotting on top of earlier years). As with the data presented in the tables, low amounts of groundfish landings and discards are apparent west of –72 degrees 30 minutes west longitude, particularly in more recent years.

Table 65 - Groundfish landings (tons) west of 72 degrees 30 minutes west longitude.

stock	2010	2011	2012	2013	2014	2015	2016	2017
Cod (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cod (GB west)	0.71	3.34	0.63	0.52	0.16	0.21	0.11	0.02
Cod (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windowpane (S)	0.94	1.63	0.00	0.00	0.00	0.03	0.00	0.00
Windowpane (N)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (SNE/MA)	1.82	3.28	0.02	21.16	4.41	2.82	2.66	3.91
Haddock (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GB west)	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
Haddock (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic halibut	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00
White hake	0.35	0.23	0.03	0.20	0.00	0.00	0.04	0.08
Ocean pout	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American plaice	0.00	0.94	0.00	0.00	0.00	0.03	0.00	0.00
Pollock	0.11	0.86	0.26	0.09	0.00	0.00	0.45	0.03
Redfish	0.00	0.00	0.00	0.00	0.00	0.00	4.40	0.00
Witch fl	0.00	0.04	0.08	1.18	0.10	0.11	0.01	0.00
Wolffish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (SNE/MA)	4.87	6.94	9.83	5.94	7.39	0.95	0.02	0.03

Table 66 - Groundfish discards (tons) west of –72 degrees 30 minutes west longitude.

stock	2010	2011	2012	2013	2014	2015	2016	2017
Cod (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cod (GB west)	2.33	1.63	0.37	0.41	0.12	0.07	0.03	0.01
Cod (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windowpane (S)	3.27	23.14	3.75	7.24	7.58	2.22	1.51	0.24
Windowpane (N)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (SNE/MA)	0.47	5.93	0.61	0.86	0.23	0.07	0.08	0.02
Haddock (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GB west)	0.07	0.08	0.08	0.29	1.72	1.06	0.76	0.01
Haddock (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic halibut	0.48	0.16	0.33	0.20	0.07	0.31	0.01	0.00
White hake	0.25	0.19	0.19	0.11	0.10	0.04	0.02	0.00
Ocean pout	1.82	2.67	1.33	1.21	1.10	0.21	0.14	0.01
American plaice	1.03	0.18	0.16	0.12	0.26	0.12	0.04	0.01
Pollock	1.38	0.97	0.59	0.22	0.11	0.15	0.01	0.00
Redfish	0.09	0.07	0.10	0.53	0.75	0.05	0.00	0.02
Witch fl	0.39	0.11	0.08	0.24	0.27	0.10	0.04	0.02
Wolffish	0.40	0.30	0.04	0.02	0.03	0.02	0.00	0.00
Yellowtail fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (SNE/MA)	1.58	0.27	0.85	0.32	0.23	0.10	0.04	0.00

Table 67 - Proportion of groundfish catch west of –72 degrees 30 minutes west longitude.

stock	2010	2011	2012	2013	2014	2015	2016	2017
Cod (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cod (GB west)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cod (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windowpane (S)	0.06	0.22	0.03	0.06	0.08	0.02	0.01	0.00
Windowpane (N)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (SNE/MA)	0.05	0.09	0.01	0.03	0.01	0.00	0.01	0.01
Haddock (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GB west)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic halibut	0.02	0.00	0.01	0.00	0.00	0.01	0.00	0.00
White hake	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ocean pout	0.03	0.04	0.03	0.04	0.03	0.00	0.01	0.00
American plaice	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pollock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Redfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Witch fl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wolffish	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (SNE/MA)	0.04	0.02	0.02	0.02	0.02	0.00	0.00	0.00

Figure 13 - Landings on all groundfish trips, 2010-2017. The dashed line indicates 72 degrees 30 minutes west longitude.

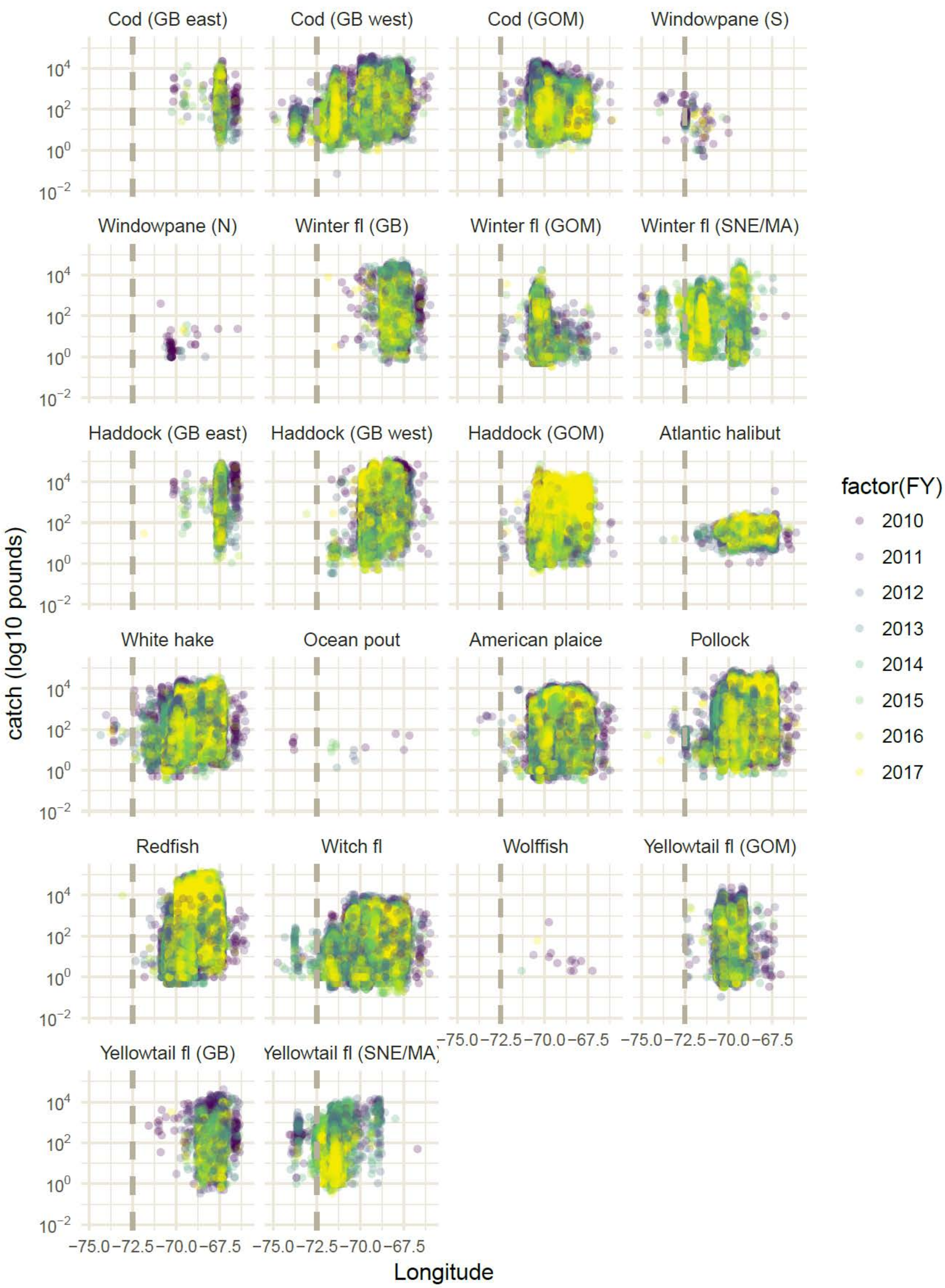
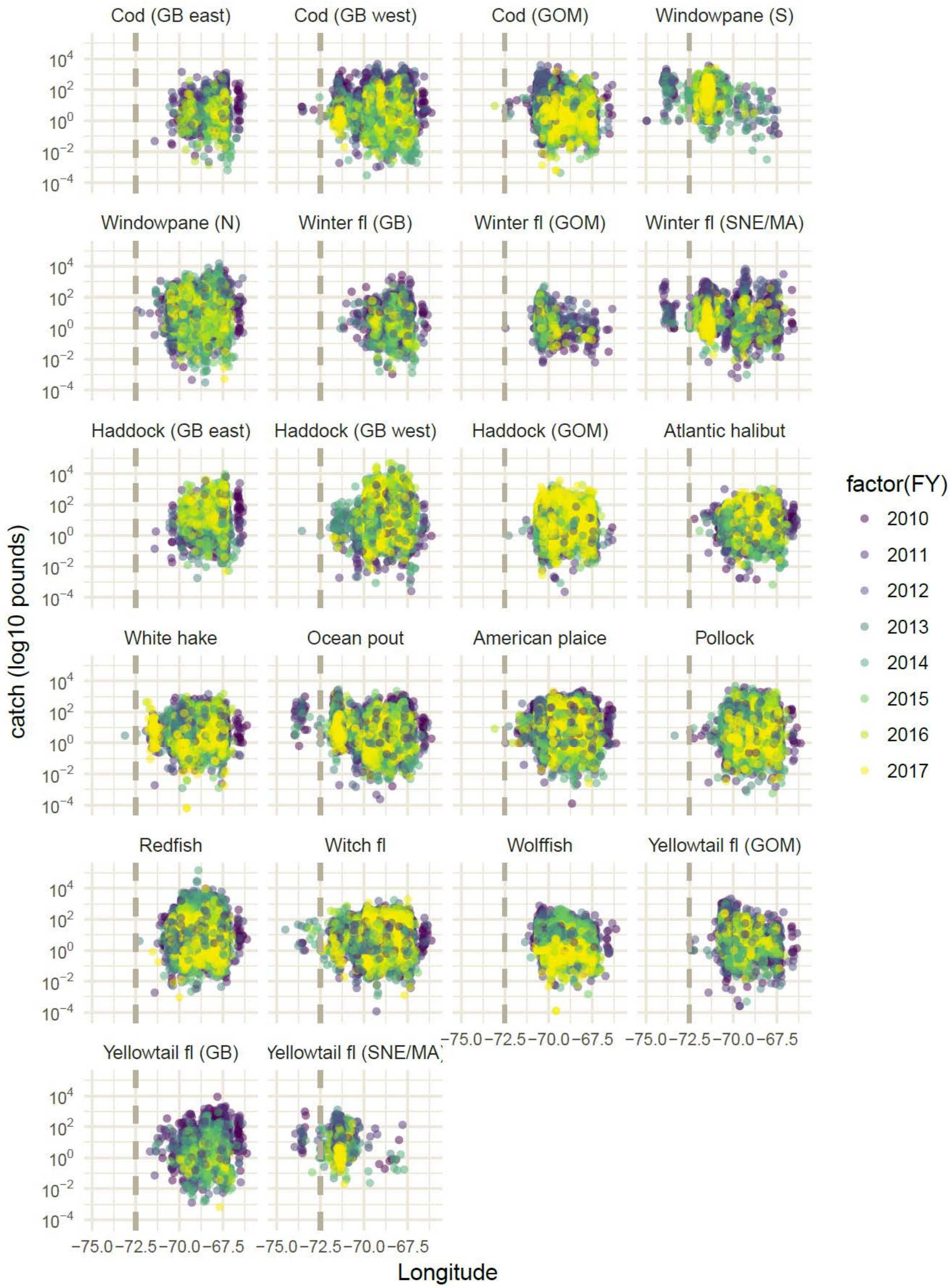


Figure 14 - Discards on observed groundfish trips, 2010-2017. The dashed line indicates 72 degrees 30 minutes west longitude.



Groundfish catch west of 71 degrees 30 minutes west longitude

The PDT examined groundfish catch west of 71 degrees 30 minutes west longitude, an area at or beyond the western limits of most groundfish species. This analysis presents data on landings and discards for groundfish trips taken during 2010-2017.

The catch summaries presented here represent the best available data from a combination of vessel trip reports (VTRs), dealer reports, and both NEFOP and ASM observer records. We only used trips with a VTR-reported longitude that matched the VTR-reported statistical area, given that longitude records are prone to reporting errors.

Groundfish catch west of 71 degrees 30 minutes west longitude. Table 68 and Table 69 present the total landings and observed discards, respectively, for each groundfish stock from 2010-2017 on trips where the reported longitude was west of 71 degrees 30 minutes west longitude. Landings came from all eligible groundfish trips while discards were restricted to observed trips (NEFOP or ASM). Table 70 presents the proportion of total groundfish catch (landings + discards) in the Greater Atlantic that was caught west of 71 degrees 30 minutes west longitude during the same period.

Total groundfish catch across longitudes. Figure 15 and Figure 16 present the trip-level landings and observed discards, respectively, for each groundfish stock from 2010-2017 for trips across all longitudes. A dashed line indicates 71 degrees 30 minutes west longitude and individual trips are colored by year (with later years plotting on top of earlier years). As with the data presented in the tables, low amounts of groundfish landings and discards are apparent west of 71 degrees 30 minutes west longitude, particularly in more recent years, though non-negligible catch of southern windowpane, SNE winter flounder, SNE yellowtail flounder, and ocean pout are apparent.

Table 68 - Groundfish landings (tons) west of 71 degrees 30 minutes west longitude.

stock	2010	2011	2012	2013	2014	2015	2016	2017
Cod (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cod (GB west)	18.86	24.43	16.94	19.88	11.19	32.93	18.66	2.71
Cod (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windowpane (S)	7.57	7.64	3.50	0.24	0.10	0.13	0.00	0.10
Windowpane (N)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (SNE/MA)	1.71	4.77	0.87	270.07	95.48	192.44	109.80	75.59
Haddock (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GB west)	5.77	0.01	0.01	0.03	0.01	0.00	0.14	0.13
Haddock (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic halibut	0.02	0.00	0.03	0.08	0.03	0.00	0.01	0.00
White hake	14.07	0.91	0.88	0.23	2.17	0.30	0.10	0.11
Ocean pout	0.44	0.00	0.08	0.00	0.00	0.02	0.00	0.00
American plaice	0.11	0.96	0.01	0.00	0.02	0.09	0.01	0.06
Pollock	0.31	1.20	0.42	0.47	0.64	0.01	0.48	1.67
Redfish	0.03	0.00	0.02	0.00	0.00	0.00	4.40	0.00
Witch fl	2.84	1.35	1.67	4.42	1.28	1.37	0.48	0.21
Wolffish	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.00
Yellowtail fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (SNE/MA)	30.72	72.37	146.60	180.41	61.08	85.76	19.59	5.70

Table 69 - Groundfish discards (tons) west of 71 degrees 30 minutes west longitude.

stock	2010	2011	2012	2013	2014	2015	2016	2017
Cod (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cod (GB west)	8.78	3.67	4.14	3.13	0.55	1.21	0.41	0.31
Cod (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windowpane (S)	27.83	69.17	43.76	68.63	39.36	76.08	79.10	26.93
Windowpane (N)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (SNE/MA)	10.89	30.31	21.11	6.26	1.48	5.08	4.67	2.15
Haddock (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GB west)	0.61	0.73	2.94	4.41	6.04	13.24	5.54	1.19
Haddock (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic halibut	0.67	0.52	1.10	0.56	0.22	0.61	0.12	0.10
White hake	0.60	0.61	0.61	0.30	0.37	0.17	0.77	0.55
Ocean pout	8.08	14.61	9.98	8.66	7.84	12.91	2.49	1.09
American plaice	4.23	1.64	1.54	0.82	1.01	2.55	1.58	0.32
Pollock	1.92	1.39	1.12	0.49	0.35	0.23	0.15	0.01
Redfish	0.44	0.55	0.61	1.53	2.13	0.52	0.35	0.54
Witch fl	1.80	1.31	0.78	1.23	1.29	4.96	1.22	0.47
Wolffish	1.26	0.55	0.15	0.15	0.08	0.48	0.01	0.00
Yellowtail fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (SNE/MA)	4.75	8.33	17.07	5.89	1.27	6.75	1.84	0.46

Table 70 - Proportion of groundfish catch west of 71 degrees 30 minutes west longitude.

stock	2010	2011	2012	2013	2014	2015	2016	2017
Cod (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cod (GB west)	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.01
Cod (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windowpane (S)	0.48	0.61	0.41	0.60	0.42	0.56	0.62	0.38
Windowpane (N)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter fl (SNE/MA)	0.25	0.34	0.20	0.35	0.18	0.29	0.25	0.19
Haddock (GB east)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GB west)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haddock (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic halibut	0.02	0.01	0.02	0.01	0.01	0.01	0.00	0.00
White hake	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ocean pout	0.13	0.23	0.25	0.26	0.24	0.25	0.15	0.10
American plaice	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pollock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Redfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Witch fl	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00
Wolffish	0.06	0.02	0.00	0.01	0.01	0.03	0.02	0.00
Yellowtail fl (GOM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (GB)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellowtail fl (SNE/MA)	0.21	0.21	0.35	0.50	0.16	0.33	0.34	0.43

Figure 15 - Landings on all groundfish trips 2010-2017. The dashed line indicates 71 degrees 30 minutes west longitude.

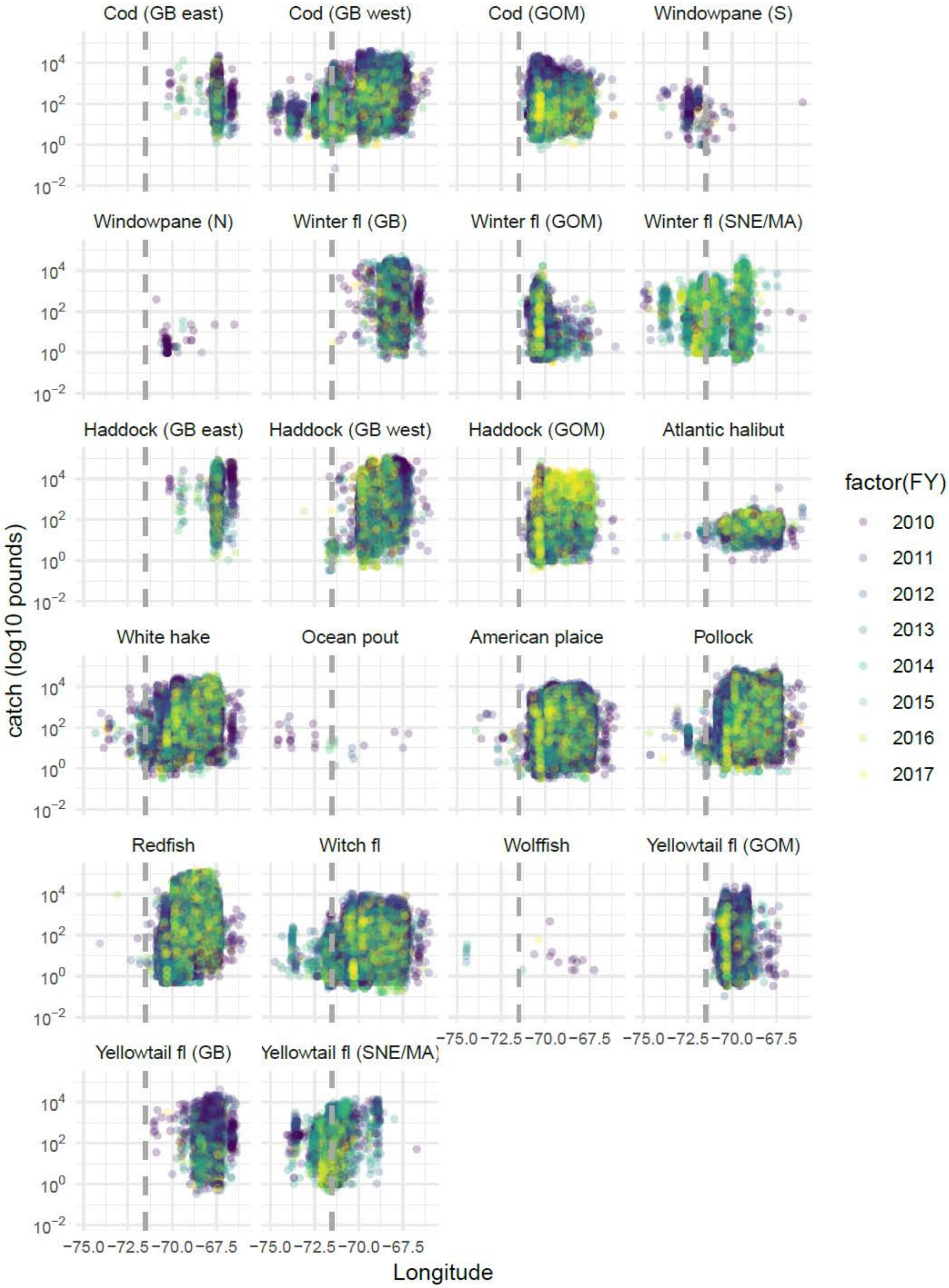
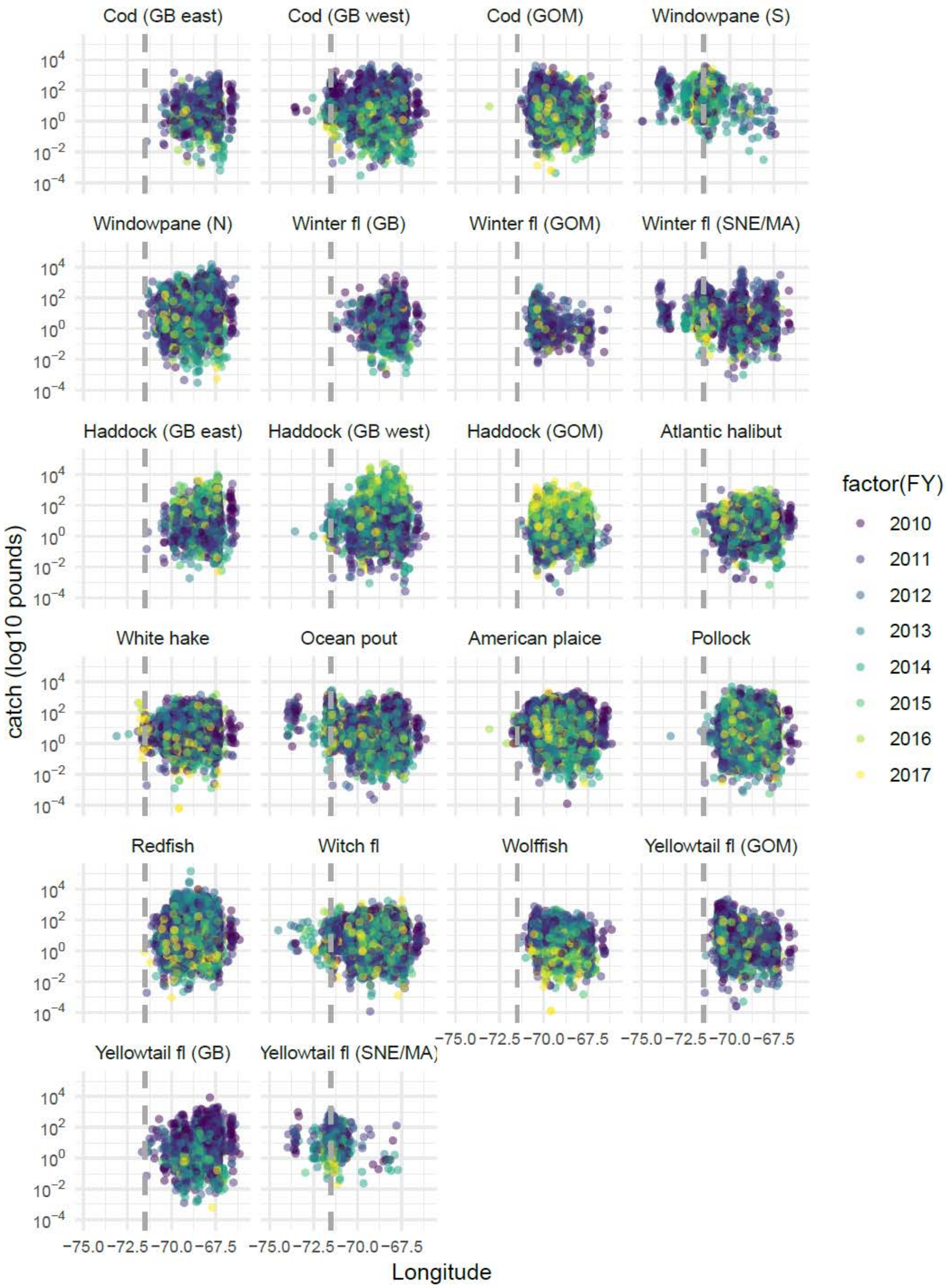


Figure 16 - Discards on observed groundfish trips 2010-2017. The dashed line indicates 71 degrees 30 minutes west longitude.



7.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

7.1 INTRODUCTION

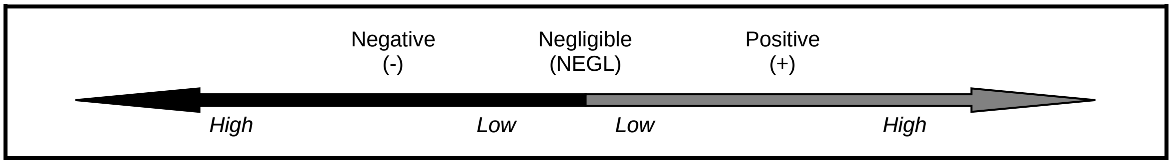
The impacts of the alternatives under consideration are evaluated herein relative to the valued ecosystem components (VECs) described in the Affected Environment (Section 6.0) and to each other.

7.1.1 Evaluation Criteria

This action evaluates the potential impacts of alternatives using the criteria in Table 71.

Table 71 - Terms used to summarize impacts on VECs.

	Direction		
VEC	**Positive (+)**	**Negative (-)**	**Negligible/Neutral**
Allocated target species, other landed species, and protected species	Actions that increase stock/population size for stocks in rebuilding. For stocks that are rebuilt, actions that maintain stock population sizes at rebuilt levels. For protected species, actions that increase the population size, or decrease gear interactions.	Actions that decrease stock/population sizes for overfished stocks. Actions that would cause a rebuilt stock to become overfished. For protected species, actions that decrease the population size, or increase or maintain gear interactions.	Actions that have little or no positive or negative impacts to stocks or populations.
Physical Environment/ Habitat/EFH	Actions that improve the quality or reduce disturbance of habitat	Actions that degrade the quality or increase disturbance of habitat	Actions that have no positive or negative impact on habitat quality
Human Communities	Actions that increase revenue and social well-being of fishermen and/or associated businesses	Actions that decrease revenue and social well-being of fishermen and/or associated businesses	Actions that have no positive or negative impact on revenue and social well-being of fishermen and/or associated businesses
	Impact Qualifiers:		
	All VECs: Mixed	**both positive and negative**	
Low (L, as in low positive or low negative)	To a lesser degree		
High (H; as in high positive or high negative)	To a substantial degree (not significant)		
Likely	Some degree of uncertainty associated with the impact		



7.1.2 Approach to Impacts Analysis

The specific approach to impacts analysis is described under each of the VECs – regulated groundfish and other species (Section 7.2), essential fish habitat (Section 7.3) endangered and other protected species (Section 7.4), human communities – economic (Section 7.5), and human communities – social (Section 7.6). Cumulative effects analysis is also provided (Section 7.7).

7.2 IMPACTS ON REGULATED GROUNDFISH AND OTHER SPECIES – BIOLOGICAL

The biological impacts discussed in this section focus on expected changes resulting from selection of each of the proposed alternatives and were developed using qualitative and quantitative methods. In this section, biological impacts are discussed in relation to impacts on regulated multispecies (groundfish) – target and non-target – and non-groundfish species – incidental catch and bycatch of other species. Impacts on protected resources and essential fish habitat are discussed in separate sections.

Overall biological impacts of improved monitoring of the commercial fishery

The biological impacts from improvements in monitoring of the commercial groundfish fishery will depend on the amount of unknown mortality that is currently caused by missing catch. Improvements in monitoring of the commercial groundfish fishery should reduce the amount of unknown missing catch and this catch will then get accounted for through the output control management system which will also improve catch data streams feeding into stock assessments. Biological impacts are difficult to assess because we do not know the true amount of missing stock specific removals through time. If missing catch is a relatively important component of total mortality for a stock, then improvements in monitoring may yield substantial biological impacts. If the missing catch is consistent over time, it may not affect assessment results (Rudd and Branch 2016). However, in this case, missing catch may have changed with the shift to sectors in 2010 because the incentives for discards and/or misreporting changed. The true biological impacts also depend on the implications of missing historical catch on potential changes to the stock assessments. For example, shifts to empirical based assessments due to unknown removals from the past will likely lead to unknown biological impacts. However, if stock assessments are static with the present ABCs/ACLs then improvements in monitoring (higher total catch from improved monitoring of missing catch) in the short-term could limit fishing effort further depending on the amount of bias in the catch data. This will sequentially result in positive biological impacts. Regardless of the stock status, if true catches are under-estimated because of poor monitoring, catches may exceed ACLs, so improved monitoring should result in a positive biological impact for the stock. The many unknowns associated with improvements in monitoring makes the quantitative determination of biological impacts difficult if not impossible to predict. We can only qualitatively rank alternatives relative to each other while also assuming improvement in monitoring will not fundamentally change how the assessments are done in the short-term. For example, increases in coverage rates that result in less bias through missing catch should result in less fishing effort and therefore produce a positive biological impact under the present catch limits.

In summary, the biological impacts are dependent on how improvements in monitoring of the commercial groundfish fishery will affect fishing effort regardless of what is known or unknown about the stock from the stock assessment. How exactly improvements in monitoring will affect fishing effort on each stock is unknown. Comprehensive improvements in monitoring will likely influence two different factors with regards to the biological impacts:

1) It could potentially have positive biological impacts by lowering fishing effort on stocks that are overfished due to higher total catch reporting from improved monitoring of missing catch, and
2) Improvements in monitoring should also improve stock assessments, stock status determination and the ability to quantify biological impacts in the future.

However, improvements to the stock assessments though improvements in monitoring will likely be different in the short-term relative to the long-term.

Biological impacts are broken down by short- and long-term impacts because stock assessments rely on historical data for the determination of stock status, management reference points, and catch advice. Therefore, if improvements in catch monitoring produce a perceived change in catch then improvements in the stock assessments in the short-term may be limited due to the assessments' reliance on historical catch data. We defined short-term as up to five years but this could be longer depending on the potential bias and the ability to estimate such a bias in the historical time series. In the long-term, which we defined as greater than five years, a better estimate of removals should result in improvements in the stock assessments. However, the realized improvements to stock assessments may take much longer than five years. It is not clear, where a distinction should be made between short-term and long-term. This time frame may also differ among stocks depending on the assessment.

In conclusion, improvements in monitoring which reduce fishing mortality through better catch accounting should produce positive biological impacts in the short-term. In the longer-term analytical assessments should improve with better catch data which should lead to subsequent improvements in groundfish catch advice and management.

Catches by fishery components other than the commercial groundfish fishery (e.g., sea scallop fishery, recreational groundfish fishery) are not evaluated, since A23 focuses on improving monitoring in the commercial groundfish fishery. An overview of these fishery components can be found in the Affected Environment (see Section 6.6.8) and recreational fisheries catches and groundfish caught as bycatch in other fisheries are routinely analyzed in Framework Adjustments to the FMP (e.g., FW56, FW57, FW58, and FW59).

7.2.1 Commercial Groundfish Monitoring Program Revisions (Sectors Only)

7.2.1.1 Sector Monitoring Standards (Target Coverage Levels)

The following is an overview of *possible* short-term and long-term impacts of the highest target coverage option -100% monitoring of all sector trips on regulated groundfish species.

- Short-term (upon implementation and up to five years)
  - Improve accuracy of catch attribution at the stock-level
  - Increase accuracy of the magnitude of catches for discard-only stocks
  - Reduce the likelihood of overfishing because in-season catch monitoring would improve – such that the "true" catch would be better known for the sector fishery
  - Reduce the likelihood that illegal discarding would occur because monitoring would have an ancillary benefit of increasing compliance. This should better control fishing mortality.
  - Increase accuracy and precision of commercial sector catch going into the assessments

- Long-term (greater than five years)
  - Improve estimation of fishing mortality and stock biomass
  - Increase the likelihood of rebuilding overfished stocks by constraining the true catch to be consistently lower than ACLs. Increased accuracy of catch data can also lead to reduced uncertainty in the stock assessments.
  - Improvements in model diagnostics if monitoring shows that missing catch was a significant issue in the past.
  - Allow for consideration of a wider-range of stock assessment approaches – for example shifting from low information content empirical approaches to the development of full analytical assessments.
  - Improvements in groundfish management through the more accurate catch advice from assessments.

The following analyses examined how various levels of observer coverage (25– 100%) would influence the estimation of groundfish catch. In the absence of bias, an increase in sampling will result in a subsequent increase in precision and, assuming the stratification is appropriate with random sampling, an increase in accuracy. When observed trips are not representative of all groundfish trips, bias is manifested by having estimates of discards that are different from the actual catch (inaccurate). Low variability around a discard estimate with non-representative sampling will only suggest that the discard estimate is precisely wrong.

We simulated how inferences regarding annual catch (landings + discards) for groundfish stocks would be affected under various levels of observer coverage, and what happens in the presence of observer bias. Here, we assumed that observer bias results in the true discard rate on unobserved trips being some inflated factor of the observed discard rate (e.g., truth = observed x10). As coverage increases to 100%, the effective bias of unobserved trips reduces to zero. Therefore, observer bias is expected to be most problematic at low levels of observer coverage.

Methods
We used the observed and estimated discards on all groundfish trips from 2010–2017 to serve as the population of actual discards during this period. Note, discards in this case refer to any discarded fish as recorded by the observer (e.g., sub-legal, legal-sized unmarketable fish [LUMF], illegal). While illegal discarding of legal-sized fish can and has been observed, its occurrence is relatively rare in the observer data. For this reason, the observer data cannot provide any context for the amount of illegal discarding that may occur on unobserved trips and how that affects total catch estimation.

For each combination of 5 levels of coverage (10%, 25%, 50%, 75%, 100%) and 4 levels of bias (1×, 2×, 5×, 10×), we re-sampled the trips 500 times using a non-parametric bootstrap to estimate total discards. The "sampled" trips were assigned their perceived discard quantity (whether originally observed or projected according to a rate) while the unsampled or unobserved trips were assigned a discard quantity that inflated their perceived quantity according to the bias level for the given simulation. For example, if a trip had an observed/projected discard quantity of 100 lbs for haddock, that quantity would be inflated to 100 lbs (1× = no bias), 200 lbs (2×), 500 lbs (5×), or 1000 lbs (10×). The bias levels we explored were for illustrative purposes. Because discards were historically a small percentage of total catch it is possible that true discards could be an order of magnitude higher than reported without requiring an unrealistic total catch.

This simulation exercise produced 2 quantities for each stock: total *estimated* discards and total *true* discards. The *estimated* discards were a summation of the sampled and projected (based on sampled rate) discards on observed and unobserved trips, respectively. The *true* discards were a summation of the sampled and inflated discards on observed and unobserved trips, respectively. In the absence of bias, the mean estimated discards – across all 500 simulations – are equivalent to true discards and uncertainty is dictated by coverage. In the presence of bias, estimated discards are no longer representative of the truth. Therefore, it is more useful to examine how true discards vary as the ratio of observed/unobserved trips changes with coverage rate.

Total catch (estimated and true) was then calculated as the summation of discards and landings. Due to differences in the relative magnitude of catch across stocks, and even within stocks across years, comparisons can be difficult to make depending on the scales being portrayed. We present the results in 2 phases:

1) effects of coverage rate (no bias) on the precision of estimated catch
2) effects of coverage rate & bias on the true catch

The variation in total catch (both estimated and true) across all 500 simulations is expected to be lowest for highly utilized stocks with total catch comprised mostly of landings (e.g., winter flounder, cod) and highest for those comprised mostly (or entirely) of discards (e.g., ocean pout, wolfish, windowpane flounder).

To allow for better illustration of relative differences, the results for estimated catch are displayed for only the past 3 years (2015–2017). True catch is displayed for all sector years (2010–2017) so that relative variation by coverage rate and bias level is displayed within the context of temporal differences.

Results
Figure 17 displays the variable uncertainty (95% confidence) in estimated catch across all 22 stocks (20 stocks plus 2 management units) as observer coverage is varied, in the scenario where there is no bias. Mean estimated catch is the same across coverage rates within a year, but means vary across years and uncertainty increases with decreasing coverage.

Figure 18 to Figure 39 display the simulated true catch (with 95% confidence intervals) separately for each stock from 2010–2017, with 4 panels for each level of bias and colored lines for each level of observer coverage. The lowest coverage levels are plotted last and will obscure higher levels when they match closely. Note that uncertainty intervals are often very small and appear absent.

It is clear that for highly utilized stocks where catch is comprised mostly of landings, the effects of observer coverage and bias are relatively low. For all stocks, with no bias present (bias = 1×) the mean estimated catch is not affected by level of observer coverage. Under high levels of bias (10×) and low levels of coverage (10–25%), simulated true catch for some stocks was significantly inflated over the true catch that occurs with no bias.

Figure 17 - Total estimated catch (with 95% confidence intervals) under varying observer coverage.

Figure 17 continued - Total estimated catch (with 95% confidence intervals) under varying observer coverage.

Figure 17 continued - Total estimated catch (with 95% confidence intervals) under varying observer coverage.

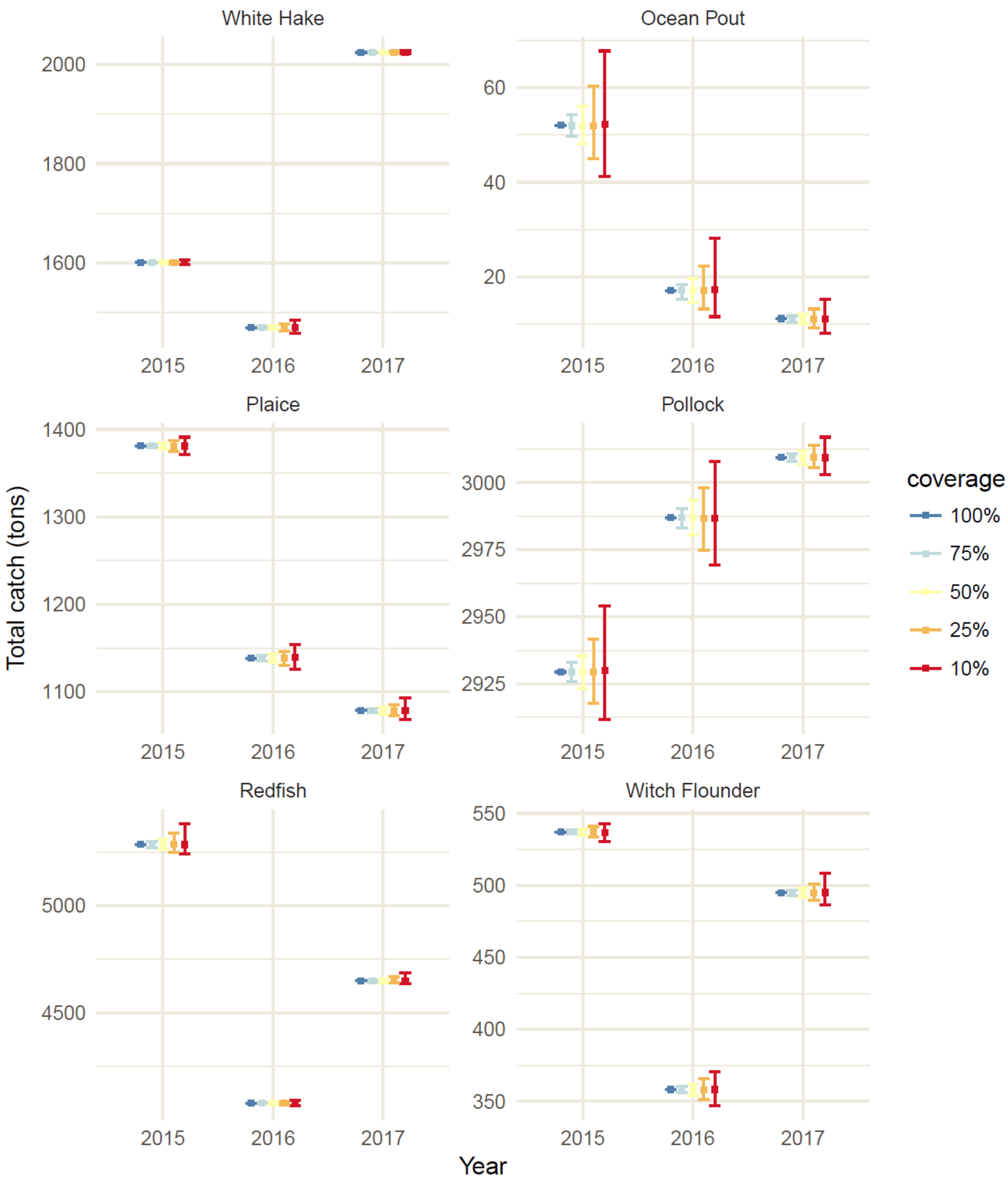


Figure 17 continued - Total estimated catch (with 95% confidence intervals) under varying observer coverage.

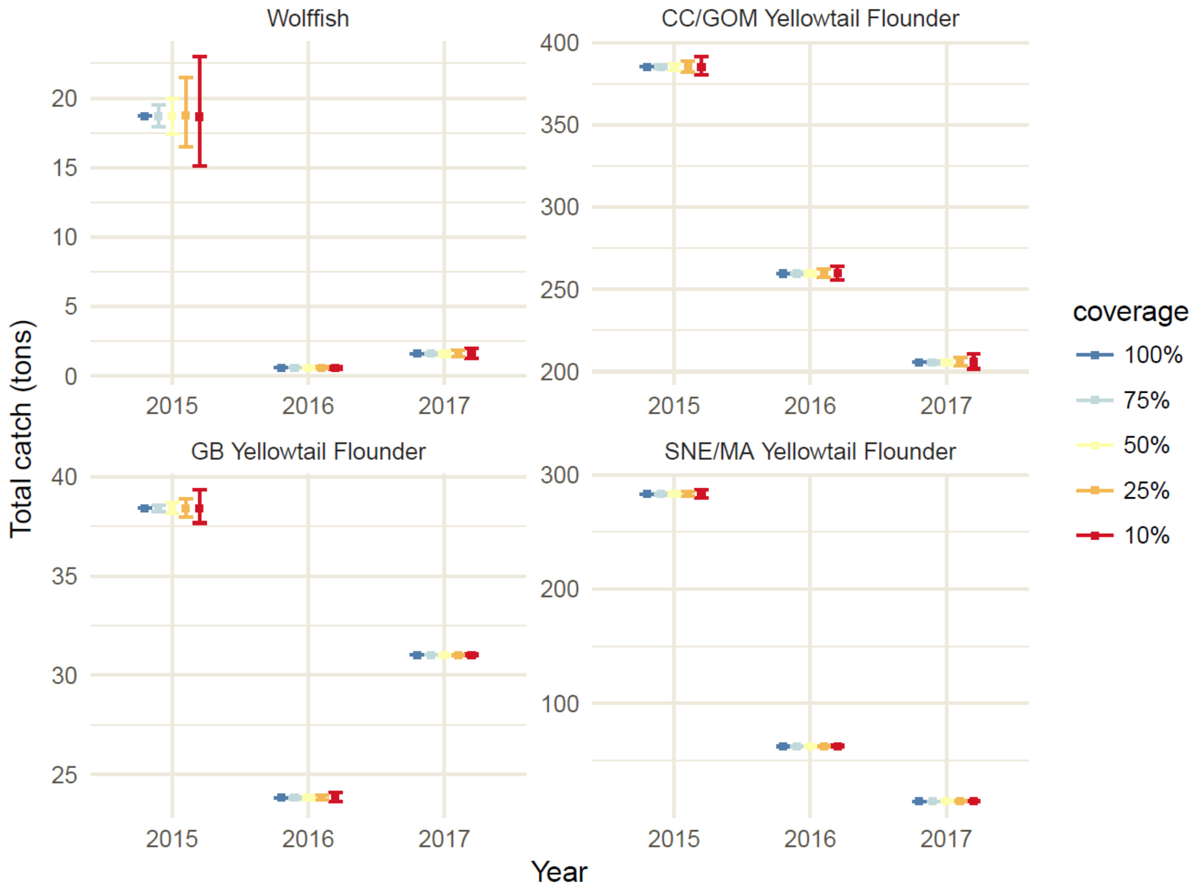


Figure 18 - Eastern GB cod, total 'true' catch under varying observer coverage and bias.

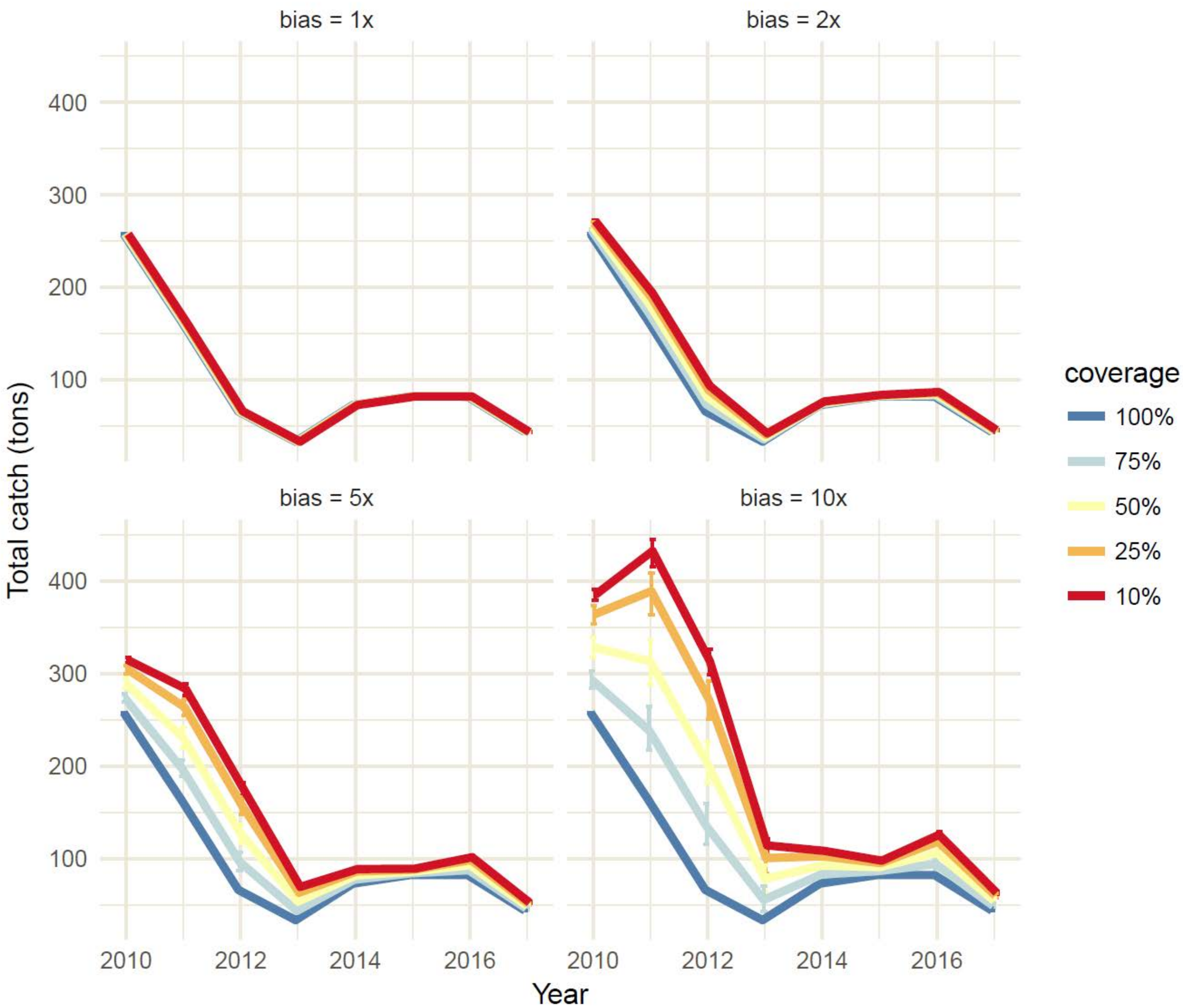


Figure 19 - Western GB cod, total 'true' catch under varying observer coverage and bias.

Figure 20 - GOM cod, total 'true' catch under varying observer coverage and bias.

Figure 21 - Southern windowpane flounder, total 'true' catch under varying observer coverage and bias.

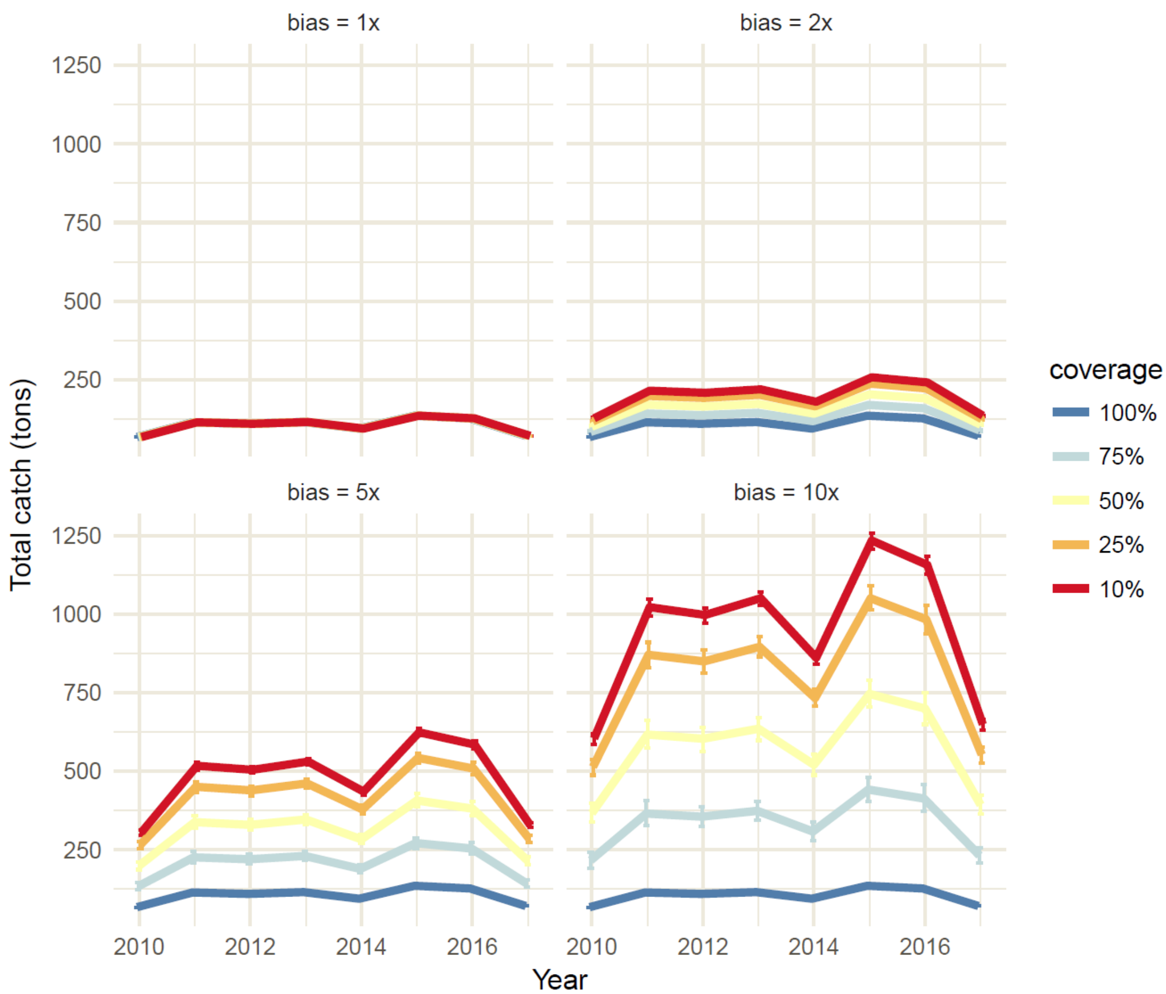


Figure 22 - Northern windowpane flounder, total 'true' catch under varying observer coverage and bias.

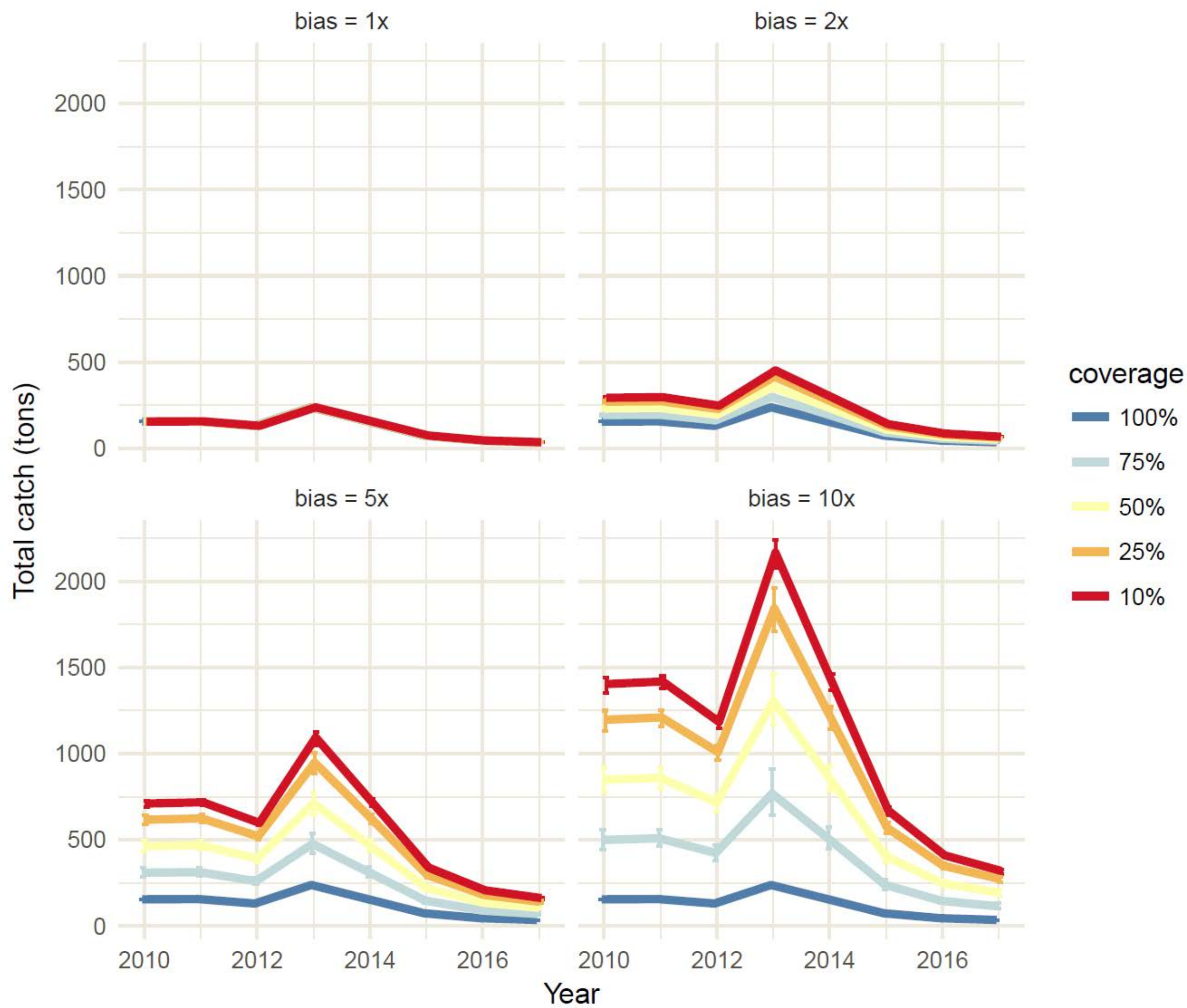


Figure 23 - GB winter flounder, total 'true' catch under varying observer coverage and bias.

Figure 24 - GOM winter flounder, total 'true' catch under varying observer coverage and bias.

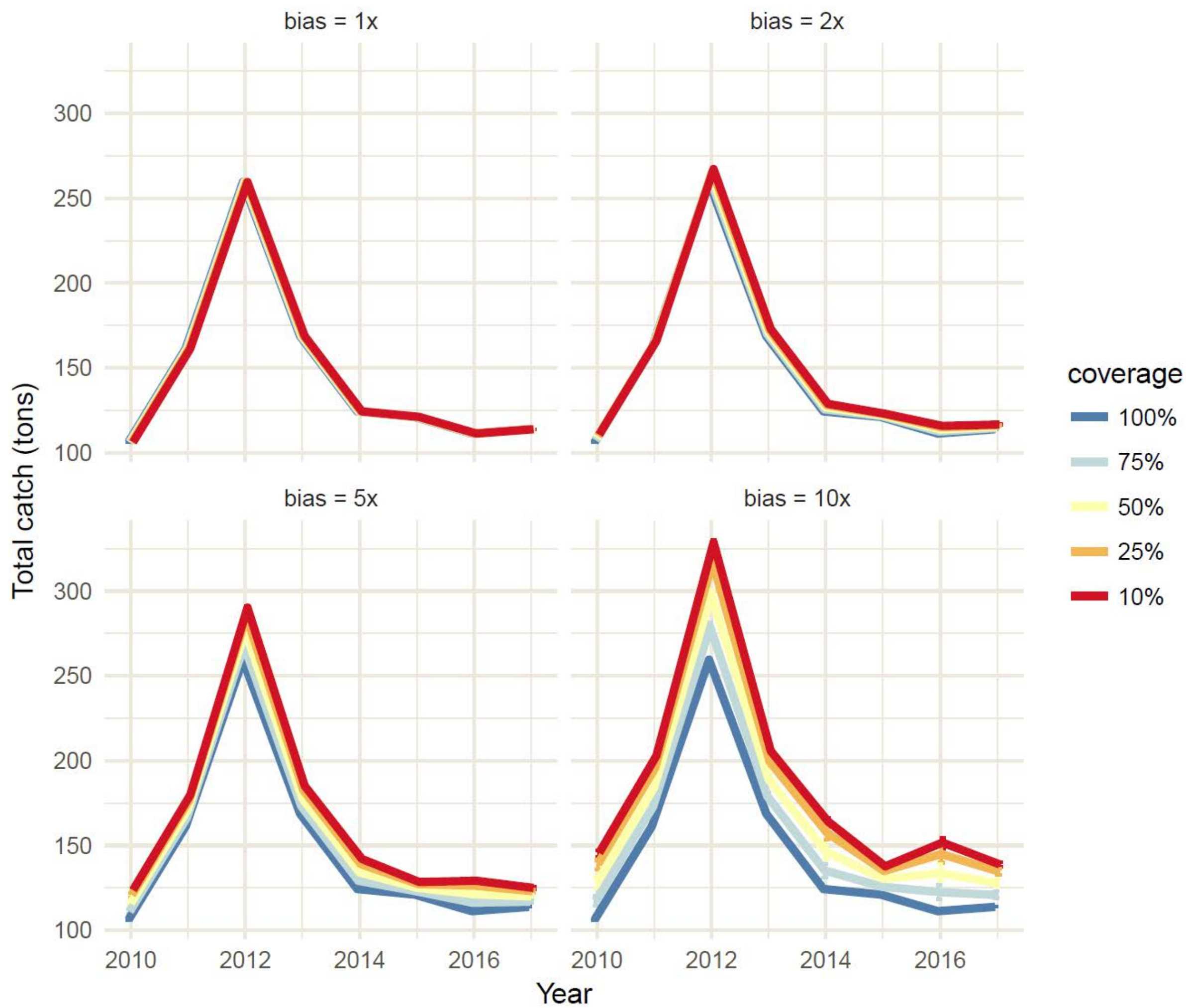


Figure 25 - SNE/MA winter flounder, total 'true' catch under varying observer coverage and bias.

Figure 26 - Eastern GB haddock, total 'true' catch under varying observer coverage and bias.

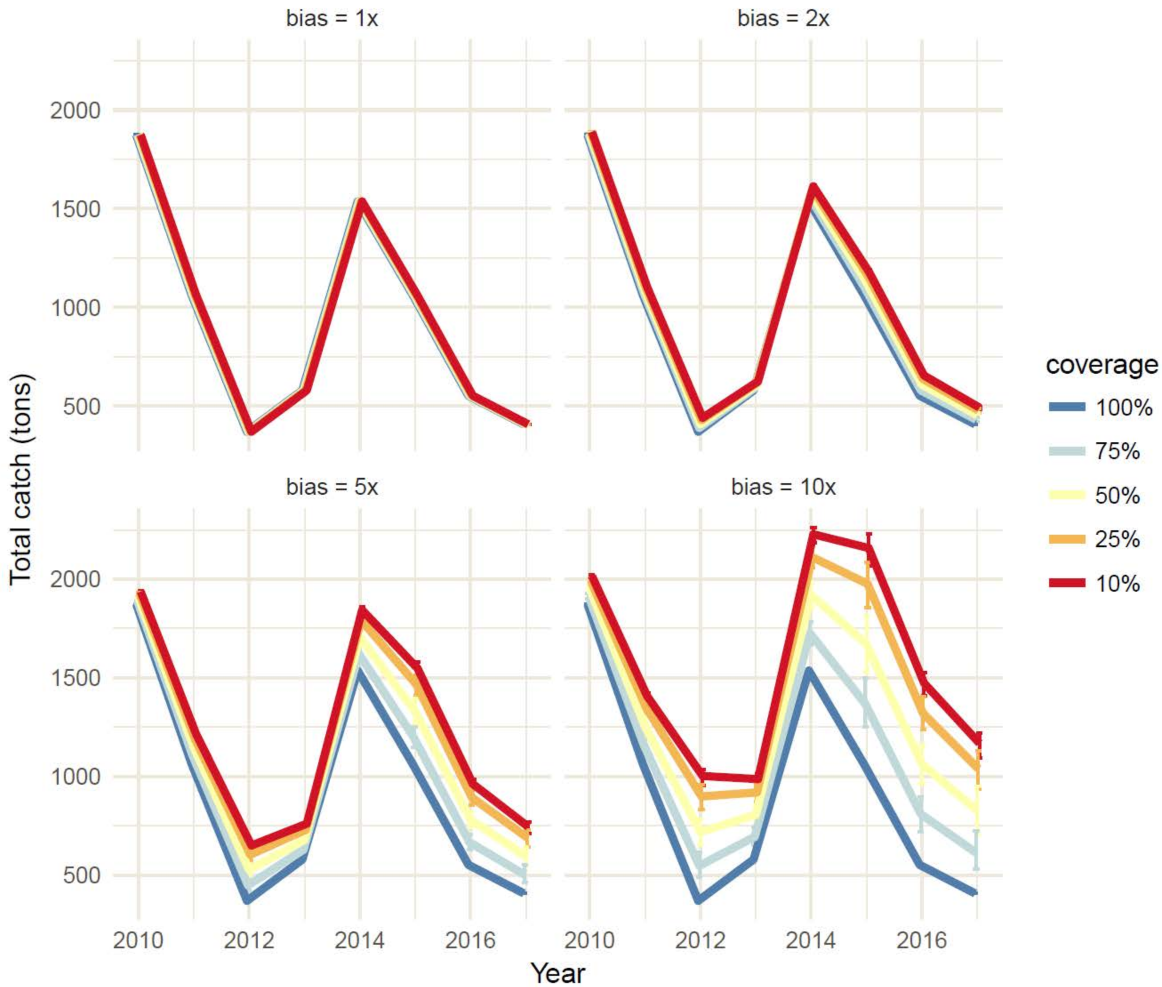


Figure 27 - Western GB haddock, total 'true' catch under varying observer coverage and bias.

Figure 28 - GOM haddock, total 'true' catch under varying observer coverage and bias.

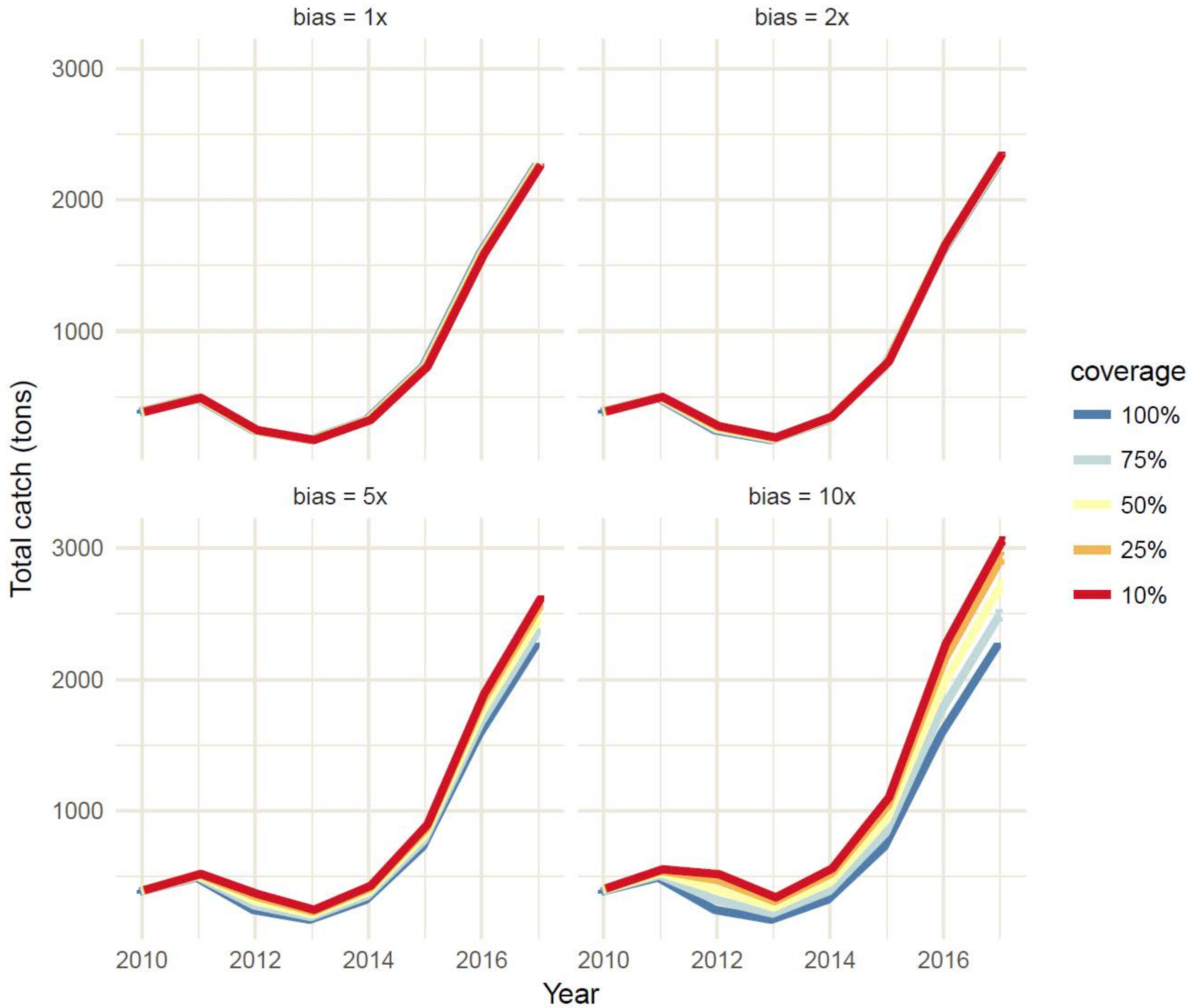


Figure 29 - Atlantic halibut, total 'true' catch under varying observer coverage and bias.

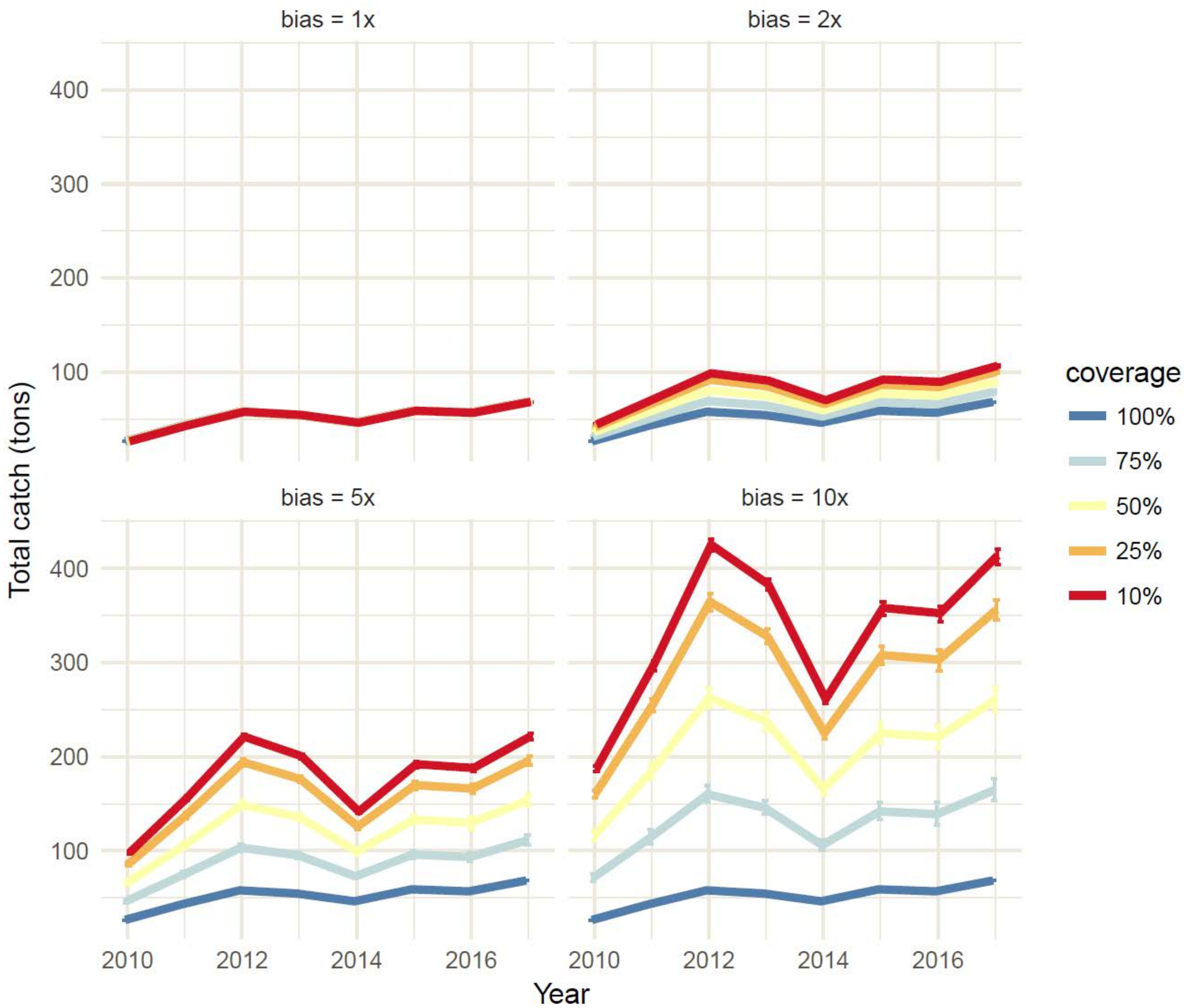


Figure 30 - White hake, total 'true' catch under varying observer coverage and bias.

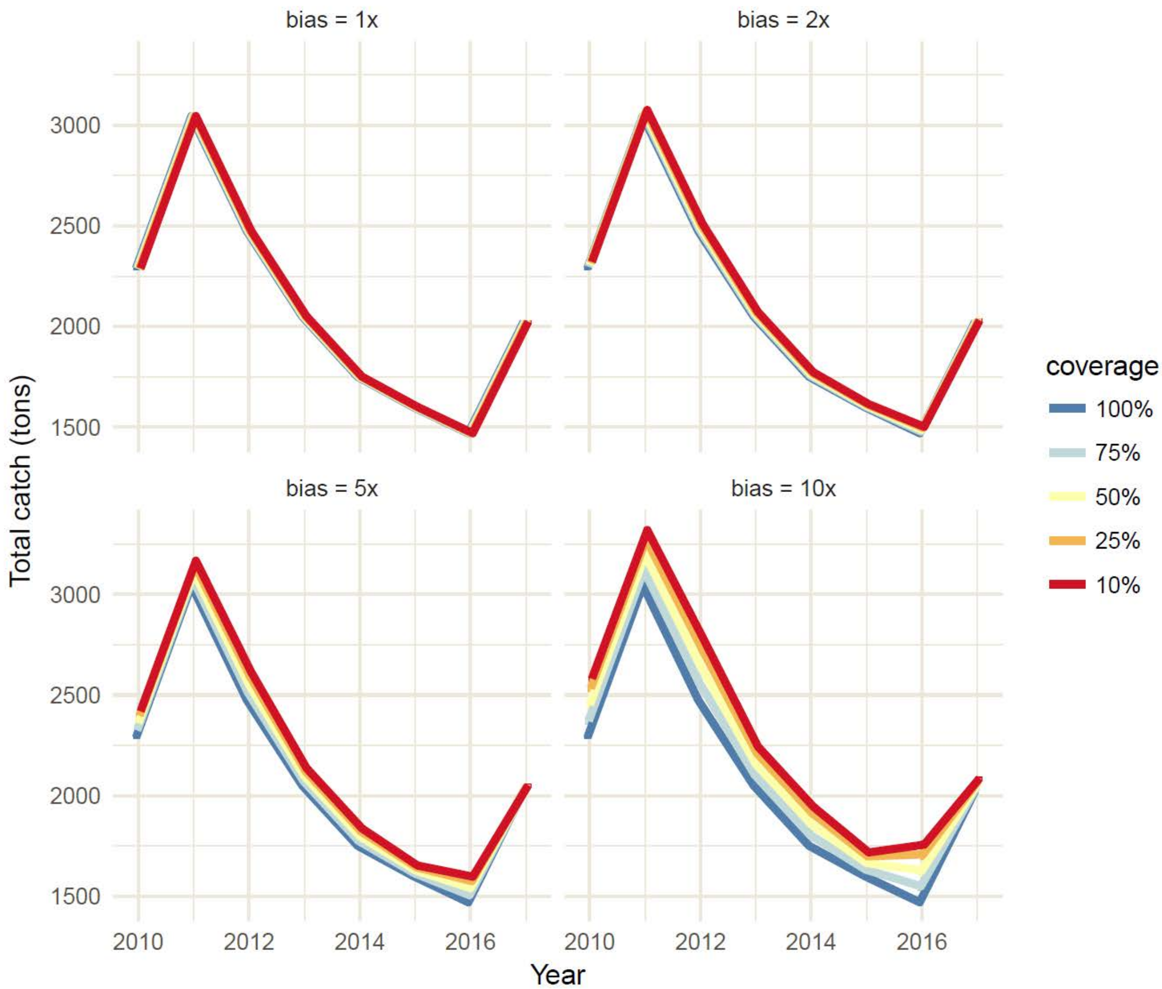


Figure 31 - Ocean pout, total 'true' catch under varying observer coverage and bias.

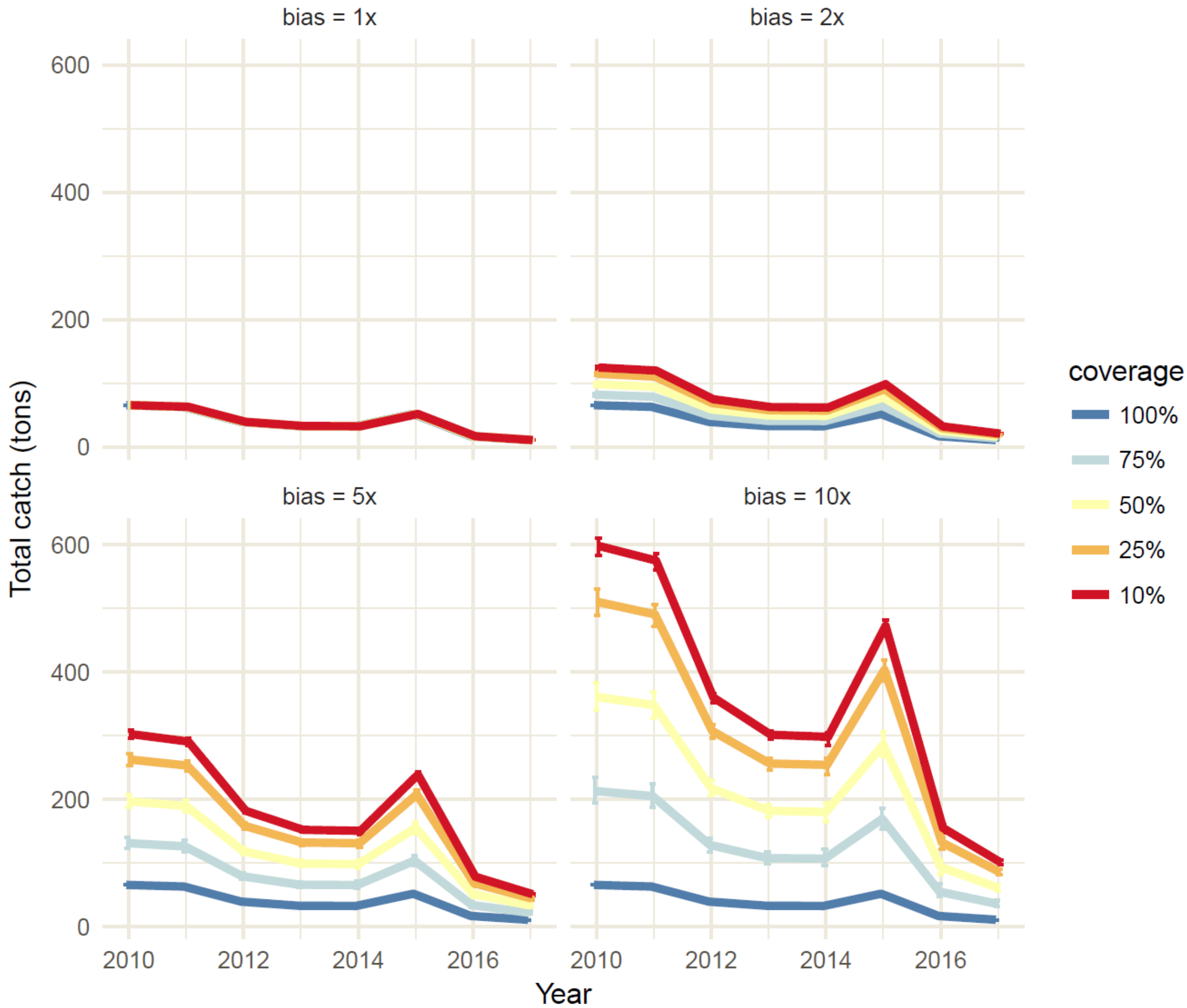


Figure 32 - American plaice, total 'true' catch under varying observer coverage and bias.

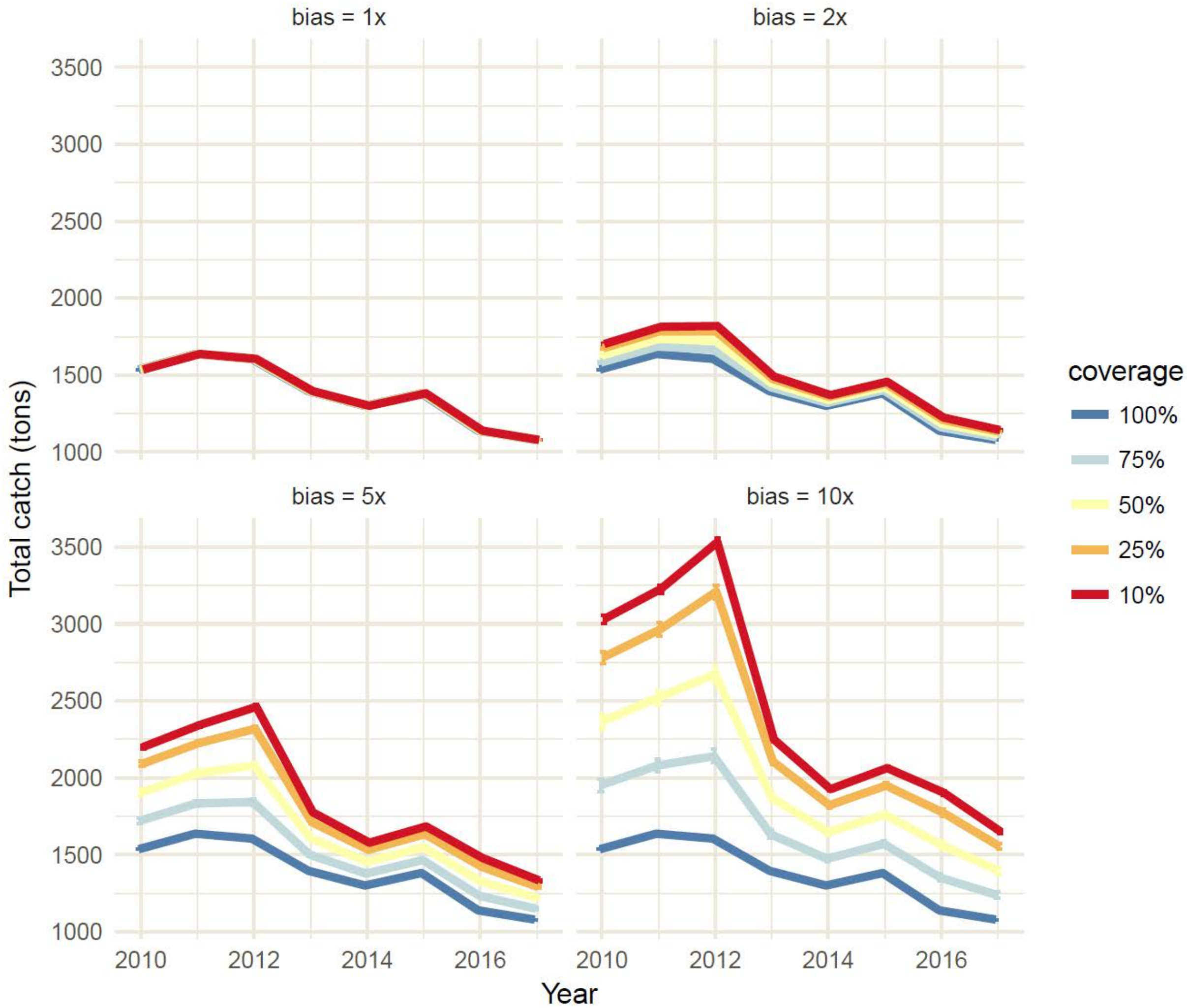


Figure 33 - Pollock, total 'true' catch under varying observer coverage and bias.

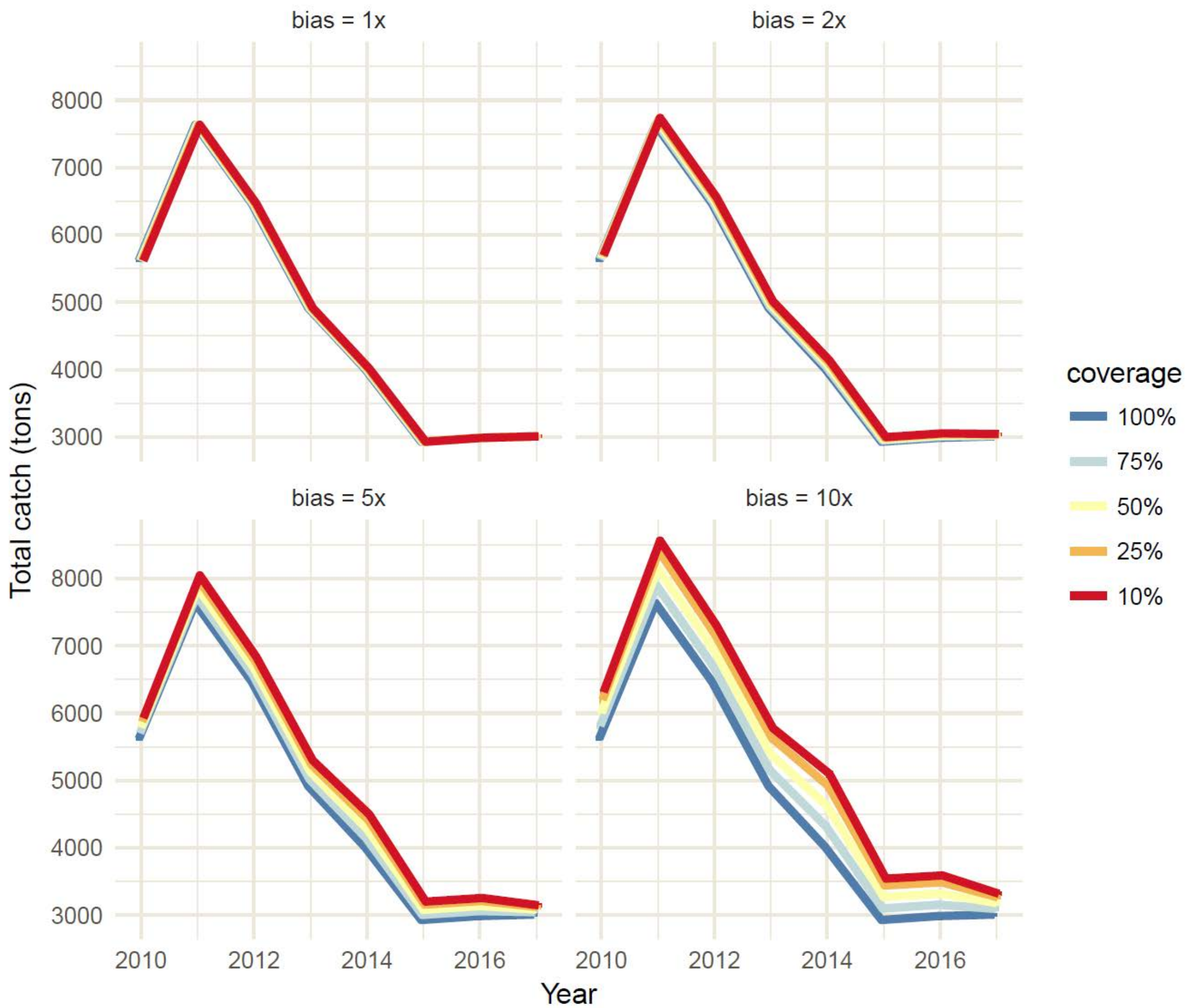


Figure 34 - Redfish, total 'true' catch under varying observer coverage and bias.

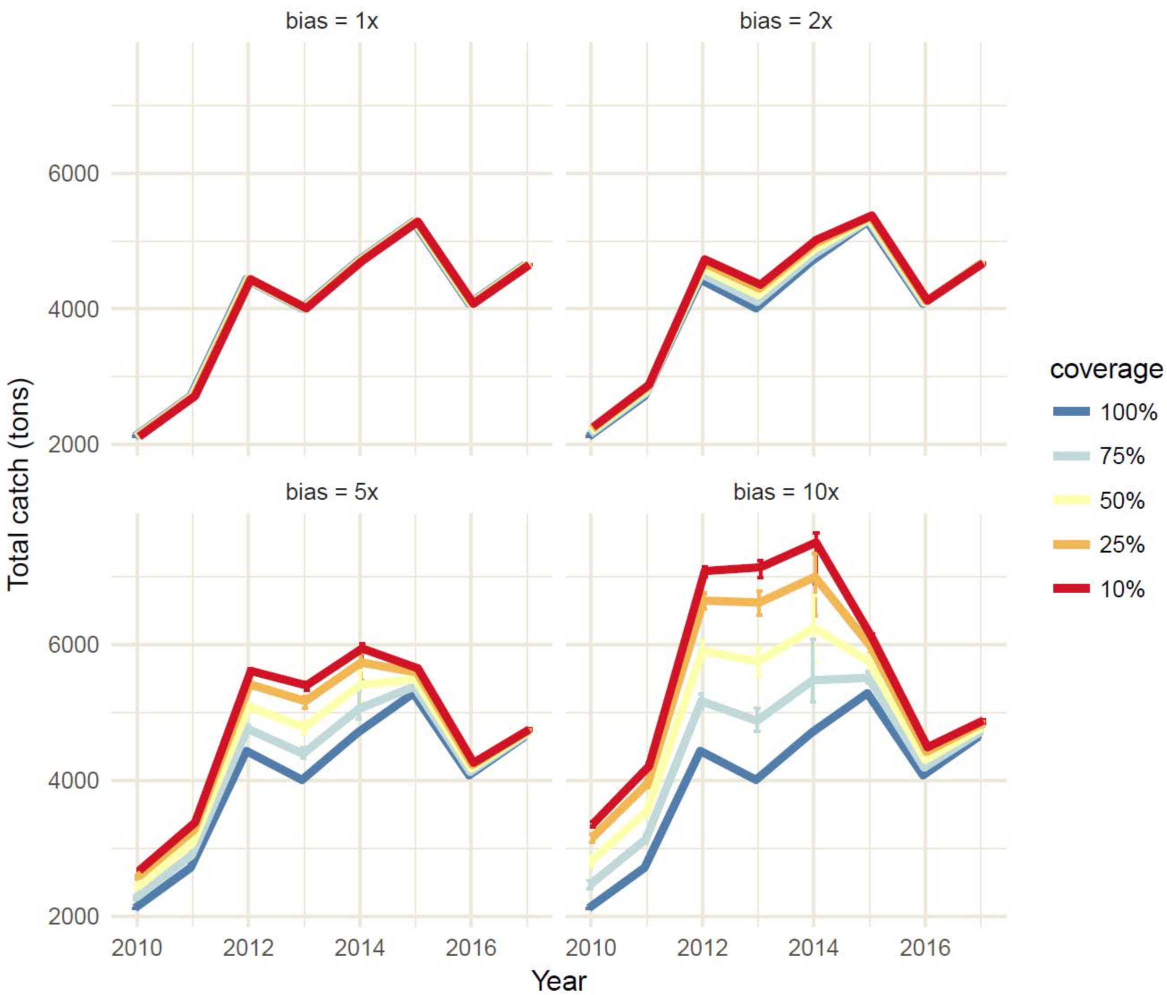


Figure 35 - Witch flounder, total 'true' catch under varying observer coverage and bias.

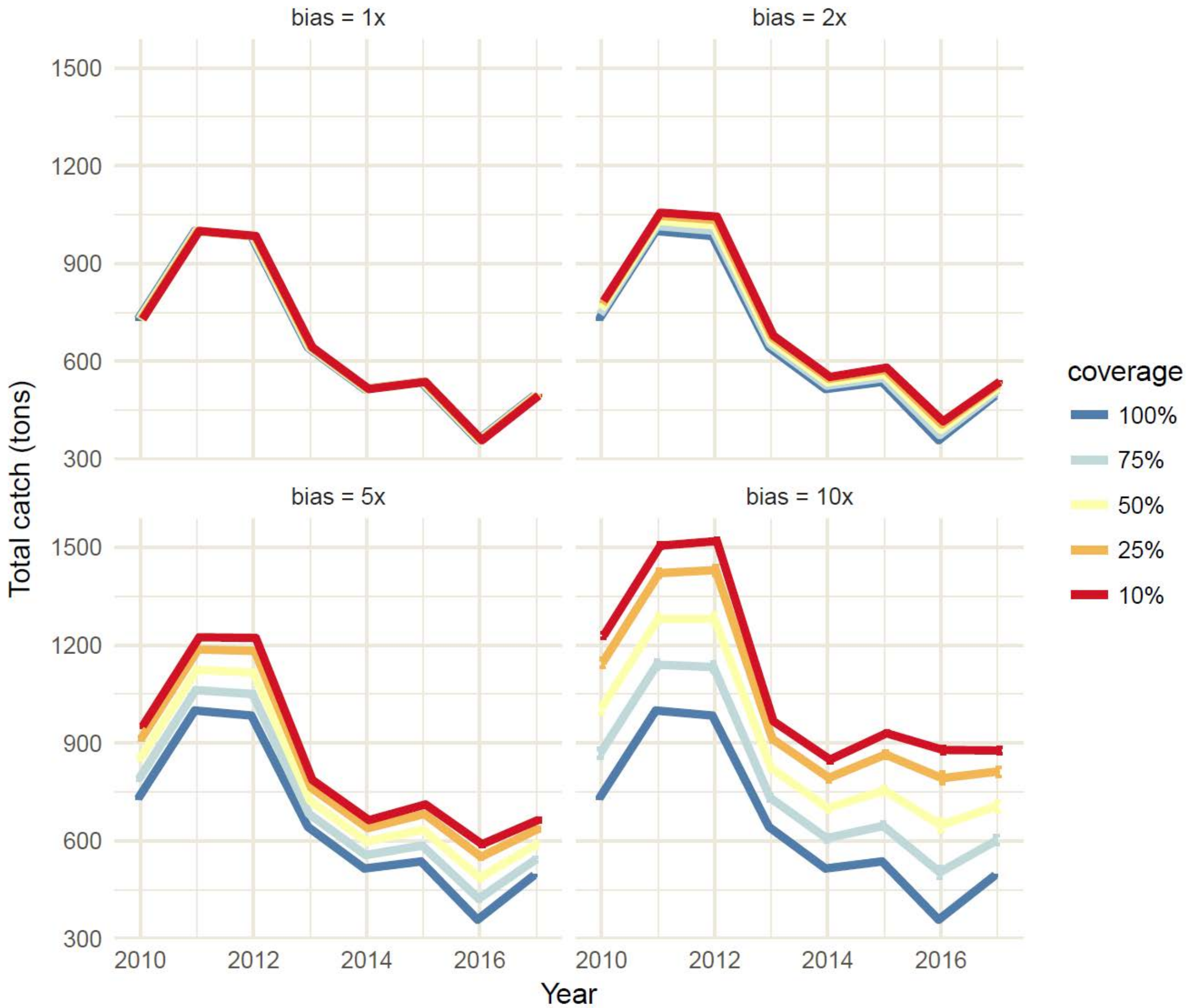


Figure 36 - Wolffish, total 'true' catch under varying observer coverage and bias.

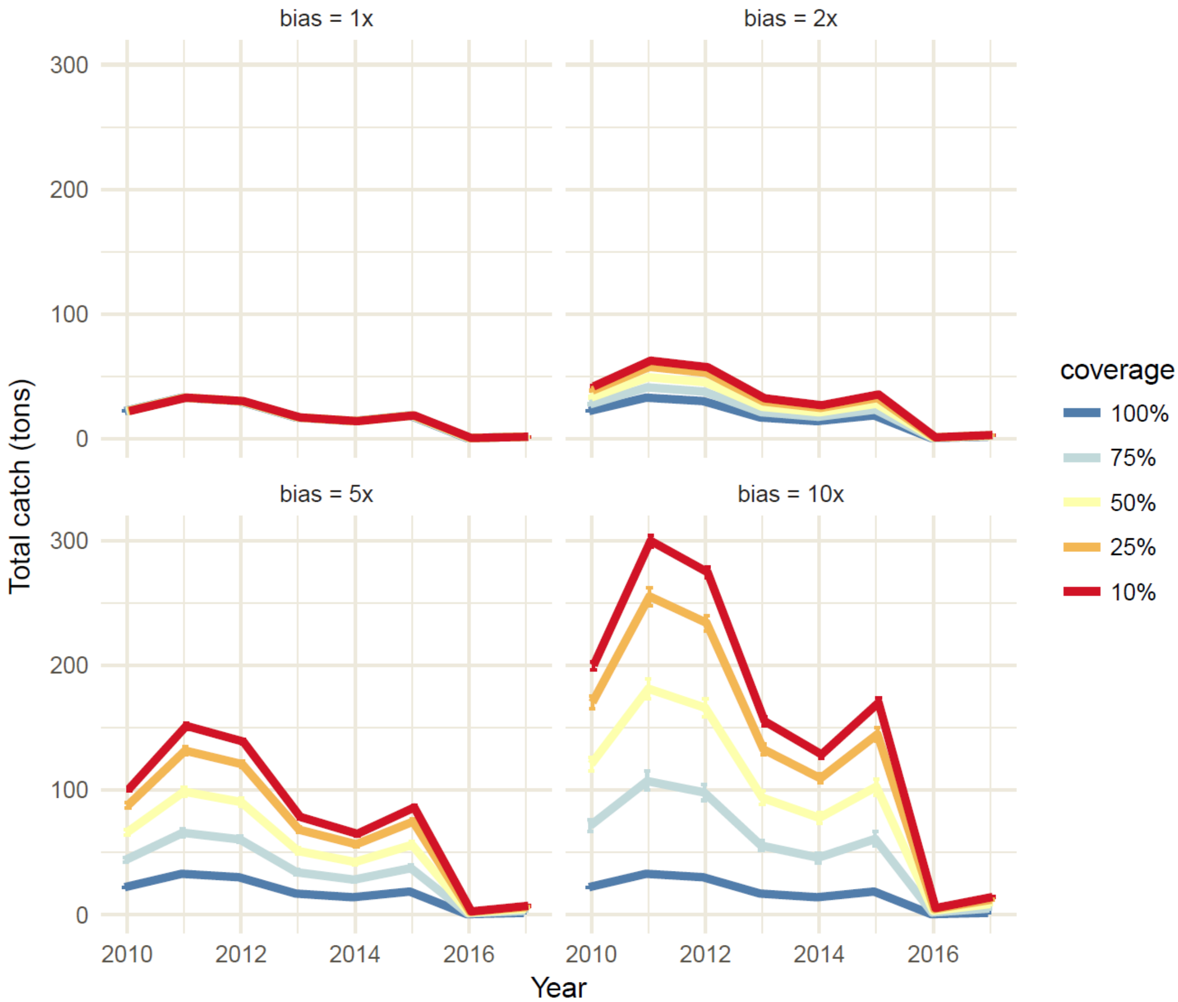


Figure 37 - CC/GOM yellowtail flounder, total 'true' catch under varying observer coverage and bias.

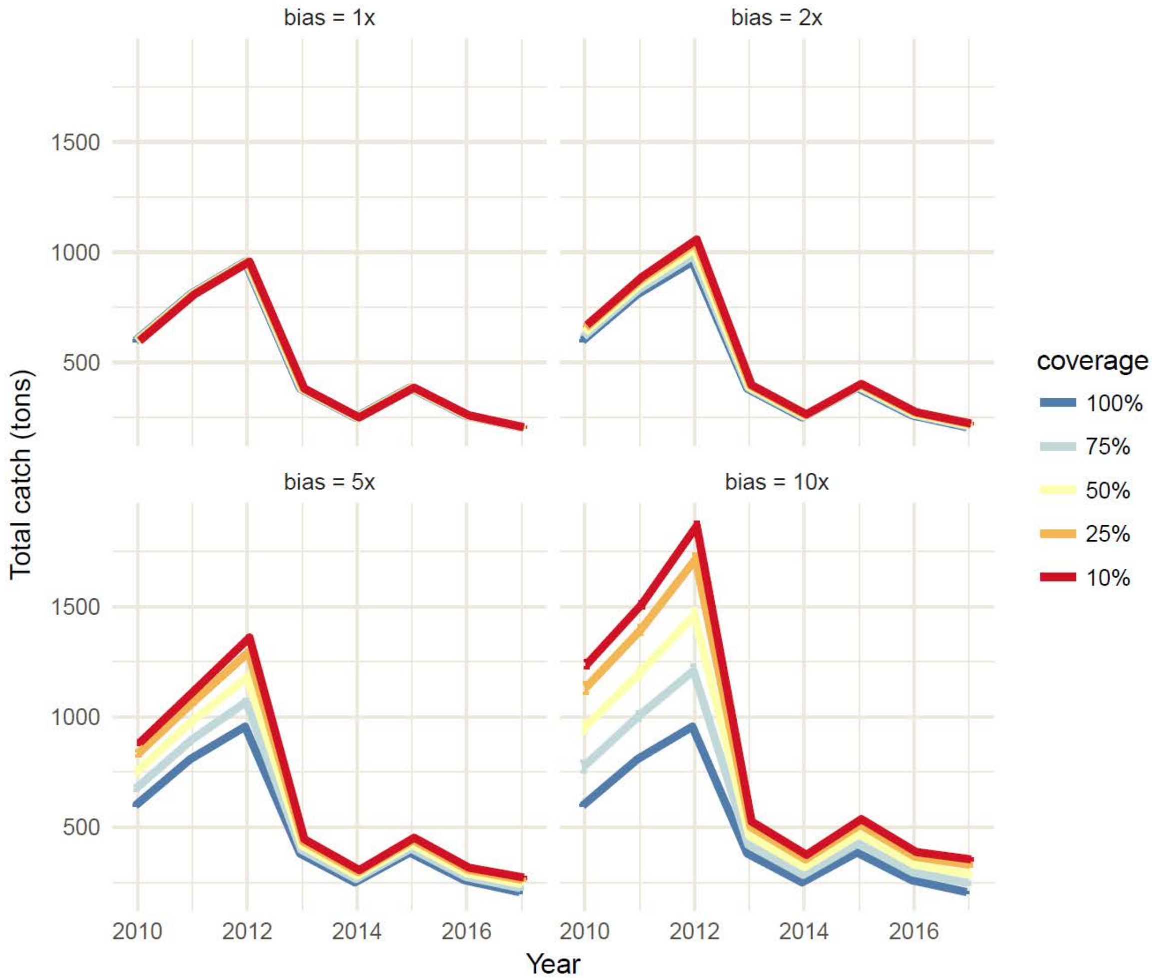


Figure 38 - GB yellowtail flounder, total 'true' catch under varying observer coverage and bias.

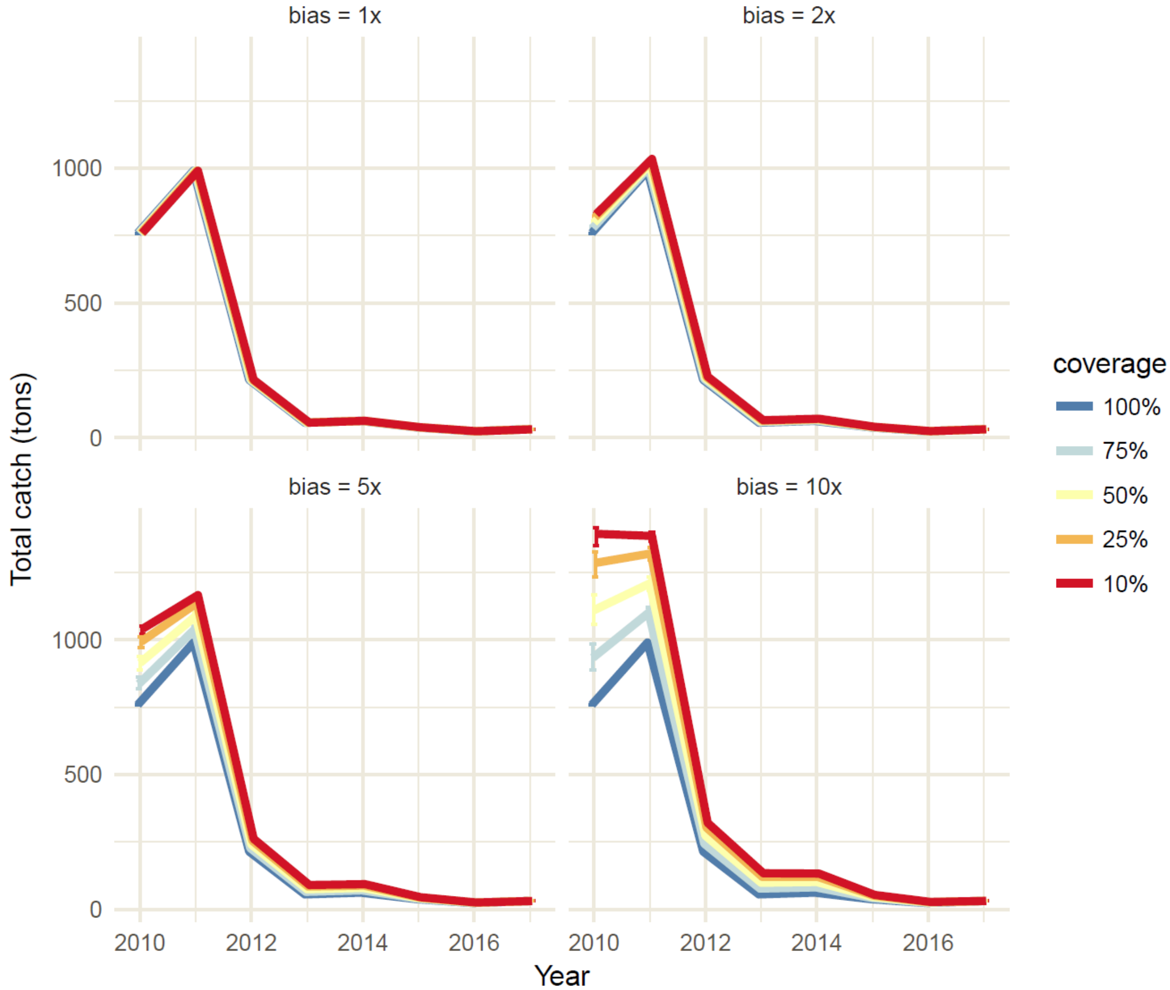


Figure 39 - SNE/MA yellowtail flounder, total 'true' catch under varying observer coverage and bias.

Magnitude of potential 2018 missing Gulf of Maine cod discards

A sub-panel of the SSC reviewed PDT analyses showing evidence of an observer effect and concluded that observed trips are not representative of unobserved trips in the groundfish fishery (see Section 6.6.10.5 and Appendix V). However, the magnitude of the missing removals that results from illegal discards across the entire fishery was not quantified at the SSC review (the PDT does provide an estimate of potential magnitude of missing removals for GOM cod on gillnet trips; see Section 6.6.10.5.3 and Appendix V, "Predicting Gulf of Maine (GOM) cod catch on Northeast Multispecies (groundfish) sector trips: implications for observer bias and fishery catch accounting"). The reviewers did suggest that further investigation into quantifying the missing catch should be done.

Overall Approach - The concept behind the following analyses is to calculate potential landings in a target year by multiplying the landings per unit of effort (landings/day absent) from a reference year by the amount of effort (days absent) in the target year. In this analysis, the reference year is chosen as a year where the stock size is similar to the target year, but the ABC is larger. Under the assumption that landing rates (landings/days absent) are influenced by stock size, the landing rates would be expected to be similar for the reference year and target year. Based on analyses in Appendix V, a lower allowable catch would be expected to change fishing behavior. Fisherman could change fishing practices in a number of ways, but one possible response would be to increase discards of legal-sized fish. The landing rate in the reference year (with the higher ABC) could be multiplied by the total effort measure in the target year (with the lower ABC) to estimate a potential landings amount. This could be compared to the actual landings, and the difference can be considered a rough estimate of discards. Since all legal-sized fish are required to be landed in the sector system, this estimate could represent unaccounted for legal-sized discards.

Assumptions - There are several assumptions and limitations to this method:

- Landings per day absent is proportional to stock size and is constant during different years with similar stock sizes.
- Fishing practices are similar in the years that are compared (other than possible discarding). This assumption ignores changes in behavior that reduce the landings per unit of effort in the target year. As a result, the calculation can be viewed as a potential upper bound on the magnitude of uncounted legal-size discards.
- Landings are assumed to be known without error. Other sources of errors in landings amounts, such as stock area misreporting or dealer misreporting, are not estimated and assumed to be insignificant in this analysis.

GOM Cod Example - Using GOM cod as the focal stock, analyses investigated the potential magnitude for missing legal-sized discards in 2018. GOM cod was used as an example for two reasons:

- First, as a result of low ABCs, this stock was highly constraining from 2015 to 2018 which produces economic incentives for sector fishermen to discard legal-size fish (see Section 6.6.10.5.1 and Appendix V, "Modeling Discard Incentives for Northeast Multispecies (Groundfish) Stocks"). In 2012 the GOM cod ABC was 6,700 mt and in 2013 was lowered to 1,550 mt. The ABC became much more constraining after 2014 and was set at 703 mt in 2018.
- Second, the GOM cod spawning stock biomass (SSB) estimate, when the quota was less constraining in 2012 and 2013, was somewhat similar to the 2018 estimate (more so for 2012) when the quota should have been constraining. There is uncertainty in the SSB estimate from the assessment due to within model retrospective issues and due to the assessment being based on two different model configurations (M=0.2 and M-ramp). The relative change in stock size over this time period (2012-2018) can be seen in Table 72, which shows the estimates of SSB from the 2019 GOM cod stock assessment.

This analysis makes assumptions in stock size over the period examined (2012-2018 or 2013-2018) occurred as described in the assessment and on levels of avoidance behavior of GOM cod by the fishery. There is considerable uncertainty surrounding a potential estimate of the magnitude of unreported legal-sized GOM cod discards.

Table 72 - SSB estimates for GOM cod from the M=0.2 and M-ramp model from the 2019 operational groundfish stock assessment. The rho adjusted SSB estimates are also shown for the terminal year of the assessment. The relative change in the SSB from 2012 and 2013 to the terminal year (2018) are shown on the right. An average of the estimated SSB changes is also given as an approximation for a stock size adjustment.

		SSB				SSB Relative Change				
year	ABC	m=0.2	rho adj	mramp	rho adj	m=0.2	rho adj	mramp	rho adj	Average
2011	9,012	6,723		8,009						
2012	6,700	3,524		4,221		1.06	0.70	0.91	0.71	0.84
2013	1,550	1,874		2,361		2.00	1.32	1.63	1.26	1.55
2014	1,550	1,263		1,809						
2015	386	1,439		2,164						
2016	500	2,258		3,023						
2017	500	3,051		3,593						
2018	703	3,752	2468	3,838	2976					

Data and Analysis - An overview of the data and analysis is summarized in this section.

- Data includes fishing year 2012, 2013, and 2018 large-mesh trawl gear sector groundfish trips or sub-trips that only occurred in the Gulf of Maine stock area. Therefore, trips with and without cod landings are included. Common pool trips are not included. Sub-trips outside of the Gulf of Maine stock area are also excluded. Data was pooled by fishing year.
- For fishing years 2012 and 2013, the ratio was calculated as the sum of all cod landings divided by the sum of all days absent in two ways:
  - First, the ratio calculated across all statistical reporting areas (SRA) and,
  - Second, the ratio calculated by each SRA with an expansion by SRA. Most Gulf of Maine stock area trips (~90%) are reported as single statistical area trips. For trips that reported effort in multiple statistical areas, the catch and effort was apportioned equally between each area, since time spent in each SRA is unknown (not reported).
- *Potential landings estimate*- The resulting ratio for each fishing year (2012 and 2013) was multiplied by the sum of all days absent in fishing year 2018 (∑days absent) to estimate the potential magnitude of discarding of legal-size GOM cod. This estimate only accounts for potential legal-size discards of GOM cod which should have been landed. Therefore, sublegal discards are not part of this calculation and hence referred as a "potential landings estimate".
  - 2018 Potential Landings Estimate = {∑ 2012 GOM cod landings/∑ 2012 Days Absent (DA) }* Total 2018 Days Absent

    or
  - 2018 Potential Landings Estimate = {∑ 2013 GOM cod landings/∑ 2013 Days Absent (DA) }* Total 2018 Days Absent.

Results and Discussion - The magnitude of the missing landings (unreported discards of legal-sized cod) was summarized as a multiplier relative to the 2018 fishing year. The estimated multipliers calculated from 2012 or 2013 landings per days absent (LPUE) and applied to the total effort in 2018 (∑days absent) are shown in Table 73 (results at 100% for "Total" and "By Stat Area"). This estimate of an upper bound of the potential magnitude for missing legal-sized discards of GOM cod. The landings multipliers are relative to the total commercial landings for sector trawl trips in 2018. The sector trawl landings were 218 mt (480 thousand pounds) in 2018. Therefore, the potential landings estimate under a multiplier of 1.71 would be 373 mt.

Estimation of the multiplier by SRA was also done since there was spatial shift in fishing effort - inshore to offshore (for example NEFSC 2017) over this time period when cod became more constraining. This did result in the slight reduction in overall estimated multipliers, as expected (Table 73).

It's possible that the reduced ABC in 2018 led fishermen to reduce cod catches by fishing differently. The impact of such changes was evaluated with a sensitivity analysis that removed a proportion of the 2012 and 2013 trawl trips that had the greatest landings of GOM cod (Table 73). Lower percentages (25% and 50%) signify the 2012 and 2013 trips used to estimate the multipliers. For example, 25% of the highest cod landings trips were eliminated in estimation of the multiplier.

The multiplier estimate is sensitive to the unknown targeting and avoidance behavior in the overall fishery. The ability of the fishery to preferentially target certain stocks is a difficult factor to account for in estimating the bound of missing catch. The fleet's true ability to avoid constraining stocks on groundfish trips is not known. Likewise, true fishery avoidance behavior is unknown for constraining stocks when a trip is unobserved because of the potential targeting of non-constraining stocks in areas of high catch per unit effort (CPUE) that may also overlap areas where cod are caught. To help bound this issue, all of the trips (no targeting behavior change) were used in the estimator and also some of the highest cod landing trips (approximate a change in targeting behavior) were eliminated from the estimate. Not surprisingly, the estimate of potential missing cod is sensitive to the elimination of the trips that caught the highest amount of cod. For example, eliminating the top 50% of the total GOM cod landings trips from the estimator (landings per unit effort) in 2013 results in predicted landings below the actual reported landings. This estimate is not realistic since one would not expect actual landings to be below the reported landings. Using all trips in the estimator may also not be realistic but this may give a sense of a bound for the missing catch given all of the other assumptions.

Table 73 - Estimated multipliers calculated for all trips and for trips by statistical area. Sensitivity of the estimate to elimination of the top 25% and 50% of GOM cod trips is also shown.

	Total			By Stat Area		
year	100%	75%	50%	100%	75%	50%
2012	3.84	2.99	2.15	3.03	2.42	1.82
2013	1.71	1.32	0.92	1.67	1.32	0.95

For further refinement, the multipliers on missing GOM cod landings were adjusted by the relative average SSB change from the stock assessment (2012 SSB estimate/2018 SSB estimate = 0.84 and 2013 SSB estimate/2018 SSB estimate = 1.55). Adjusting for the change in SSB estimated by the assessment would bring the 2012 and 2013 estimates slightly closer together between years which can be seen in Table 74.

Table 74 - Estimated multipliers calculated for all trips and for trips by statistical area which were also adjusted for the relative average SSB change from the stock assessment (2012 = 0.84 and 2013 = 1.55).

	Total			By Stat Area						
year	100%	75%	50%	100%	75%	50%	Max	min	average	median
2012	3.24	2.53	1.82	2.56	2.04	1.54	3.24	1.54	2.31	2.29
2013	2.65	2.05		2.59	2.05					

In conclusion, the results of the analysis indicate a possible upper bound multiplier of 2.3 times GOM cod landings, roughly 1,100 thousand pounds (~498mt) of missing landings (or missing legal-sized discards), with an uncertainty range of 1.5 to 2.5, or about 700 thousand pounds to 1,200 thousand pounds (~317mt to 544mt). This estimate is perhaps a more realistic bound on the potential missing catch for GOM cod relative to multipliers that are much higher since total fishing effort will limit the potential for missing discards.

7.2.1.1.1 Sector Monitoring Standard Option 1: No Action

Impacts on regulated groundfish

Option 1/No Action would maintain the current CV method for determining the annual total monitoring coverage. The average realized coverage rate for years FY2010-FY2017 was 22%. Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38%, and 14-32%, respectively, resulting in an average target and realized coverage level of 25% and 22%, respectively. As documented above in Section 7.1.1, there are a number of uncertainties within the current monitoring program related to low levels of monitoring coverage. In particular, PDT analysis (see Section 6.6.10.5 and Appendix V) has shown that observed trips are not representative of unobserved trips. Under the low levels of monitoring that have been realized under Option 1/No Action, many groundfish trips would have estimates of discards that are not accurate. Therefore, Option 1/No Action is likely to continue to have negative biological impacts on regulated groundfish.

Additionally, compliance scores, which follow a qualitative analytical approach based on assessing the risk of noncompliance of alternatives (Section 7.5.2.6), provide some idea of the risk of non-compliance with different fixed rates of at-sea monitoring coverage as a percentage of trips. Non-compliance with regulations reduces the accuracy of catch accounting and increases the potential for ACLs to be exceeded. As described in Section 7.5.2.6, the risk of non-compliance depends on the coverage rate selected, and because the compliance score depends on both the opportunity to be noncompliant and the economic incentive to be noncompliant, as discussed in PDT analyses (see Section 6.6.10.5.1 and Appendix V, “Modeling Discard Incentives for Northeast Multispecies (Groundfish) Stocks”), there is less compliance risk for violations at sea when the at-sea monitoring coverage rate is higher. The coverage levels under Option 1/No Action (average target and realized coverage level of 25% and 22%, respectively) have a score of ‘low’ compliance since there is high risk of non-compliance. This is due to the opportunity on the majority of trips for misreporting or illegal discarding of certain stocks that are constraining, which could mean the majority of groundfish trips would not have accurate estimates.

Compared to the four options for fixed coverage of trips under Option 2, Option 1/No Action would have similar/neutral biological impacts to 25% monitoring coverage, since the average realized coverage rate for years FY2010-FY2017 was 22%. Option 1/No Action would have negative biological impacts compared to the options for 50%, 75%, and 100% coverage of trips. Compared to the four options for fixed coverage of catch under Option 3, Option 1/No Action would have negative biological impacts compared to the options for 25%, 50%, 75%, and 100% coverage of catch, as a simulation analysis shows that overall coverage of trips will have to be set higher in order to achieve the target catch percentage for each allocated groundfish stock (see Section 7.2.1.1.3 for more details).

Impacts on other species

Under Option 1/No Action, the average realized coverage rate for years FY2010-FY2017 was 22%. Under the low levels of monitoring that have been realized under Option 1/No Action, there is less assurance that sector vessels do not exceed their ACE. As such, there is less opportunity for fishing effort to be reduced. Therefore, Option 1/No Action is likely to have negative biological impacts on other species.

Compared to the four options for fixed coverage of trips under Option 2, Option 1/No Action would have similar/neutral biological impacts to 25% monitoring coverage, since the average realized coverage rate for years FY2010-FY2017 was 22%. Option 1/No Action would have negative biological impacts compared to the options for 50%, 75%, and 100% coverage of trips. Compared to the four options for fixed coverage of catch under Option 3, Option 1/No Action would have negative biological impacts compared to the options for 50%, 75%, and 100% coverage of catch, as a simulation analysis shows that overall coverage of trips will have to be set higher in order to achieve the target catch percentage for each allocated groundfish stock (see Section 7.2.1.1.3 for more details).

7.2.1.1.2 Sector Monitoring Standard Option 2: Fixed Total At-Sea Monitoring Coverage Level Based on a Percentage of trips (*Preferred Alternative*)

Impacts on regulated groundfish

As described above in Section 7.2, improvements in monitoring through higher levels of monitoring coverage have positive biological impacts on groundfish species, both in the short- and long-term. In the short-term, improvements in monitoring which reduce fishing mortality through better catch accounting should produce positive biological impacts. In the longer-term analytical assessments should improve with better catch data which should lead to subsequent improvements in groundfish catch advice and management. The four options for a fixed total monitoring coverage level based on a percentage of trips (25, 50, 75, and 100%) are analyzed and qualitatively ranked relative to each other. When possible, additional analyses are referred to that provide further comparative ranking of the four options for monitoring coverage. Compared to No Action, this option is expected to have neutral to positive biological impacts for regulated groundfish species.

Impacts on other species

Improvements in monitoring through higher levels of monitoring coverage have positive biological impacts on other species, in particular species that are caught incidentally as bycatch in the commercial groundfish fishery. Improved monitoring through higher monitoring coverage levels ensures that sector vessels do not exceed their ACE. As such, fishing effort may be reduced with higher levels of monitoring coverage which produces positive biological impacts for other species. The four options for a fixed total monitoring coverage level based on a percentage of trips (25, 50, 75, and 100%) are analyzed and qualitatively ranked relative to each other. Compared to No Action, this option is expected to have neutral to positive biological impacts for other species.

7.2.1.1.2.1 Sub-option 2A – 25 percent

Impacts on regulated groundfish

The 25% monitoring coverage option would not improve monitoring relative to the No Action since the average realized coverage rate for years FY2010-FY2017 was 22%. Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38%, and 14-32%, respectively, resulting in an average target and realized coverage level of 25% and 22%, respectively. Therefore a 25% fixed percentage coverage rate is expected to have neutral biological impacts relative to the No Action, and would continue to have negative impacts on regulated groundfish. Further, 75% of the groundfish trips would not have accurate estimates of discards since PDT analysis (see Section 6.6.10.5 and Appendix V) has shown that observed trips are not representative of unobserved trips.

As described in Section 7.5.2.6, the risk of non-compliance depends on the coverage rate selected. The 25% coverage option has a score of 'low' compliance since there is high risk of non-compliance. This is due to the opportunity on the majority of trips for misreporting or illegal discarding of certain stocks that are constraining, which could mean the majority of groundfish trips would not have accurate estimates.

Impacts on other species

The 25% monitoring coverage option would not improve monitoring relative to the No Action since the average realized coverage rate for years FY2010-FY2017 was 22%. Therefore, this option is expected to have neutral biological impacts for other species compared to the No Action. Since observer bias is still expected to be an issue under the 25% option, there are unknown impacts on discard estimation for other species since observed trips are not representative.

7.2.1.1.2.2 Sub-option 2B – 50 percent

Impacts on regulated groundfish

The 50% monitoring coverage option would establish slightly higher coverage rates relative to the No Action (average coverage rate for years FY2010-FY2017 of 22%). This option is expected to have low positive biological impacts relative to the No Action alternative. This option would provide accurate estimates of groundfish landings and discards for half of all the groundfish trips. However, half of the groundfish trips would not have accurate estimates of discards since PDT analysis (see Section 6.6.10.5 and Appendix V) has shown that observed trips are not representative of unobserved trips.

However, as described in Section 7.5.2.6, the risk for noncompliance at 50% monitoring coverage might be more similar to the risk of noncompliance at 25% coverage, and less similar to 75% coverage. Since an observer is on board 50% of the trips there is less opportunity to discard illegally than at a lower coverage levels, while there is simultaneously a potential for the incentive to misreport catch or landings to increase substantially if it means catch of certain stocks is more constraining some proportion of the time. Therefore, if an observer is not onboard, the incentive to illegally discard, may be higher and just as, if not more catch may be discarded at 50% coverage as at the 25% coverage rate, when the incentive effect isn't as strong (see Section 7.5.2.6). 50% coverage level is scored as 'low' compliance since there is a high risk of non-compliance. This strong incentive to misreport on the unobserved trips at 50% coverage could lead to increased illegal discards on the unobserved trips. There may be tradeoffs between the higher coverage level under this option, relative to coverage levels under No Action, and the potential for strong incentives to misreport on the unobserved trips under 50% coverage. Therefore, impacts to regulated groundfish from this option would still be considered to be negative, similar to the option for 25% coverage.

Impacts on other species

The 50% monitoring coverage option would have slightly higher coverage rates relative to the No Action (average coverage rate for years FY2010-FY2017 of 22%). This option is expected to have low positive biological impacts for other species relative to the No Action alternative. Since observer bias is still expected to be an issue under the 50% option, there are unknown impacts on discard estimation for other species since observed trips are not representative.

7.2.1.1.2.3 Sub-option 2C – 75 percent

Impacts on regulated groundfish

The 75% monitoring coverage option would have higher coverage rates relative to the No Action (average coverage rate for years FY2010-FY2017 of 22%). This option is expected to have positive biological impacts relative to the No Action alternative. Since 75% of all groundfish trips will have accurate estimates of discards this option has positive biological impacts relative to the 50% monitoring coverage option. With the 75% fixed coverage rate, 25% of the groundfish trips will likely have inaccurate estimates of discards due to the observed trips not being an accurate representation of unobserved trips (see Section 6.6.10.5 and Appendix V).

As described in Section 7.5.2.6, at 75% coverage, a potentially strong incentive effect to misreport or behave differently is counteracted by a lower opportunity. As described in Section 7.5.2.6, under such coverage levels misreporting or illegal discarding behavior can now occur only on a minority of trips, which limits the amount of potential illegal activity somewhat, but not entirely. Therefore, risk of non-compliance is likely lower at 75% coverage compared to 50% or 25% coverage. The 75% coverage level option is scored as 'medium' since there is some risk of non-compliance. It should be noted that this is likely conservative, as there is expected to be a strong incentive to misreport on the unobserved portion of trips under 75% coverage, which could lead to inaccurate catch estimates from the 25% of groundfish trips that are unobserved.

Impacts on other species

The 75% monitoring coverage option would have higher coverage rates relative to the No Action (average coverage rate for years FY2010-FY2017 of 22%). This option is expected to have positive biological impacts for other species relative to the No Action alternative since the majority of trips will have accurate estimates of discards.

7.2.1.1.2.4 Sub-option 2D – 100 percent (*Preferred Alternative*)

Impacts on regulated groundfish

The 100% monitoring coverage option will provide an accurate estimate of groundfish discards on groundfish trips since an estimate for unobserved trips is not needed (with the exception of instances such as unobserved hauls or waivers issued). This will provide accurate estimates of discards on groundfish trips which will result in positive biological impacts since discard mortality will be fully accounted for in the groundfish fishery. Section 7.2.1.1 lists potential biological impacts from 100% monitoring of all sector trips on regulated groundfish, both in the short- and long-term. Compared to the No Action, the option for 100% monitoring coverage would have positive biological impacts. Similarly, 100% monitoring coverage would have positive biological impacts when compared to 25% and 50% coverage and would have low positive impacts compared to 75% coverage.

Impacts on other species

The 100% monitoring coverage option will provide comprehensive in-season monitoring on groundfish trips which ensures that sector vessels do not exceed their ACE. As such, fishing effort may be reduced with higher levels of monitoring coverage. Compared to the No Action, the option for 100% monitoring coverage would have positive biological impacts for other species. Similarly, 100% monitoring coverage would have positive biological impacts when compared to 25% and 50% coverage and would have low positive impacts compared to 75% coverage.

7.2.1.1.3 Sector Monitoring Standard Option 3: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Catch

Impacts on regulated groundfish

As described above in Section 7.2, improvements in monitoring through higher levels of monitoring coverage have positive biological impacts on groundfish species, both in the short- and long-term. In the short-term, improvements in monitoring which reduces fishing mortality through better catch accounting should produce positive biological impacts. In the longer-term, analytical assessments should improve with better catch data which should lead to subsequent improvements in groundfish catch advice and management. The four options for a fixed total monitoring coverage level based on a percentage of catch (25, 50, 75, and 100%) for each allocated groundfish stock are analyzed and qualitatively ranked relative to each other. Compared to No Action, this option is expected to have low positive to positive biological impacts for regulated groundfish species. Compared to Option 2, this option is expected to have low positive to positive biological impacts to regulated groundfish species, because achieving a target percent coverage of catch of each allocated groundfish stock will require a higher overall monitoring coverage level, due to the variation among stocks (see Section 7.5.3.1.3).

Impacts on other species

Improvements in monitoring through higher levels of monitoring coverage have positive biological impacts on other species. Improved monitoring through higher monitoring coverage levels ensures that sector vessels do not exceed their ACE. As such, fishing effort may be reduced with higher levels of monitoring coverage which produces positive biological impacts for other species. The four options for a fixed total monitoring coverage level based on a percentage of catch (25, 50, 75, and 100%) for each allocated groundfish stock are analyzed and qualitatively ranked relative to each other. Compared to No Action, this option is expected to have low positive to positive biological impacts for other species.

7.2.1.1.3.1 Sub-option 3A – 25 percent

Impacts on regulated groundfish

25% monitoring coverage as a percentage of catch for each allocated groundfish stock would likely result in some improvement to monitoring relative to Option 1/No Action. As demonstrated in a simulation exercise described in Section 7.5.3.1.3in order to investigate what overall coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock, a higher overall coverage level is needed in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. The simulations show that 50% randomized observer coverage across all FY2018 sector trips would result in a 90% probability that at least 25% of the total catch of every allocated stock (and halibut) was observed (Figure 45, Table 136 in Section 7.5.3.1.3). 25% monitoring coverage as a percentage of catch for each allocated groundfish stock would, therefore, result in improvements to monitoring when compared to Option 1/No Action, since the average realized coverage rate for years FY2010-FY2017 was 22%. Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38%, and 14-32%, respectively, resulting in an average target and realized coverage level of 25% and 22%, respectively. Therefore a 25% percentage coverage rate of total catch of each allocated groundfish stock is expected to have low positive biological impacts for regulated groundfish relative to the No Action. However, there are still concerns that the unobserved portion of groundfish trips would not have accurate estimates of discards since PDT analysis (see Section 6.6.10.5 and Appendix V) has shown that observed trips are not representative of unobserved trips.

Impacts on other species

25% monitoring coverage as a percentage of catch for each allocated groundfish stock would likely result in some improvement to monitoring relative to Option 1/No Action. As demonstrated in a simulation exercise described in Section 7.5.3.1.3 in order to investigate what overall coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock, a higher overall coverage level is needed in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. The simulations show that 50% randomized observer coverage across all FY2018 sector trips would result in a 90% probability that at least 25% of the total catch of every allocated stock (and halibut) was observed (Figure 45, Table 136 in Section 7.5.3.1.3). 25% monitoring coverage as a percentage of catch for each allocated groundfish stock would, therefore, result in improvements to monitoring when compared to Option 1/No Action, since the average realized coverage rate for years FY2010-FY2017 was 22%. Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38%, and 14-32%, respectively, resulting in an average target and realized coverage level of 25% and 22%, respectively. Therefore a 25% percentage coverage rate of total catch of each allocated groundfish stock is expected to have low positive biological impacts for other species relative to the No Action. However, there are still concerns that the unobserved portion of groundfish trips would not have accurate estimates of discards since PDT analysis (see Section 6.6.10.5 and Appendix V) has shown that observed trips are not representative of unobserved trips.

7.2.1.1.3.2 Sub-option 3B – 50 percent

Impacts on regulated groundfish

50% monitoring coverage as a percentage of catch for each allocated groundfish stock would result in higher monitoring coverage relative to Option 1/No Action. As demonstrated in a simulation exercise described in Section 7.5.3.1.3 in order to investigate what overall coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock, a higher overall coverage level is needed in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. The simulations show that increasing coverage rates to 70% of trips would confer roughly a 90% chance that 50% of total catch was observed for each allocated groundfish stock, with many stocks having a 100% chance of meeting that catch target if effort and stock availability remained identical to 2018. (Figure 46, Table 136 in Section 7.5.3.1.3). 50% monitoring coverage as a percentage of catch for each allocated groundfish stock would, therefore, result in improvements to monitoring when compared to the No Action (average coverage rate for years FY2010-FY2017 of 22%). Therefore a 50% percentage coverage rate of total catch of each allocated groundfish stock is expected to have positive biological impacts relative to the No Action. However, there are still concerns that the unobserved portion of groundfish trips would not have accurate estimates of discards since PDT analysis (see Section 6.6.10.5 and Appendix V) has shown that observed trips are not representative of unobserved trips.

Impacts on other species

50% monitoring coverage as a percentage of catch for each allocated groundfish stock would result in higher monitoring coverage relative to the No Action. As demonstrated in a simulation exercise described in Section 7.5.3.1.3 in order to investigate what overall coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock, a higher overall coverage level is needed in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. The simulations show that increasing coverage rates to 70% of trips estimates roughly a 90% chance that 50% of total catch was observed for each allocated groundfish stock, with many stocks having a 100% chance of meeting that catch target if effort and stock availability remained identical to 2018. (Figure 46, Table 136 in Section 7.5.3.1.3). 50% monitoring coverage as a percentage of catch for each allocated groundfish stock would, therefore, result in improvements to monitoring when compared to the No Action (average coverage rate for years FY2010-FY2017 of 22%). Therefore a 50% percentage coverage rate of total catch of each allocated groundfish stock is expected to have positive biological impacts for other species relative to the No Action.

7.2.1.1.3.3 Sub-option 3C – 75 percent

Impacts on regulated groundfish

75% monitoring coverage as a percentage of catch for each allocated groundfish stock would result in higher monitoring coverage relative to the No Action. As demonstrated in a simulation exercise described in Section 7.5.3.1.3 in order to investigate what overall coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock, a higher overall coverage level is needed in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. The simulations show that increasing coverage rates to 90% of trips would confer roughly a 90% chance that 75% of total catch was observed for each stock (Figure 47, Table 136 in Section 7.5.3.1.3). 75% monitoring coverage as a percentage of catch for each allocated groundfish stock would, therefore, result in improvements to monitoring when compared to the No Action (average coverage rate for years

FY2010-FY2017 of 22%). Therefore a 75% percentage coverage rate of total catch of each allocated groundfish stock is expected to have positive biological impacts relative to the No Action. However, there are still concerns that the unobserved portion of groundfish trips would not have accurate estimates of discards since PDT analysis (see Section 6.6.10.5 and Appendix V) has shown that observed trips are not representative of unobserved trips.

Impacts on other species

75% monitoring coverage as a percentage of catch for each allocated groundfish stock would result in higher monitoring coverage relative to the No Action. As demonstrated in a simulation exercise described in Section 7.5.3.1.3 in order to investigate what overall coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock, a higher overall coverage level is needed in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. The simulations show that increasing coverage rates to 90% of trips would confer roughly a 90% chance that 75% of total catch was observed for each stock (Figure 47, Table 136 Section 7.5.3.1.3). 75% monitoring coverage as a percentage of catch for each allocated groundfish stock would, therefore, result in improvements to monitoring when compared to the No Action (average coverage rate for years FY2010-FY2017 of 22%). Therefore a 75% percentage coverage rate of total catch of each allocated groundfish stock is expected to have positive biological impacts for other species relative to the No Action.

7.2.1.1.3.4 Sub-option 3D – 100 percent

Impacts on regulated groundfish

100% monitoring coverage as a percentage of catch for each allocated groundfish stock will provide an accurate estimate of groundfish discards on groundfish trips since an estimate for unobserved trips is not needed. This will provide accurate estimates of discards on groundfish trips which will result in positive biological impacts since discard mortality will be fully accounted for in the groundfish fishery. Section 7.2.1.1 lists potential biological impacts from 100% monitoring of all sector trips on regulated groundfish, both in the short- and long-term. Compared to the No Action, the option for 100% monitoring coverage would have positive biological impacts. Similarly, 100% monitoring coverage would have positive biological impacts when compared to 25% and 50% coverage and would have low positive impacts compared to 75% coverage.

Impacts on other species

100% monitoring coverage as a percentage of catch for each allocated groundfish stock will provide comprehensive in-season monitoring on groundfish trips which ensures that sector vessels do not exceed their ACE. As such, fishing effort may be reduced with higher levels of monitoring coverage. Compared to the No Action, the option for 100% monitoring coverage would have positive biological impacts for other species. Similarly, 100% monitoring coverage would have positive biological impacts when compared to 25% and 50% coverage and would have low positive impacts compared to 75% coverage.

7.2.1.2 Sector Monitoring Tools (Options for meeting monitoring standards)

7.2.1.2.1 Sector Monitoring Tools Option 1: Electronic Monitoring in place of Human At-Sea Monitors

Impacts on regulated groundfish

This option would not produce a change to the biological impacts on regulated groundfish relative to the No Action assuming the data collected from electronic monitoring is equivalent to a human at-sea-monitor. However, there are some instances where monitoring data collected by a human observer and a camera system may not be equivalent. For example, it is difficult to differentiate between some species, such as red and white hake, using electronic monitoring systems. In these instances, there is a potential negative biological impact for some stocks relative to an equivalent 100% coverage rates using human at-sea monitors. On the other hand, electronic monitoring systems can monitor every tow, which a human observer may not be able to achieve, especially on a multi-day trip. Further, electronic monitoring systems cannot be coerced into falsifying data, which may be a concern with human observers. In these respects, electronic monitoring data can provide information that is superior to a human observer.

Impacts on other species

This option would not produce a change to the biological impacts on other species relative to the No Action assuming the data collected from electronic monitoring is equivalent to a human at-sea-monitor. This assumption is likely not met for some stocks that are difficult to identify from the video such as red hake. There is a potential negative biological impact for some stocks relative to an equivalent 100% coverage rates using human at-sea monitors.

7.2.1.2.2 Sector Monitoring Tools Option 2: Audit Model Electronic Monitoring Option (*Preferred Alternative*)

Impacts on regulated groundfish

Positive biological impacts on regulated groundfish will occur under a fully developed audit model electronic monitoring option. A fully developed audit model electronic monitoring option should produce biological impacts that are similar to the impacts under 100% fixed rate for human at-sea coverage since discard estimates under this program should be unbiased and accurate. This option would have positive biological impacts on regulated groundfish species compared to the options for lower fixed rates (25-75%) for human at-sea coverage under Option 2. For some difficult to identify stocks from the video review like white hake there may be some negative biological impacts relative to an equivalent 100% coverage rates using human at-sea monitors. However, these identification issues can likely be alleviated through targeted subsampling, and thus this alternative would still offer an improvement over the No Action.

Impacts on other species

Positive biological impacts on other species will occur under a fully well-developed audit model electronic monitoring option. If the audit model is correctly developed then this option should produce biological impacts that are similar to the impacts under 100% fixed rate for human at-sea coverage since this would provide comprehensive coverage of groundfish trips. Comprehensive monitoring coverage ensures that sector vessels do not exceed their ACE, and as such, fishing effort may be reduced with higher levels of monitoring coverage. This option would have positive biological impacts on other species compared to the options for lower fixed rates (25-75%) for human at-sea coverage under Option 2. For some difficult to identify stocks from the video review like red hake there may be some negative biological impacts relative to an equivalent 100% coverage rates using human at-sea monitors.

7.2.1.2.3 Sector Monitoring Tools Option 3: Maximized Retention Electronic Monitoring Option (*Preferred Alternative*)

Impacts on regulated groundfish

Positive biological impacts will occur under a fully developed maximized retention model electronic monitoring option. A fully developed maximized retention model electronic monitoring option should produce biological impacts that are similar to the biological impacts of 100% fixed rate for human at-sea coverage assuming the maximum retention model does not result in a shift in fishery selectivity to younger smaller fish. This option would have positive biological impacts on regulated groundfish species compared to the options for lower fixed rates (25-75%) for human at-sea coverage under Option 3. In the short term, a shift in fishery to targeting to smaller younger fish will likely result in negative biological impacts since the contemporary catch limits are set assuming that the recent selectively will not change. Future ABCs, however, would take into account the change in selectivity. A shift in selectively to smaller younger fish while holding all other factors constant will result in a decrease in the estimated overfishing mortality rate ($F_{40(MSYproxy)}$) (see section 7.1.2.4.3 in FW48 for further analysis and discussion). Assessments would need to track to see if a change in selectivity occurred and potentially adjust the model assumptions. Accounting for fish would be within the ABCs - as discards and landings. Furthermore, fishing across a range of fish sizes – rather than larger fish alone – could be better from an ecological standpoint. One nice solution to this problem is to manage fisheries in such a way that large fish are unlikely to be caught (Conover and Munch 2002). Since the Maximized Retention Option and the EM Audit Option are designed to meet the same standard, this alternative is expected to have similar biological impacts to Option 2: EM audit model.

Impacts on other species

Positive biological impacts on other species will occur under a fully well-developed maximized retention model electronic monitoring option. If the maximized retention model is correctly developed then this option should produce biological impacts that are similar to the impacts under 100% fixed rate for human at-sea coverage since this would provide comprehensive coverage of groundfish trips. Comprehensive monitoring coverage ensures that sector vessels do not exceed their ACE, and as such, fishing effort may be reduced with higher levels of monitoring coverage. This option would have positive biological impacts on other species compared to the options for lower fixed rates (25-75%) for human at-sea coverage under Option 3. Since the Maximized Retention Option and the EM Audit Option are designed to meet the same standard, this alternative is expected to have similar biological impacts to Option 2: EM audit model.

7.2.1.3 Combined Impacts of At-Sea and Dockside Monitoring

If at-sea monitoring options for sectors are combined with dockside monitoring options for sectors and the common pool, greater positive biological impacts are expected for regulated groundfish species and other species. High positive impacts are expected at a target coverage level of 100% in each program. It is difficult at present to determine a trade-off point in which 100% dockside coverage for the commercial fishery in combination with a level of at-sea coverage less than 100% would provide similarly high positive impacts. Practically, this might be possible with data generated from the at-sea and dockside programs, after a few years and following an evaluation through the review process for sector monitoring coverage.

7.2.1.4 Total Monitoring Coverage Level Timing

7.2.1.4.1 Coverage Level Timing Option 1: No Action

Impacts on regulated groundfish
Option 1/No Action would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is administrative because it only affects the timing of information availability for business planning.

Impacts on other species
Option 1/No Action would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is administrative because it only affects the timing of information availability for business planning.

7.2.1.4.2 Coverage Level Timing Option 2: Knowing Total Monitoring Coverage Level at a Time Certain

Impacts on regulated groundfish
Option 2 would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is administrative because it only affects the timing of information availability for business planning.

Impacts on other species
Option 2 would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is administrative because it only affects the timing of information availability for business planning.

7.2.1.5 Review Process for Sector Monitoring Coverage

7.2.1.5.1 Coverage Review Process Option 1: No Action

Impacts on regulated groundfish
Option 1/No Action would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

Impacts on other species
Option 1/No Action would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

7.2.1.5.2 Coverage Review Process Option 2: Establish a Review Process for Monitoring Coverage Rates (*Preferred Alternative*)

Impacts on regulated groundfish
Option 2 would not be expected to have direct impacts on regulated groundfish species. While this measure is primarily administrative, by establishing a review process there could be indirect positive impacts on regulated groundfish from an evaluation of the efficacy of monitoring coverage rates to determine, for example, whether there is evidence of bias, and whether the monitoring standards are being met. Therefore, compared to No Action there could be indirect low positive impacts on regulated groundfish.

Impacts on other species
Option 2 would not be expected to have direct impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. While this measure is primarily administrative, by establishing a review process there could be indirect positive impacts on non-groundfish species from an evaluation of the efficacy of monitoring coverage rates to determine, for example, whether there is evidence of bias, and whether the monitoring standards are being met. Therefore, compared to No Action there could be indirect low positive impacts on other species.

7.2.1.6 Addition to List of Framework Items (*Preferred Alternative*)

Impacts on regulated groundfish
This option would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

This option would add new sector monitoring tools to the list of framework items. Impacts to regulated groundfish species would depend on the nature of new monitoring tools, which may include additional models of EM developed in the future.

This option would also add vessel coverage levels to the list of framework items. Initial discussion and analysis on possible impacts of vessel coverage levels can be found in "Memo from Groundfish PDT to Groundfish Committee re vessel specific coverage level option"[39], as well as in a letter from the NEFSC to the Council[40] in response to a request for information on observer deployment data at the vessel level for groundfish trips.

Impacts on other species

This option would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

[39] "Memo from Groundfish PDT to Groundfish Committee re vessel specific coverage level option", dated November 19, 2019; https://s3.amazonaws.com/nefmc.org/191119-GF-PDT-memo-to-GF-Committee-re-vessel-specific-coverage-level-option-with-attachments.pdf

[40] Letter from NEFSC to NEFMC, dated November 22, 2019; https://s3.amazonaws.com/nefmc.org/191122_Letter_NEFSC-to-NEFMC_vessel-observer-coverage-rates.pdf

7.2.2 Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool)

7.2.2.1 Dockside Monitoring Program (Sectors and Common Pool)

The following is an overview of *possible* short- and long-term impacts of the highest target coverage option -100% monitoring of all commercial (sector and common pool) groundfish landings.

- Short-term (upon implementation and up to five years)
  - Increased accuracy of commercial landings going into the assessments
  - Reduce the likelihood of overfishing because in-season monitoring of landings would improve – such that the "true" landings would be known by at least the species-level
- Long-term (greater than five years)
  - Improved estimation of fishing mortality and biomass
  - Allow for consideration of a wider-range of stock assessment approaches – for example, comprehensive monitoring may enable assessments to shift from low information content empirical approaches to the development of full analytical assessments. This transition is assessment methodology may be possible because comprehensive monitoring would provide accurate data on the magnitude and age structure of removals in the commercial fishery, which would be better aligned with the data requirements of the age-structured assessment models that are employed for groundfish in the region.

7.2.2.1.1 Dockside Monitoring Option 1: No Action (*Preferred Alternative*)

Impacts on regulated groundfish

If this option is selected, a dockside monitoring program would not be established for the groundfish fishery. When compared to other options under consideration, Option 1/No Action would result in lower certainty regarding the magnitude of groundfish catches at the species level, because the majority of groundfish catch is landed. An accurate estimate of groundfish catch is critical for stock assessments, as most assessment models assume there is little error surrounding the magnitude of the removals. In the absence of dockside monitoring, information on sector catches is expected to be less reliable, and it is possible that sectors could exceed their ACE, increasing the risk of overfishing. Under No Action, there is a much greater probability that landings could be misreported and/or underreported, which has occurred in the groundfish fishery in the recent past. As a result, this alternative is expected to have negative biological impacts to groundfish stocks.

Impacts on other species

Under this alternative, no dockside monitoring program for the groundfish fishery would be established, and thus no independent verification of groundfish landings (other than occasional verification by enforcement agents). As such, information on groundfish catches will be unverified, and sectors could potentially exceed their ACE. Therefore, under this alternative it is less likely that fishing effort would be reduced in season. This alternative is expected to have low negative biological impacts for other species.

7.2.2.1.2 Dockside Monitoring Option 2: Mandatory Dockside Monitoring Program for the Commercial Groundfish Fishery

Impacts on regulated groundfish

This alternative would establish a comprehensive dockside monitoring program for both the sector and common pool fishery. Currently in the groundfish fishery there is no independent verification of landings when catches are offloaded, and a very low percentage of groundfish trips are inspected by enforcement for compliance during offload (see Appendix III, "Groundfish PDT Dockside Monitoring Discussion Document"). This dockside monitoring program is intended to deter misreported landings, and provide independent verification of groundfish landings, and therefore should result in increased certainty in the magnitude of groundfish catches at the species level. Dockside monitoring will allow for more accurate in-season monitoring of landings, which will help ensure that sectors do not exceed the ACE, and that common pool vessel do not exceed daily catch limits. This independent verification of catch will reduce the risk of overfishing. Therefore, relative to No Action, this alternative is expected to have positive biological impacts for regulated groundfish species.

Impacts on other species

This alternative would provide comprehensive in-season monitoring of groundfish landings. As such, this alternative will ensure that sector vessels do not exceed their ACE. Therefore, fishing effort may be reduced under this alternative. Further, a dockside monitoring program would also provide independent verification of landings amounts for other species that are landed by groundfish vessels, which is expected to increase the accuracy of landings data for these other stocks. Relative to No Action, this alternative is expected to have low positive biological impacts for other species as landings verification would occur for incidental catches.

7.2.2.2 Dockside Monitoring Program Structure and Design

7.2.2.2.1 Dockside Monitoring Program Funding Responsibility

7.2.2.2.1.1 Dockside Monitoring Program Funding Responsibility Option A – Dealer Responsibility

Impacts on regulated groundfish
Option A would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

Impacts on other species
Option A would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

7.2.2.2.1.2 Dockside Monitoring Program Funding Responsibility Option B – Vessel Responsibility

Impacts on regulated groundfish
Option B would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

Impacts on other species
Option B would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

7.2.2.2.2 Dockside Monitoring Program Administration

7.2.2.2.2.1 Dockside Monitoring Program Administration Option A – Individual contracts with dockside monitor providers

Impacts on regulated groundfish

Option A would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

Impacts on other species
Option A would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

7.2.2.2.2.2 Dockside Monitoring Program Administration Option B – NMFS-administered dockside monitoring program

Impacts on regulated groundfish
Option B would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

Impacts on other species
Option B would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

7.2.2.2.3 Options for Lower Dockside Monitoring Coverage Levels (20 percent coverage)

7.2.2.2.3.1 Option A - Lower coverage levels for <u>ports</u> with low volumes of groundfish landings)

Option A would allow for lower levels of dockside monitoring for low volume ports to act as a "spot check." To determine which ports would be considered low volume, an analysis of total annual groundfish landings by port was done (see in Section 6.6.11.1). Offloads at ports that received ~98 percent of total annual groundfish landings for 2016-2018 would be monitored at 100 percent coverage. These "major" ports are those in the top nine – New Bedford, MA; Gloucester, MA; Boston, MA; Portland, ME; Chatham, MA; Point Judith, RI; Seabrook, NH; Rye, NH; and Portsmouth, NH (see Figure 10 in Section 6.6.11.1). Offloads in these nine major ports would be monitored at 100 percent coverage, whether dockside monitoring is a dealer-funded program or a vessel-funded program. All other ports would be considered "low volume" as characterized by lower landings volumes, and offloads in these ports would be monitored at the lower coverage level of 20 percent. This means that ports which land approximately 2 percent of total groundfish pounds would be exempted from 100 percent coverage and would be monitored at 20 percent coverage instead, as a spot check.

Impacts on regulated groundfish

Option A would allow for lower levels of dockside monitoring coverage for low volume ports. Relative to No Action (no required dockside monitoring program), this option would have positive impacts on regulated groundfish, since the dockside monitoring program is intended to deter misreported landings, and provide independent verification of groundfish landings, and therefore should result in increased certainty regarding the magnitude of groundfish landings at the species level. An accurate estimate of groundfish catch is critical for stock assessments, as many assessment models assume that the magnitude and age structure of removals is known without error. Additionally, in the absence of dockside monitoring, information on sector catches is expected to be less reliable, and it is possible that sectors could exceed their ACE, increasing the risk of overfishing.

Relative to Option 2, which would require 100 percent monitoring for the entire commercial groundfish fishery, this option would be expected to have low negative impacts on regulated groundfish since dockside monitoring coverage would be lower for offloads in certain ports under this option. However, landings from the low volume ports that would receive lower coverage comprise ~2 percent of the total annual groundfish landings, and so the majority of groundfish landings would be monitored at 100 percent coverage (Figure 10). Table 211 in Section 7.5.4.2.3.1shows the amount of landed pounds of groundfish by sector vessels and common pool vessels landed in ports that would be monitored at the lower coverage level under this option and the amount of landed groundfish pounds landed in ports that would be monitored at 100 percent coverage for each year from FY2016 to FY2018. Between FY2016-2018, major ports accounted for 98.5% of all pounds landed of any allocated groundfish stock (Table 211 in Section 7.5.4.2.3.1).

Periodic evaluation of landings volumes at each port is intended to mitigate any potentially low negative impacts from the possible shifting of landings from the ports in which offloads are monitored at 100 percent coverage to those in which offloads are monitored at the lower coverage level.

Impacts on other species

Option A would allow for lower levels of dockside monitoring coverage for low volume ports. Relative to the No Action, this option would have positive impacts on non-groundfish, since dockside monitoring will ensure that sector vessels do not exceed their ACE. As such, fishing effort may be reduced under dockside monitoring coverage. Further, a dockside monitoring program would also provide independent verification of landings amounts for other species that are landed by groundfish vessels, which is expected to increase the accuracy of landings data for these other stocks.

Relative to Option 2, which would require 100 percent dockside monitoring for the entire commercial groundfish fishery, this option would be expected to have low negative impacts on non-groundfish since dockside monitoring coverage would be lower for certain ports under this option, and thus a lower proportion of non-groundfish landings would be subject to independent verification.. However, landings from the low volume ports that would be monitored at the lower coverage level comprise ~5 percent of the total annual groundfish landings, and so the majority of groundfish landings would be monitored at 100 percent coverage (Figure 10). Table 211 in Section 7.5.4.2.3.1 shows the amount of landed pounds of non-groundfish by sector vessels and common pool vessels landed in ports that would be monitored at the lower coverage level under this option and the amount of landed groundfish pounds landed in ports that would be monitored at 100 percent coverage for each year from FY2016 to FY2018. Between FY2016-2018, major ports accounted for 89% of all non-groundfish pounds (Table 211 in Section 7.5.4.2.3.1).

7.2.2.2.3.2 Option B - Lower coverage levels for <u>vessels</u> with total groundfish landings volumes in the 5th percentile of total annual landings

Background analysis of total annual groundfish landings by vessel to determine the landings threshold for lower coverage for low volume vessels

Option B would allow for lower levels of dockside monitoring for low volume vessels to act as a "spot check." To determine which vessels would be considered "low volume", an analysis of total annual groundfish landings by volume was done (see Section 6.6.11.1). Vessels with total annual groundfish landings volumes in the 5th percentile of total annual landings volume for 2016-2018 were determined to be low volume and offloads from these vessels would be monitored at a lower "spot check" coverage under this option. This means that vessels which land approximately 5 to 10 percent of total groundfish pounds each year would be exempted from 100 percent dockside monitoring coverage and offloads from these vessels would be monitored at 20 percent coverage instead, as a spot check. Vessels that landed 90-95 percent of groundfish for 2012-2018 would have 100 percent of their offloads monitored. The vessels that cover ~95 percent of total groundfish landings are those that landed 46,297lbs or more annually on average from 2016-2018 (see Figure 12 in Section 6.6.11.1). Offloads from vessels landing 46,297lbs or more annually, would be monitored at 100 percent coverage, whether dockside monitoring is a dealer-funded program or vessel-funded program. Offloads from vessels with annual landings volumes of less than 46,297lbs, would be monitored at the lower coverage rate of 20 percent. This measure would include a periodic re-evaluation of what constitutes a "low volume vessel" based on landings volume, to occur after two years of landings data is available and every three years after that.

Impacts on regulated groundfish

Option B would allow for lower levels of dockside monitoring coverage for low volume vessels. Relative to the No Action (no required dockside monitoring program), this option would have positive impacts on regulated groundfish, since dockside monitoring is intended to deter misreported landings, and provide independent verification of groundfish landings, and therefore should result in increased certainty regarding the magnitude of groundfish catches at the species level. An accurate estimate of groundfish catch is critical for stock assessments, as many assessment models assume that the magnitude and age structure of removals is known without error. Additionally, in the absence of dockside monitoring, information on sector catches is expected to be less reliable, and it is possible that sectors could exceed their ACE, increasing the risk of overfishing.

Relative to Option 2, which would require 100 percent dockside monitoring for the entire commercial groundfish fishery, this option would be expected to have low negative impacts on regulated groundfish since dockside monitoring coverage would be lower for certain vessels under this option. However, landings from the low volume vessels that would be monitored at the lower coverage level comprise ~5 percent of the total annual groundfish landings, and so the majority of groundfish landings would be monitored at 100 percent coverage (Figure 12). Table 213 in Section 7.5.4.2.3.2 shows the amount of landed pounds of groundfish landed by sector vessels and common pool vessels that would be monitored at the lower coverage level under this option and the amount of landed groundfish pounds landed by vessels that would be monitored at 100 percent coverage for each year from FY2016 to FY2018. Between FY2016-2018, low volume vessels accounted for only 2% of all landed groundfish pounds (Table 213 in Section 7.5.4.2.3.2).

Periodic evaluation of landings volumes is intended to mitigate any potentially low negative impacts from the potential that the 5th percentile of total annual groundfish landings changes over time and results in a different annual vessel landings volume threshold.

Impacts on other species

Option B would allow for lower levels of dockside monitoring coverage for small, low volume vessels. This option would have positive impacts on non-groundfish, since dockside monitoring will ensure that sector vessels do not exceed their ACE. As such, fishing effort may be reduced under dockside monitoring coverage. Further, a dockside monitoring program would also provide independent verification of landings amounts for other species that are landed by groundfish vessels, which is expected to increase the accuracy of landings data for these other stocks.

Relative to Option 2, which would require 100 percent monitoring for the entire commercial groundfish fishery, this option would be expected to have negative impacts on non-groundfish since dockside monitoring coverage would be lower for certain vessels under this option. The majority of non-groundfish pounds from FY2016-2018 were landed by low volume vessels that would have the lower rate. However, landings from the low volume vessels that would receive lower coverage comprise ~5 percent of the total annual groundfish landings, and so the majority of groundfish landings would be monitored at 100 percent coverage (Figure 12). Table 213in Section 7.5.4.2.3.2 shows the amount of landed pounds of non-groundfish landed by sector vessels and common pool vessels that would be monitored at the lower coverage level under this option and the amount of landed groundfish pounds landed by vessels that would be monitored at 100 percent coverage for each year from FY2016 to FY2018. While low coverage vessels account for a minority of landed groundfish pounds, they account for the majority of landed non-groundfish pounds in any year. Between FY2016-2018, low volume vessels accounted for 65% of all non-groundfish pounds (Table 213 in Section 7.5.4.2.3.2).

Periodic evaluation of landings volumes is intended to mitigate any potentially low negative impacts from the potential that the 5th percentile of total annual groundfish landings changes over time and results in a different annual vessel landings volume threshold.

7.2.2.2.4 Dockside Monitoring Fish Hold Inspection Requirements

7.2.2.2.4.1 Fish Hold Inspection Option A – Dockside monitor fish hold inspections required

Impacts on regulated groundfish

Option A would require dockside monitor fish hold inspections at the conclusion of an offload. Fish hold inspections as part of a dockside monitoring program help to ensure that all landings are accounted for, which therefore should result in increased certainty in the magnitude of groundfish catches at the species level. This independent verification of catch will reduce the risk of overfishing. Therefore, this option is expected to have positive biological impacts for regulated groundfish species. Compared to Option B, this option may have similar positive impacts, provided that alternative methods to dockside monitors directly inspecting the fish hold (cameras) can account for all catch. Compared to Option C, this option would likely have positive biological impacts, as it provides an independent verification of catch whereas Sub-Option C does not; Option C it is self-validation by the captain.

Impacts on other species

Option A would require dockside monitor fish hold inspections at the conclusion of an offload. Fish hold inspections as part of a dockside monitoring program help to ensure that all landings are accounted for, which will ensure that sector vessels do not exceed their ACE. As such, fishing effort may be reduced under this alternative. Therefore, this option is expected to have low positive biological impacts for other species. Compared to Option B, this option may have similar positive impacts, provided that alternative methods to dockside monitors directly inspecting the fish hold (cameras) can account for all catch. Compared to Option C, this option would likely have low positive biological impacts, as it provides an independent verification of catch whereas Option C does not.

7.2.2.2.4.2 Fish Hold Inspection Option B – Alternatives method for inspecting fish holds (cameras)

Impacts on regulated groundfish

Option B would allow for the use of cameras as an alternate method to dockside monitors directly inspecting fish holds at the conclusion of an offload. Fish hold inspections as part of a dockside monitoring program help to ensure that all landings are accounted for, which therefore should result in increased certainty in the magnitude of groundfish catches at the species level. This independent verification of catch will reduce the risk of overfishing. Therefore, this option is expected to have positive biological impacts for regulated groundfish species. Compared to Option A, this option may have similar positive impacts, provided that alternative methods to dockside monitors directly inspecting the fish hold (cameras) can account for all catch. Compared to Option C, this option would likely have low positive biological impacts, as it provides an independent verification of catch whereas Option C does not.

Impacts on other species

Option B would allow for the use of cameras as an alternate method to dockside monitors directly inspecting fish holds at the conclusion of an offload. Fish hold inspections as part of a dockside monitoring program help to ensure that all landings are accounted for, which will ensure that sector vessels do not exceed their ACE. As such, fishing effort may be reduced under this alternative. Therefore, this option is expected to have low positive biological impacts for other species. Compared to Option A, this option may have similar positive impacts, provided that alternative methods to dockside monitors directly inspecting the fish hold (cameras) can account for all catch. Compared to Option C, this option would likely have low positive biological impacts, as it provides an independent verification of catch whereas Option C does not.

7.2.2.2.4.3 Fish Hold Inspection Option C – No fish hold inspection required, captain signs affidavit

Impacts on regulated groundfish

Option C would not require fish hold inspections at the conclusion of an offload, and instead the captain would sign an affidavit verifying all catch has been offloaded, or an estimate of catch. Requiring a signed affidavit may help to ensure all catch has been offloaded and accounted for; however, there would be no independent verification of catch (aside from Office of Law Enforcement inspections, which occur infrequently, see PDT memo with information from OLE[41]). Therefore, this option is expected to have low positive biological impacts for regulated groundfish. Compared to Option A and Option B, this option may have low negative impacts, as there would be no independent verification of catch.

Impacts on other species

Option C would not require fish hold inspections at the conclusion of an offload, and instead the captain would sign an affidavit verifying all catch has been offloaded, or an estimate of catch. Requiring a signed affidavit may help to ensure all catch has been offloaded and accounted for; however, there would be no independent verification of catch. Therefore, this option is expected to have low positive biological impacts for other species. Compared to Option A and Option B, this option may have low negative impacts, as there would be no independent verification of catch.

7.2.2.3 Combined Impacts of At-Sea and Dockside Monitoring

If at-sea monitoring options for sectors are combined with dockside monitoring options for sectors and the common pool, greater positive biological impacts are expected for regulated groundfish species and other species. High positive impacts are expected at a target coverage level of 100% in each program. It is difficult at present to determine a trade-off point in which 100% dockside coverage for the commercial fishery in combination with a level of at-sea coverage less than 100% would provide similarly high positive impacts. Practically, this might be possible with data generated from the at-sea and dockside programs, after a few years and following an evaluation through the review process for sector monitoring coverage.

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[41] "190503 Groundfish PDT memo to Groundfish Committee re analyses for A23, Attachment 6": https://s3.amazonaws.com/nefmc.org/7_190503-PDT-memo-to-GF-Committee-re-analyses-for-A23-with-attachments.pdf

7.2.3 Sector Reporting

7.2.3.1 Sector Reporting Option 1: No Action

Impacts on regulated groundfish
Option 1/No Action would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

Impacts on other species
Option 1/No Action would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

7.2.3.2 Sector Reporting Option 2 – Grant Regional Administrator the Authority to Streamline Sector Reporting Requirements

Impacts on regulated groundfish
Option 2 would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative. Sectors would continue to monitor catch and reconcile with NMFS, but the format or process may be revised.

Impacts on other species
Option 2 would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. This measure is primarily administrative.

7.2.4 Funding/Operational Provisions of Groundfish Monitoring (Sectors and Common Pool)

7.2.4.1 Funding Provisions Option 1: No Action

Impacts on regulated groundfish

Option 1/No Action would not be expected to have direct or indirect impacts on regulated groundfish species, as it is primarily administrative. However, relative to Sub-Option 2B, Option 1/No Action has the potential to result in lower fishing effort, should NMFS not have sufficient funding for its shoreside costs, which would require vessels to reduce fishing effort to match the available level of monitoring that could be covered by available funding for NMFS' shoreside costs. Option 1/No Action could potentially have low positive impacts on regulated groundfish species compared to Sub-Option 2B. Impacts to regulated groundfish species from Option 1/No Action, therefore, are somewhat unclear, as it is not known whether or not NMFS would have sufficient funding available for its shoreside costs for the specified level of monitoring. Impacts of Option 1/No Action would be neutral to low negative when compared to Sub-Option 2A, as Sub-Option 2A is not expected to change fishing effort, but it does have the potential for higher monitoring coverage levels.

Impacts on other species

Option 1/No Action would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops as it is primarily administrative. However, relative to Sub-Option 2B, Option 1/No Action has the potential to result in lower fishing effort, should NMFS not have sufficient funding for its shoreside costs, which would require vessels to reduce fishing effort to match the available level of monitoring that could be covered by available funding for NMFS' shoreside costs. Option 1/No Action could potentially have low positive impacts on non-groundfish species compared to Sub-Option 2B. Impacts to non-groundfish species from Option 1/No Action, therefore, are somewhat unclear, as it is not known whether or not NMFS would have sufficient funding available for its shoreside costs for the specified level of monitoring. Impacts of Option 1/No Action would be neutral to low negative when compared to Sub-Option 2A, as Sub-Option 2A is not expected to change fishing effort, but it does have the potential for higher monitoring coverage levels.

7.2.4.2 Funding Provisions Option 2: Provisions for an Increase or Decrease in Funding for the Groundfish Monitoring Program

7.2.4.2.1 Funding Provisions Sub-Option 2A – Higher Monitoring Coverage Levels if NMFS Funds are Available (Sectors Only)

Sub-Option 2A would allow for at-sea monitoring at higher coverage levels than the target coverage required (see Section 4.1.1), up to 100 percent, provided that NMFS has determined funding is available to cover the additional administrative costs to NMFS and sampling costs to industry in a given year

Impacts on regulated groundfish

Sub-Option 2A would be expected to have indirect positive impacts on regulated groundfish species, as there is a potential for higher monitoring coverage levels under this option. If the Council selects less than 100 percent monitoring coverage, then it is expected that the increases in coverage that could potentially occur under Sub-Option 2A would likely have similar impacts as those described for the options for higher monitoring coverage, e.g., 75 percent (Section 7.2.1.1.2.3) and 100 percent (Section 7.2.1.1.2.4) as a percentage of trips, and 75 percent (Section 7.2.1.1.3.3) and 100 percent (Section 7.2.1.1.3.4) as a percentage of catch. Additionally, Section 7.2.1.1 lists potential biological impacts from 100% monitoring of all sector trips on regulated groundfish, both in the short- and long-term. Compared to Option 1/No Action, the impacts of Sub-Option 2A are somewhat unclear, as it is not known whether or not NMFS would have the funding available to cover additional administrative costs to NMFS and sampling costs to industry in a given year. The federal government may provide the funding to cover additional administrative costs to NMFS and sampling costs to industry, which would allow for at-sea monitoring at higher coverage levels than the target coverage required (see Section 4.1.1), up to 100 percent, in which case then Sub-Option 2A would have indirect positive impacts compared to Option 1/No Action. The level of additional monitoring coverage in a given year would be determined by the amount of funding available to cover additional administrative costs to NMFS and sampling costs to industry. The impacts to regulated groundfish species would depend on the level of additional monitoring coverage that NMFS has determined funding is available for in a given year. If the federal government did not have funding available for additional monitoring coverage, then impacts to regulated groundfish species would be similar to those under Option 1/No Action, and therefore, relative to Option 1, would result in neutral impacts to regulated groundfish species. Compared to Sub-Option 2B, Sub-Option 2A would have indirect low positive impacts, as there is a potential for lower monitoring coverage levels under Sub-Option 2B.

Impacts on other species

Sub-Option 2A would be expected to have indirect positive impacts on non-groundfish species, as there is a potential for higher monitoring coverage levels under this option. Compared to Option 1/No Action, the impacts of Sub-Option 2A are somewhat unclear, as it is not known whether or not NMFS would have the funding available to cover additional administrative costs to NMFS and sampling costs to industry in a given year. The federal government may provide the funding to cover additional administrative costs to NMFS and sampling costs to industry, which would allow for at-sea monitoring at higher coverage levels than the target coverage required (see Section 4.1.1), up to 100 percent, in which case then Sub-Option 2A would have indirect positive impacts compared to Option 1/No Action. The level of additional monitoring coverage in a given year would be determined by the amount of funding available to cover additional administrative costs to NMFS and sampling costs to industry. The impacts to non-groundfish species would depend on the level of additional monitoring coverage that NMFS has determined funding is available for in a given year. If the federal government did not have funding available for additional monitoring coverage, then impacts to non-groundfish species would be similar to those under Option 1/No Action, and therefore, relative to Option 1, would result in neutral impacts to non-groundfish species. Compared to Sub-Option 2B, Sub-Option 2A would have indirect low positive impacts, as there is a potential for lower monitoring coverage levels under Sub-Option 2B.

7.2.4.2.2 Funding Provisions Sub-Option 2B – Waivers from Monitoring Requirements Allowed (Sectors and Common Pool) (*Preferred Alternative*)

Sub-Option 2B would allow vessels to be issued waivers to exempt them from industry-funded monitoring requirements, for either a trip or the fishing year, if coverage was unavailable due to insufficient funding for NMFS shoreside costs for the specified target coverage level.

Impacts on regulated groundfish

Sub-Option 2B would be expected to have indirect low negative impacts on regulated groundfish species, as there is a potential for lower monitoring coverage levels under this option. Depending on what potential coverage level could result from waivers being issued, then it is expected that the decreases in coverage that could potentially occur under Sub-Option 2B would likely have similar impacts as those described for the corresponding monitoring coverage level in Section 7.2.1.1.2 (coverage as a fixed percentage of sector trips or Section 7.2.1.1.3 (coverage as a fixed percentage of catch). Compared to Option 1/No Action, Sub-Option 2B would have indirect low negative impacts to regulated groundfish species, as there is a potential for lower monitoring coverage levels under Sub-Option 2B. Additionally, Sub-Option 2B could potentially have direct impacts on regulated groundfish species compared to Option 1/No Action, as there is the potential for lower effort under Option 1/No Action, should NMFS not have sufficient funding for its shoreside costs, which would require vessels to reduce fishing effort to match the available level of monitoring that could be covered by available funding for NMFS' shoreside costs. Sub-Option 2B could potentially have low negative impacts on regulated groundfish species compared to Option 1/No Action, as this measure does not have the potential to result in a reduction of fishing effort. Impacts to regulated groundfish species from Sub-Option 2B, therefore, are somewhat unclear, as it is not known whether or not NMFS would have funding available. Compared to Sub-Option 2A, Sub-Option 2B would have indirect low negative impacts, as there is a potential for higher monitoring coverage levels under Sub-Option 2A. However, it is unclear whether or not NMFS would have the funding available to cover additional administrative costs to NMFS and sampling costs to industry in a given year.

Impacts on other species

Sub-Option 2B would be expected to have indirect low negative impacts on non-groundfish species, as there is a potential for lower monitoring coverage levels under this option. Compared to Option 1/No Action, Sub-Option 2B would have indirect low negative impacts to non-groundfish species, as there is a potential for lower monitoring coverage levels under Sub-Option 2B. Additionally, Sub-Option 2B could potentially have direct impacts on non-groundfish species compared to Option 1/No Action, as there is the potential for lower effort under Option 1/No Action, should NMFS not have sufficient funding for its shoreside costs, which would require vessels to reduce fishing effort to match the available level of monitoring that could be covered by available funding for NMFS' shoreside costs. Sub-Option 2B could potentially have low negative impacts on non-groundfish species compared to Option 1/No Action, as this measure does not have the potential to result in a reduction of fishing effort. Impacts to non-groundfish species from Sub-Option 2B, therefore, are somewhat unclear, as it is not known whether or not NMFS would have funding available. Compared to Sub-Option 2A, Sub-Option 2B would have indirect low negative impacts, as there is a potential for higher monitoring coverage levels under Sub-Option 2A. However, it is unclear whether or not NMFS would have the funding available to cover additional administrative costs to NMFS and sampling costs to industry in a given year.

7.2.5 Management Uncertainty Buffers for the Commercial Groundfish Fishery (Sectors)

Management uncertainty is the likelihood that management measures will result in a level of catch that is greater than the catch objective. It is related to the effectiveness of management measures (lower effectiveness of management measures results in greater management uncertainty, i.e., greater likelihood that measures will result in a catch that exceeds the catch level objective). An increase in the adjustment for management uncertainty may be warranted if there is a greater likelihood that management measures will result in a catch that exceeds the catch level objective. Adjustments to management uncertainty buffers should consider uncertainty in the ability of managers to constrain catch so the ACL is not exceeded, and uncertainty in quantifying the true catch amounts (i.e., estimation errors). The current default adjustment for management uncertainty for groundfish stocks is 5 percent of the ABC. Stocks without state waters catches have a lower management uncertainty buffer of 3 percent of the ABC; zero possession, discard-only stocks have a higher management uncertainty buffer of 7 percent of the ABC (see Table 3 in Section 4.5.1 for management uncertainty buffers for each stock).

7.2.5.1 Management Uncertainty Buffer Option 1: No Action

Impacts on regulated groundfish

Option 1/No Action would maintain the current process for setting management uncertainty buffers for groundfish stocks for the different sub-components of the commercial groundfish fishery. Option 1/No Action would likely have neutral to low positive biological impacts to regulated groundfish, as management uncertainty buffers are a part of the ACL-setting process, designed to constrain fishing effort to allowable levels. Maintaining current management uncertainty buffers would likely keep the groundfish fishery operating at current levels, and changes in effort would not be expected.

Compared to Option 2, Option 1/No Action may have neutral to low positive impacts to regulated groundfish. Option 2 would eliminate the management uncertainty buffers for the sector ACL for all allocated groundfish stocks, only if the option for 100% at-sea monitoring is selected, which may increase fishing effort since setting the buffer to zero would result in higher sector ACLs. However, 100% monitoring required to select Option 2 would provide an accurate estimate of groundfish discards on groundfish trips since an estimate for unobserved trips would not be needed. This will provide accurate estimates of discards on groundfish trips which will result in positive biological impacts for regulated groundfish since discard mortality will be fully accounted for in the groundfish fishery. Section 7.2.1.1 lists potential biological impacts from 100% monitoring of all sector trips on regulated groundfish, both in the short- and long-term. Further, it may be difficult to predict how changes to the management uncertainty buffers would influence fishing effort.

Impacts on other species

Option 1/No Action would likely have neutral to low positive biological impacts to other species, as management uncertainty buffers are a part of the ACL-setting process, designed to constrain fishing effort to allowable levels. Maintaining current management uncertainty buffers would likely keep the groundfish fishery operating at current levels, and changes in effort would not be expected.

7.2.5.2 Management Uncertainty Buffer Option 2 – Elimination of Management Uncertainty Buffer for Sector ACLs with 100 Percent Monitoring of All Sector Trips (*Preferred Alternative*)

Impacts on regulated groundfish

Option 2 would revise the management uncertainty buffer for the sector ACL for all allocated groundfish stocks to be zero, if the option for 100 percent at-sea monitoring, whether as a fixed percentage of sector trips (Section 4.1.1.2) or as a percentage of catch (Section 4.1.1.3) is selected. Thus, this option would increase the sector ACLs by 3 to 5 percent, depending upon the stock. It is difficult to predict whether removing the buffers would result in substantial increases in fishing effort. This option has the potential to increase fishing effort and landings since setting the buffer to zero would result in higher sector ACLs. Therefore, relative to No Action, Option 2 has the potential to result in low negative impacts on regulated groundfish. However, 100% monitoring is required to select Option 2, and having comprehensive monitoring would essentially create a census of commercial catch, as an estimate of catch for unobserved trips would rarely be needed. This would provide positive impacts to regulated groundfish as there would be greater certainty in the magnitude and age structure of the commercial catch, and lower risks of the sector ACL being exceeded.

Section 7.2.1.1.2 lists potential biological impacts from 100% monitoring of all sector trips on regulated groundfish, both in the short- and long-term. Based on the above information, impacts to regulated groundfish from Option 2 may range from low negative to low positive. It is important to note that Option 2 would not remove the scientific uncertainty buffer that is used to set ACLs (25%) which should provide a backstop to ensure that overall ACLs are not exceeded, even if sector catches increase slightly (3-5%) for some stocks under Option 2. Additionally, there are other elements evaluated in setting management uncertainty buffers besides monitoring adequacy (which includes timeliness, completeness, and accuracy of monitoring data), described in Section 4.5.1. These include enforceability of management measures, precision, latent effort, and other fishery catch. Changes in any of these elements have the potential to result in higher catches that could exceed ACLs which could warrant maintaining management uncertainty buffers. If this action also removes monitoring requirements for some vessels fishing exclusively west of 72 degrees 30 minutes west longitude or 71 degrees 30 minutes west longitude in Section 4.6, some of the potential positive impacts of 100% monitoring under this alternative would be reduced. In particular, the preferred alternative Option 3 (remove monitoring requirements for vessels fishing exclusively west of 71 degrees 30 minutes west longitude) could reduce accuracy of catch and could introduce sampling bias for some stocks that have higher catches in that area, e.g. southern windowpane, ocean pout, SNE/MA winter flounder and SNE/MA yellowtail flounder. If the management uncertainty buffer is removed for these stocks and a large proportion of total catch is not monitored there could be increased risks to these stocks in particular; thus negative biological impacts.

Impacts on other species

Option 2 has the potential to increase fishing effort since setting the buffer to zero would result in higher sector ACLs that are 3-5% greater. Therefore, Option 2 has the potential to result in low negative impacts on other species. However, 100% monitoring required to select Option 2 would provide comprehensive in-season monitoring on groundfish trips which ensures that sector vessels do not exceed their ACE. As such, fishing effort may be reduced, and therefore, Option 2 would provide positive impacts to other species. It is difficult to predict whether the removing the management uncertainty buffers would result in substantial increases in fishing effort. Based on the above information, impacts to other species from Option 2 may range from low negative to positive.

7.2.6 Remove Commercial Groundfish Monitoring Requirements for Certain Vessels Fishing Under Certain Conditions

7.2.6.1 Removal of Monitoring Program Requirements Option 1: No Action (Sectors Only)

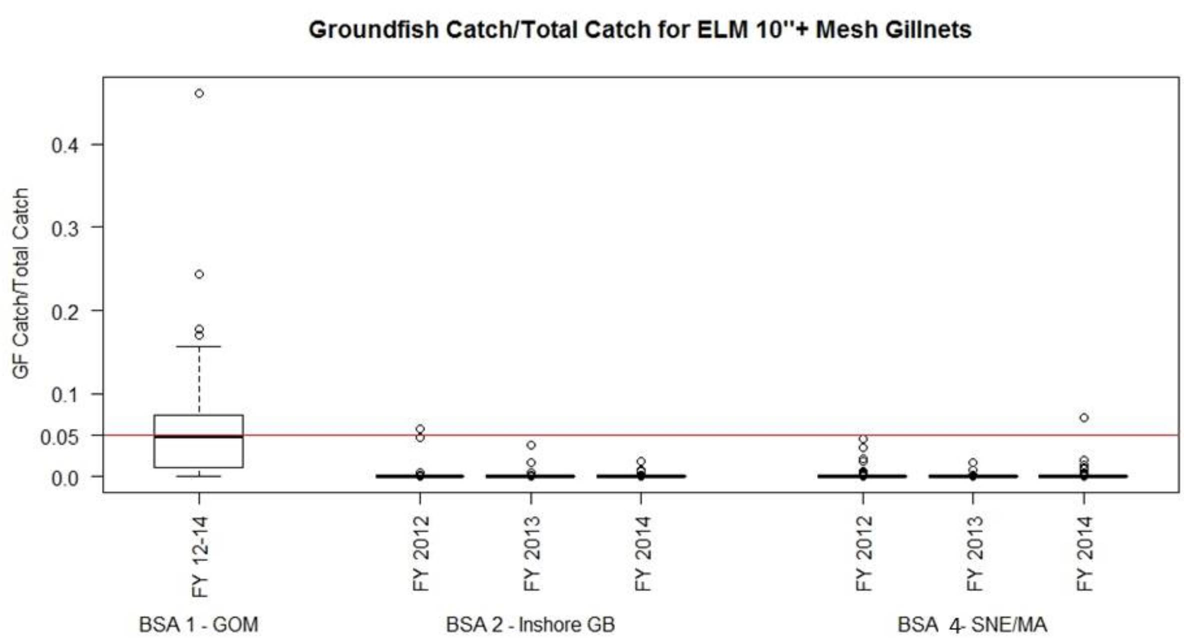
Analysis from FW55 – to be updated

Option 1/No Action would maintain the existing measures for removal of groundfish monitoring program requirements. These include the removal of ASM requirements for sector vessels fishing exclusively with extra-large mesh (ELM) gillnets of 10 inches (25.4 cm) or greater on a sector trip fishing exclusively in the SNE/MA and/or the Inshore GB Broad Stock Area (see Map 1 in Section 4.6.1). Additionally, sector vessels fishing on these non-ASM sector trips and fishing exclusively within the footprint and season of either the Nantucket Shoals Dogfish Exemption Area, the Eastern Area of the Cape Cod Spiny Dogfish Exemption Area, and SNE Dogfish Gillnet Fishery Exemption Area (see Map 1 in Section 4.6.1) are removed from the requirement to only use 10+ inch mesh on these excluded trips in order to target dogfish with 6.5 inch mesh on the same trip, and are thus also excluded from the at-sea monitoring coverage requirement. However, these spiny dogfish exemptions are handled through sector operations plans.

On both types of trips, groundfish catches are low (Figure 40 and Figure 42). These measures for removal of monitoring requirements, singly or in combination, could help to maintain the amount of fishing on these types of trips at status quo levels, limiting any dampening effect ASM requirements have on these fisheries.

These measures for removal of monitoring requirements have the potential to introduce sampling bias if not applied across all broad stock areas (BSAs) in the same manner, which could limit the ability of using the information in stock assessments. Sampling bias could occur unless the exemption was broadly applied to the ELM gear. BSA 1 (GOM) and BSA 3 (GB) would still have the ASM requirement, but other areas would not. Another possible result could be incentivizing fishing outside of BSA 1 and BSA 3.

Figure 40 - Groundfish catch as a proportion of total catch on observed sector trips by fishing year and BSA.

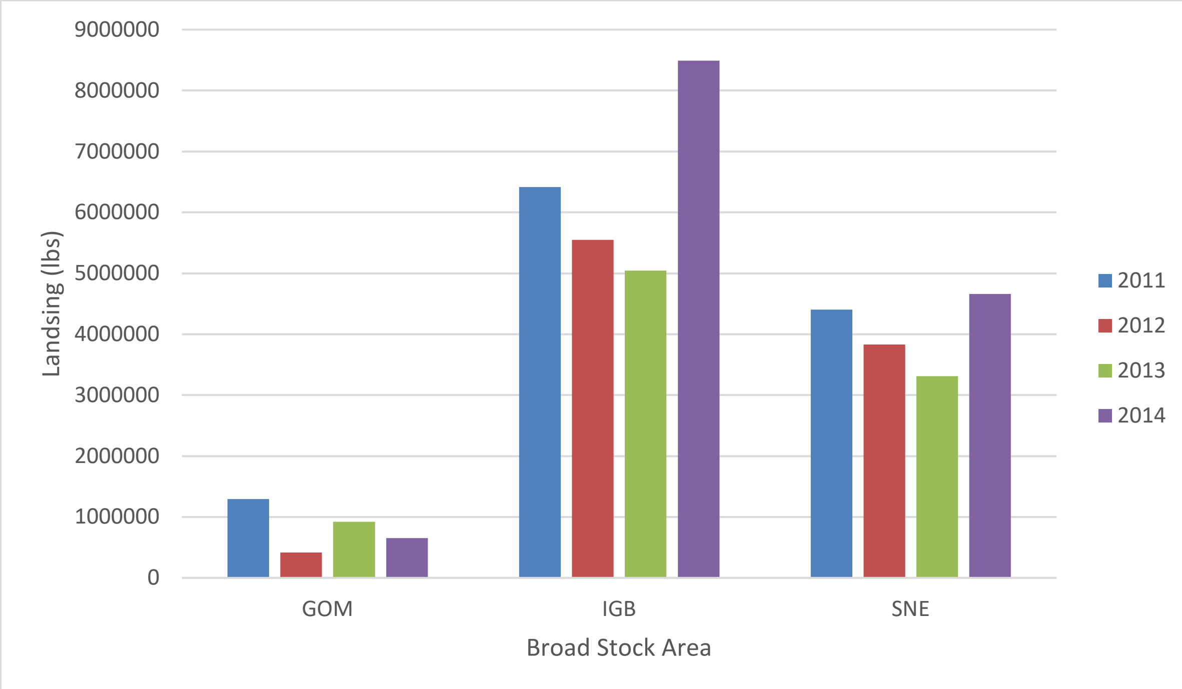


Kept catch on sector gillnet trips fishing only mesh size of 8" or greater varies greatly by BSA fished (Table 75), with the majority of landings coming from BSA 2, inshore Georges Bank. Figure 41 depicts annual landings of ELM 8"+.

Table 75 - Commercial landings on sector groundfish gillnet trips fishing mesh size of 8" or greater.

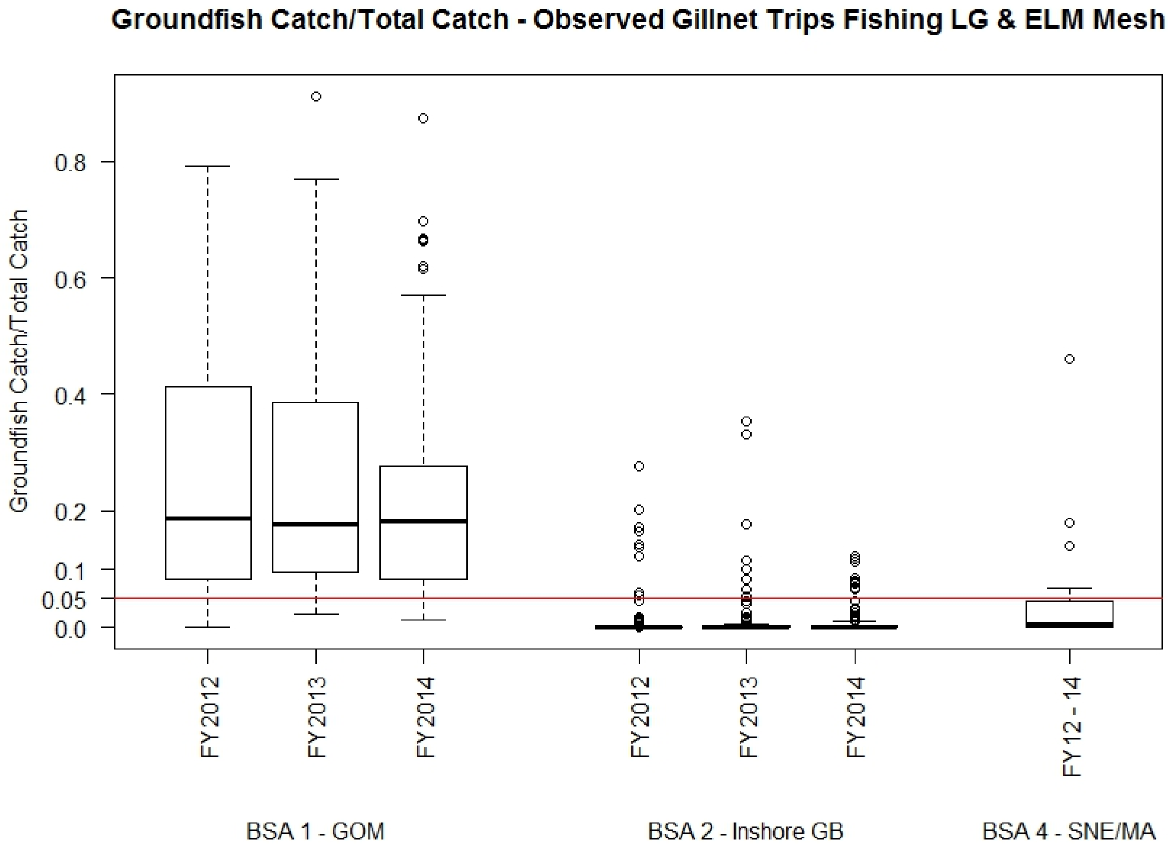
Commercial Landings on Sector Groundfish GNS ELM Trips				
MULT_YEAR	BSA	KALL	VESSEL_COUNT	
2011	GOM	1,296,111	24	
2011	IGB	6,413,731	15	
2011	SNE	4,404,371	38	
2012	GOM	418,433	25	
2012	IGB	5,549,951	14	
2012	SNE	3,829,406	39	
2013	GOM	922,521	16	
2013	IGB	5,042,322	14	
2013	SNE	3,313,405	35	
2014	GOM	652,975	18	
2014	IGB	8,492,619	17	
2014	SNE	4,659,861	29	
Total	GB	22,864	5	
Total	GOM	3,290,040	38	
Total	IGB	25,498,623	20	
Total	SNE	16,207,043	45	
Note GB by year are confidential due to fewer than three vessel reports.				
Based on DMIS SSB tables as of 10/23/15				

Figure 41 - Kept catch from sector trips fishing only ELM by BSA, FY 2011 - FY2014.



Sector vessels fishing on a sector trip may fish multiple mesh sizes on the same trip. ASM coverage for sub-set of these trips fishing within the footprint of existing dogfish exempted fisheries which are within BSAs 2 and 4 is not required. The boxplot in Figure 42 indicates that groundfish catch represents less than 5% of total catch on the majority of trips fishing multiple mesh sizes in BSA 2 and 4. The number of observed trips fishing multiple mesh sizes in the GOM ranged from 74 – 132, from 97 – 143 in the Inshore GB, and 21 in trips in SNE.

Figure 42 - Groundfish catch to total catch ratios for sector trips fishing both LG and ELM gillnets by fishing year and broad stock area (BSA). Due to a low sample size, SNE/MA trips were binned.



Impacts on regulated groundfish

Under Option 1/No Action, impacts on regulated groundfish are expected to be low negative, since the existing measures remove ASM requirements for a subset of sector trips. This is because reducing observer coverage also reduces the precision of discard estimates. Impacts relative to Option 2 are likely to be low positive since Option 2 would remove monitoring requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a trip from at-sea monitoring (Sub-option 2A) and/or dockside monitoring (if implemented) (Sub-option 2B), in addition to maintaining that ELM trips in BSAs 2 and 4 would not be subject to ASM coverage. Impacts relative to Option 3 are similar and likely to be low positive since Option 3 would remove monitoring requirements for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a trip from at-sea monitoring (Sub-option 3A) and/or dockside monitoring (if implemented) (Sub-option 3B), in addition to maintaining that ELM trips in BSAs 2 and 4 would not be subject to ASM coverage.

Catches of regulated groundfish stocks on observed sector trips fishing exclusively ELM have been consistently low in BSAs 2 and 4 (Figure 40). Median groundfish catches within this universe of sector trips were zero for each individual fishing year in BSAs 2 and 4, with two trips in the time series with groundfish catches in excess of 5% of total catch (Figure 40).

Impacts on other species

Under Option 1/No Action, impacts on other species are expected to be low negative, since the existing measures remove ASM requirements for a subset of sector trips and the precision associated with non-groundfish discards would also decrease. The economic incentive to use ELM gillnets to target other species may increase effort – and subsequently – catch of these species. However, recent catch of skates, monkfish, and dogfish have been below total allowable catches for these species, such that additional catch would not be expected to result in catches exceeding ACTs for these species. Impacts on other species, such as skates, monkfish, and dogfish relative to Option 2 are likely to be low positive since Option 2 would remove monitoring requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a trip from at-sea monitoring (Sub-option 2A) and/or dockside monitoring (if implemented) (Sub-option 2B), in addition to maintaining that ELM sector trips would not be subject to ASM coverage and the precision associated with non-groundfish discards would also decrease. Impacts relative to Option 3 are similar and likely to be low positive since Option 3 would remove monitoring requirements for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a trip from at-sea monitoring (sub-option 3A) and/or dockside monitoring (if implemented) (Sub-option 3B), in addition to maintaining that ELM trips in BSAs 2 and 4 would not be subject to ASM coverage. Impacts of Option 2 may be slightly less negative relative to Option 1/No Action then for Option 3, as the area for the exemptions is slightly larger under Option 3 than in Option 2.

7.2.6.2 Removal of Monitoring Program Requirements Option 2 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 72 Degrees 30 Minutes West Longitude

7.2.6.2.1 Removal of Monitoring Program Requirements Sub-option 2A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only)

Impacts on regulated groundfish

This option would remove the ASM requirement for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Since this would remove at-sea monitoring requirements for vessels fishing in this area, this option would result in negative biological impacts to regulated groundfish, as lower monitoring coverage would likely reduce the accuracy of catch estimates and could introduce sampling bias. However, catch composition for groundfish on trips fishing in this area is relatively low (see Table 65-Table 67, Figure 13-Figure 14 in Section 6.6.11.2). The proportion of groundfish caught on trips west of 72 degrees 30 minutes west longitude from FY2010-2017 is less than 5% for most stocks in most years, with the exception of southern windowpane flounder in a few years (Table 67). Removing ASM requirements for vessels fishing in this area would result in some loss of information on groundfish catches, particularly for Southern New England stocks. However, groundfish discards on trips fishing in this area have been low, generally <2mt with the exception of southern windowpane flounder. Further, the groundfish fishery currently receives only 18% of the southern windowpane flounder ACL. Overall, while there would be expected to be some negative impacts from removing ASM requirements for vessels fishing west of 72 degrees 30 minutes west longitude, groundfish catches in this area comprise less than 5 percent of the total annual groundfish catches, and so the majority of groundfish catch would receive at-sea monitoring. Impacts of this option on regulated groundfish, therefore, would be expected to be low negative.

Additionally, the line of 72 degrees 30 minutes west longitude bisects several statistical areas, as well as the SNE/MA broad stock area (see Map 2). There will need to be consideration for how to determine an ad hoc method for estimating catch for stocks within these statistical areas and stock area if at-sea monitoring coverage requirements are removed from vessels fishing in one portion of these statistical areas and stock area.

Relative to No Acton, Sub-Option 2A would be expected to have low negative biological impacts on regulated groundfish, as this would allow for removal of ASM coverage requirements in other areas, in addition to the current measure for removal of ASM requirement for extra-large mesh gillnets (see section 7.2.6.1 for a description). In addition, this action is considering a review process for these exemptions (see Section 4.6.4.2). Therefore, if negative impacts are found from removing vessels from monitoring requirements in these areas, that can be adjusted in a future action. This option is expected to have neutral impacts to Sub-Option 2B, removal of dockside monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Compared to Sub-Option 3A, this option would be expected to have positive biological impacts, particularly for Southern New England stocks that have higher catches in the area under Sub-Option 3A, as the exemption area under Sub-Option 3A is larger and groundfish catches have been larger there.

Impacts on other species

This option would be expected to have negative biological impacts to other species, since this would remove at-sea monitoring requirements for vessels fishing in this area. As such, information on groundfish catches will be less reliable, and sectors could potentially exceed their ACE. Therefore, under this alternative it is less likely that fishing effort would be reduced in season.

Relative to Option 1/No Acton, Sub-Option 2A would be expected to have low negative biological impacts on regulated groundfish, as this would allow for removal of ASM coverage requirements in other areas, in addition to the current ASM exemption for ELM gillnets (see section 7.2.6.1 for a description). This option is expected to have neutral impacts to Sub-Option 2B, removal of dockside monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Compared to Sub-Option 3A, this option would be expected to have low positive biological impacts, as the exemption area under Sub-Option 3A is larger.

7.2.6.2.2 **Removal of Monitoring Program Requirements Sub-option 2B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool)**

Impacts on regulated groundfish

This option would remove dockside monitoring coverage requirements (if implemented for vessels fishing exclusively west of 72 degrees 30 minutes west longitude from). Exempting vessels fishing in this area from dockside monitoring would be expected to have negative impacts on regulated groundfish since there would be no independent verification of landings for vessels fishing in this area. However, groundfish landings from trips in this area have been low, generally less than 1mt with the exception of SNE/MA winter flounder and SNE/MA yellowtail flounder in a few years (see Table 65, Figure 13 in

Section 6.6.11.2). Therefore, the majority of total groundfish landings would receive dockside monitoring coverage (if implemented). Overall, while there would be expected to be some negative impacts of exempting vessels fishing west of 72 degrees 30 minutes west longitude from dockside monitoring, groundfish landings in this area comprise less than 5 percent of the total annual groundfish catches, and so the majority of groundfish landings would receive dockside monitoring (if implemented).

Relative to No Acton, Sub-Option 2B would be expected to have low negative biological impacts on regulated groundfish, as this would allow for removal of dockside monitoring coverage requirements (if implemented) in other areas, in addition to the current ASM exemption for extra-large mesh gillnets (see section 7.2.6.1 for a description). In addition, this action is considering a review process for these exemptions (see Section 4.6.4.2). Therefore, if negative impacts are found from removing vessels from monitoring requirements in these areas, that can be adjusted in a future action. This option is expected to have neutral impacts to Sub-Option 2A, removal of at-sea monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Compared to Sub-Option 3B, this option would be expected to have low positive biological impacts, as the exemption area under Sub-Option 3B is larger and groundfish landings have been larger there.

Impacts on other species

This option would be expected to have negative biological impacts to other species, since this would remove dockside monitoring requirements (if implemented) for vessels fishing in this area. As such, information on groundfish catches will be less reliable, and sectors could potentially exceed their ACE. Therefore, under this alternative it is less likely that fishing effort would be reduced in season.

Relative to Option 1/No Acton, Sub-Option 2B would be expected to have low negative biological impacts on regulated groundfish, as this would allow for removal of dockside monitoring coverage requirements (if implemented) in other areas, in addition to the current ASM exemption for ELM gillnets (see section 7.2.6.1 for a description). This option is expected to have neutral impacts to Sub-Option 2A, removal of at-sea monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Compared to Sub-Option 3B, this option would be expected to have low positive biological impacts, as the exemption area under Sub-Option 3B is larger.

7.2.6.3 Removal of Monitoring Program Requirements Option 3 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 71 Degrees 30 Minutes West Longitude (*Preferred Alternative*)

7.2.6.3.1 Removal of Monitoring Program Requirements Sub-option 3A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only) (*Preferred Alternative*)

Impacts on regulated groundfish

This option would remove the ASM requirement for vessels fishing exclusively west of 71 degrees 30 minutes west longitude. Since this would remove at-sea monitoring requirements for vessels fishing in this area, this option would result in negative biological impacts to regulated groundfish, as lower monitoring coverage would likely reduce the accuracy of catch estimates and could introduce sampling bias. While groundfish catches from FY2010-2017 on trips fishing in this area for some stocks have been low, for other stocks there have been substantial catches (see Table 68-Table 70 and Figure 15-Figure 16 in Section 6.6.11.2). The proportion of groundfish caught on trips west of 71 degrees 30 minutes west longitude from FY2010-2017 is less than 5% for many stocks in most years, however, for Southern New England stocks of SNE/MA winter flounder, SNE/MA yellowtail flounder, and southern windowpane flounder, as well as ocean pout the proportion of catch in this area has been relatively high, between 25-60% in most years (Table 70). Catches for these stocks in this area have, however, been lower in recent years. Impacts of this option, therefore, would be expected to have differential impacts by stock. For GOM and GB stocks, impacts of removing at-sea monitoring coverage requirements for vessels fishing exclusively west of 71 degrees 30 minutes west longitude would be low negative. However, impacts of this option on SNE/MA stocks would be expected to be high negative since a larger proportion of total catch for these stocks is from this area. Further, the 71 degrees 30 minutes west longitude line cuts the most important fishing grounds in half for SNE winter flounder and SNE yellowtail flounder which will likely have major implication for these two allocated groundfish stocks.

Removing the ASM coverage requirement for vessels fishing in this area from at-sea monitoring would result in a loss of information on groundfish catches, particularly for Southern New England stocks. It should be noted that SNE/MA winter flounder and yellowtail flounder, as well as ocean pout are currently overfished and in a rebuilding plan (see Section 6.2). Groundfish discards on trips fishing in this area for many stocks have been low, generally <2mt, but for the Southern New England stocks of southern windowpane flounder, SNE/MA winter flounder, and SNE/MA yellowtail flounder, as well as ocean pout, discards have been substantial in some years (Table 69, Figure 16). For example, discards for southern windowpane flounder in this area have ranged from 25mt to 80mt from FY2010-2017 (Table 69). Overall, there would be expected to be negative impacts of exempting vessels fishing west of 71 degrees 30 minutes west longitude from at-sea monitoring, as groundfish catches in this area for some stocks comprise a fairly large proportion of the total annual groundfish catches. Therefore, while the majority of groundfish catch for most stocks would be monitored at sea, based on information on groundfish catches from vessels fishing west of 71 degrees 30 minutes west longitude from FY2010-2017, Southern New England stocks would be monitored at lower coverage levels.

Additionally, the line of 71 degrees 30 minutes west longitude bisects several statistical areas, as well as the SNE/MA broad stock area (see Map 2). There will need to be consideration for how to determine an ad hoc method for estimating catch for stocks within these statistical areas and stock area if at-sea monitoring coverage requirements are removed from vessels fishing in one portion of these statistical areas and stock area.

Relative to No Action, Sub-Option 3A would be expected to have negative biological impacts on regulated groundfish, particularly Southern New England stocks, as this would allow for removal of ASM coverage requirements in other areas, in addition to the current ASM exemption for ELM gillnets (see Section 7.2.6.1 for a description). In addition, this action is considering a review process for these exemptions (see Section 4.6.4.2). Therefore, if negative impacts are found from removing vessels from monitoring requirements in these areas, that can be adjusted in a future action. This option is expected to have neutral impacts to Sub-Option 3B, removal of dockside monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Compared to Sub-Option 2A, this option would be expected to have negative biological impacts, particularly for Southern New England stocks, as the exemption area under Sub-Option 2A is smaller and groundfish catches have been fewer there.

Impacts on other species

This option would be expected to have negative biological impacts to other species, since this would remove at-sea monitoring requirements for vessels fishing in this area. As such, information on groundfish catches will be less reliable, and sectors could potentially exceed their ACE. Therefore, under this alternative it is less likely that fishing effort would be reduced in season.

Relative to No Acton, Sub-Option 3A would be expected to have low negative biological impacts on regulated groundfish, as this would allow for removal of ASM coverage requirements in other areas, in addition to the current ASM exemption for ELM gillnets (see section 7.2.6.1 for a description). This option is expected to have neutral impacts to Sub-Option 3B, removal of dockside monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Compared to Sub-Option 2A, this option would be expected to have low negative biological impacts, as the exemption area under Sub-Option 2A is smaller.

7.2.6.3.2 Removal of Monitoring Program Requirements Sub-option 3B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool) (*Preferred Alternative*)

Impacts on regulated groundfish

This option would exempt vessels fishing exclusively west of 71 degrees 30 minutes west longitude from dockside monitoring (if implemented). Exempting vessels fishing in this area from dockside monitoring would be expected to have negative impacts on regulated groundfish since there would be no independent verification of landings for vessels fishing in this area. While groundfish landings from trips in this area have been relatively low, generally less than 1mt, landings for SNE/MA winter flounder, SNE/MA yellowtail flounder, and GB cod (west) have been substantial (see Table 68, Figure 15 in Section 6.6.11). Therefore, while the majority of total groundfish landings would receive dockside monitoring coverage, coverage could be lower for these Southern New England stocks. Overall, there would be expected to be negative impacts of exempting vessels fishing west of 71 degrees 30 minutes west longitude from dockside monitoring, as groundfish landings in this area for some stocks comprise a fairly large proportion of the total annual groundfish catches. Therefore, while the majority of groundfish landings for most stocks would receive dockside monitoring (if implemented), based on information on groundfish landings from vessels fishing west of 71 degrees 30 minutes west longitude from FY2010-2017, Southern New England stocks would receive lower dockside monitoring coverage.

Relative to No Acton, Sub-Option 3B would be expected to have low negative biological impacts on regulated groundfish, as this would allow for removal of dockside monitoring coverage requirements (if implemented) in other areas, in addition to the current ASM exemption for ELM gillnets (see section 7.2.6.1 for a description). This option is expected to have neutral impacts to Sub-Option 3A, removal of at-sea monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude. Compared to Sub-Option 2B, this option would be expected to low have negative biological impacts, as the exemption area under Sub-Option 2B is smaller and groundfish landings have been fewer there.

Impacts on other species

This option would be expected to have negative biological impacts to other species, since this would remove dockside monitoring requirements (if implemented) for vessels fishing in this area. As such, information on groundfish catches will be less reliable, and sectors could potentially exceed their ACE. Therefore, under this alternative it is less likely that fishing effort would be reduced in season.

Relative to No Acton, Sub-Option 3B would be expected to have low negative biological impacts on regulated groundfish, as this would allow for removal of dockside monitoring coverage requirements (if implemented) in other areas, in addition to the current ASM exemption for ELM gillnets (see section 7.2.6.1 for a description). Compared to Sub-Option 2B, this option would be expected to have negative biological impacts, as the exemption area under Sub-Option 2B is smaller.

7.2.6.4 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements

7.2.6.4.1 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 1: No Action

Impacts on regulated groundfish

Under No Action there is no formal review process to verify that catch composition from vessels fishing on trips that are exempt from monitoring requirements have little to no groundfish. This option would not be expected to have direct or indirect impacts on regulated groundfish species. This measure is primarily administrative.

Impacts on other species

This option would not be expected to have direct or indirect impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops, provided catch composition did not change for these bycatch species. This measure is primarily administrative.

7.2.6.4.2 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 2 – Implement a Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements (*Preferred Alternative*)

Impacts on regulated groundfish

This option would not be expected to have direct impacts on regulated groundfish species. While this measure is primarily administrative, by requiring a periodic review there could be indirect positive impacts on regulated groundfish to confirm that measures for removal of monitoring requirements are not impacting estimates of groundfish catch. Therefore, compared to No Action there could be indirect low positive impacts on regulated groundfish.

Impacts on other species

This option would not be expected to have direct impacts on non-groundfish species such as monkfish, dogfish, skates, and Atlantic sea scallops. While this measure is primarily administrative, by requiring a periodic review there could be indirect positive impacts on non-groundfish species to confirm that exemptions from monitoring requirements are not impacting estimates of non-target catch. Therefore, compared to No Action there could be indirect low positive impacts on other species.

7.3 IMPACTS ON PHYSICAL ENVIRONMENT AND ESSENTIAL FISH HABITAT

The alternatives under consideration in this amendment include various approaches to monitoring the sector and/or common pool segments of the groundfish fishery, with various options for coverage rates and monitoring approaches, which could be combined with one another in many ways. The effects on essential fish habitat (EFH) associated with these alternatives, if any, would be indirect, and related to whether a particular change to the monitoring system influences either the magnitude of effort in the fishery, the location of that effort, or both. The direction of change in the magnitude of effort is easier to predict than the amount of change or any spatial shifts in effort. While some management actions have the ability to affect the types of gears used in a fishery, which could have large influences on the magnitude of impacts to EFH because different gears have very different seabed impacts, the alternatives in Amendment 23 would apply regardless of gear type and seem unlikely to lead to gear switching. Thus, this analysis assumes that vessels that currently fish with trawls will continue to fish with trawls, gillnets with gillnets, etc.

The EFH impacts discussion below focuses on changes in the amount or location of fishing that might occur as a result of the implementation of the various alternatives. This approach to evaluating adverse effects to EFH is based on two principles: (1) seabed habitat vulnerability to fishing effects varies spatially, due to variations in seabed substrates, energy regimes, living and non-living seabed structural features, etc., between areas and (2) the magnitude of habitat impacts is based on the amount of time that fishing gear spends in contact with the seabed. This seabed area swept (seabed contact time) is grossly related to the amount of time spent fishing, although it will of course vary depending on catch efficiency, gear type used, and other factors.

In general, the effects of the groundfish fishery on EFH are more closely related to catch allocations than to monitoring approaches. Catch limits, which are not a part of this action, directly influence common pool trimester limits and sector annual catch entitlement values. These limits, combined with spatial and temporal patterns in fish availability, and other management measures such as year-round and seasonal fishery closures, largely determine patterns of effort in the groundfish fishery. In general, the monitoring approaches considered here are similarly burdensome or more burdensome than current (No Action) measures, so these alternatives, combined with catch limits, are likely to result in either similar levels of effort in the fishery as currently exist, or lower levels of effort, if costs associated with higher rates of monitoring create limits on overall effort. How exactly improvements in monitoring will affect fishing effort on each stock is unknown.

Biological impacts are broken down into short and long-term, and the same is done here for EFH impacts. An overview of possible short- and long-term impacts of 100% monitoring of all sector trips on regulated groundfish species are provided in the biological impacts section. Improvements in monitoring which reduce fishing mortality through better catch accounting should produce positive biological impacts in the short-term. In the longer-term, generally five years or more into the future, analytical assessments should improve with better catch data which should lead to subsequent improvements in groundfish catch advice and management.

Overall, the many unknowns associated with improvements in monitoring makes the determination of EFH impacts difficult, and we can only qualitatively rank alternatives relative to each other. Estimates of change in the fishery are complex and likely to vary by sector, since many of these approaches are sector-based. Spatial measures to minimize the impacts of the groundfish fishery and other fisheries on EFH were implemented via Omnibus Habitat Amendment 2. These spatial measures will not be altered by any of the alternatives under consideration here.

The area that is potentially affected by the proposed alternatives includes EFH for species managed under the following Fishery Management Plans: NE Multispecies; Atlantic Sea Scallop; Monkfish; Atlantic Herring; Summer Flounder, Scup and Black Sea Bass; Atlantic Mackerel, Squid, and Butterfish; Spiny Dogfish; Tilefish; Deep-Sea Red Crab; Atlantic Surfclam and Ocean Quahog; Atlantic Bluefish; Northeast Skates; and Atlantic Highly Migratory Species. Effects on EFH are considered in aggregate across these species; nearly all areas of the continental shelf are EFH for one or more managed species of fish or shellfish.

7.3.1 Commercial Groundfish Monitoring Program Revisions (Sectors Only)

These alternatives consider revisions to the groundfish monitoring program for sectors, including fixed at-sea monitoring coverage levels based on a percentage of trips or a percentage of catch, with percentages of 25, 50, 75, and 100%. This section also considers revisions to options for meeting monitoring standards, including electronic monitoring approaches. There are also administrative measures related to the timing of when monitoring coverages levels would be set relative to the fishing year, and the review process for establishing coverage rates.

7.3.1.1 Sector Monitoring Standards (Target Coverage Levels)

Under Option 1 (No Action) coverage levels for at-sea monitoring are set for each sector based on target coefficients of variation in estimated catch at the stock level. Option 2 would set a long-term, fixed coverage level based on a percentage of trips, with percentages ranging from 25-100%. Option 3 would set a long-term, fixed coverage based on a percentage of catch, with percentages ranging from 25-100%. Across all options, realized coverage rates may be lower than the target coverage rates due to availability of at-sea monitors. Regardless of option, higher coverage rates come at a higher cost for sectors and their members because sectors are responsible for funding any trips that are not covered by NOAA funds. If sectors deem that these costs are too high given the expected profits from the trips in question, trips would not be taken and fishing effort levels would decline. Such effort declines are more likely with progressively higher ASM coverage levels.

7.3.1.1.1 Sector Monitoring Standard Option 1: No Action

Under Option 1 (No Action), target coverage levels have averaged around 25%, varying by year, with somewhat lower (22%) realized ASM coverage rates, from FY2010-2017. As discussed in the introduction, impacts of the fishery on EFH are more dependent on annual catch limits and only somewhat related to at-sea monitoring coverage requirements, to the extent that these requirements impose a cost burden and reduce the likelihood of a trip occurring. As discussed in the biological impacts section, current coverage rates create limited opportunities for an ASM cost-related reduction in effort, so the direct effects of No Action ASM coverage rates on fishing effort levels, and therefore on the magnitude of the fishery's impact to EFH, are expected to be negligible. Given the recent target levels, No Action is expected to have similar impacts on the amount of fishing effort, and therefore on EFH, as compared to the 25% coverage levels, regardless of whether the 25% is based on a percentage of trips or a percentage of catch.

Over the longer term, the coverage rates under No Action appear to be introducing error into the catch data streams due to underreporting of discards during trips that are not monitored. There is an incentive for misreporting when the sector's annual catch entitlement for a stock is constraining, relative to the encounter rate of the stock during fishing (see analysis in Section 6.6.10.5 and Appendix V). Very generally, errors in the catch data create difficulty in fitting assessment models, leading to uncertainties in stock status, and the need to lower catch limits to account for these larger uncertainties. Lower catch limits would result in lower levels of effort and therefore reduce any negative effects of the fishery on EFH.

7.3.1.1.2 Sector Monitoring Standard Option 2: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Trips (*Preferred Alternative*)

Selecting one of the sub-options in this section would set a long-term fixed ASM coverage level at 25, 50. 75, or 100% of trips.

7.3.1.1.2.1 Sub-option 2A – 25 percent

ASM coverage of 25% is similar to recent coverage targets under the No Action/CV-based system. Thus, sub-option 2A is expected to have similar impacts to Option 1/No Action, negligible effects on EFH in the short term, towards potential positive effects in the long term if continued lower levels of monitoring influence catch advice in such a way that ACE values are lower as an outgrowth of these coverage rates.

7.3.1.1.2.2 Sub-option 2B – 50 percent

ASM coverage rates of 50% represent an increase over current targets under the CV-based system. This increase in coverage rates could have multiple effects on the fishery and fishery data. Costs associated with ASM could make it difficult for operators to afford to go fishing, such that effort could decline, but EFH impacts would also decline (i.e. sub-option 2B could have a positive impact on EFH). This decline in effort due to increased per trip costs might or might not occur, and the magnitude of such a decline is unknown. An increase in ASM coverage will also influence data streams associated with the fishery. For the fraction of trips that are monitored, catch data, in particular data on discards, would improve. Over the long term it is assumed that such improvements in data would benefit assessments, decreasing uncertainty and potentially leading to higher catch limits for sectors (and other groundfish and non-groundfish vessels subject to groundfish ACLs). For other trips, data quality could remain the same, or could decrease. Decreases in data quality, i.e. an increase in misreporting of discards, might be incentivized under higher coverage rates as described in the biological impacts analysis. If this occurs, the net positive benefits on assessments and quotas might be reduced. If changes in coverage rates contribute to higher catch limits, effort could increase, causing negative impacts on EFH, but if they lead to lower catch limits, or no changes in catch limits, this ASM coverage rate could have positive impacts on EFH. The magnitude of these effects is uncertain.

7.3.1.1.2.3 Sub-option 2C – 75 percent

Sub-option 2C represents a substantial increase in ASM coverage rates as compared to current targets. The increase from 50% to 75% would increase the likelihood that sectors would find difficulty in paying ASM costs, and therefore increase the likelihood of effort reductions. Such effort reductions could lead to positive impacts on EFH. Over the longer term, however, a 75% coverage rate would mean that catch and discards are well accounted for on the majority of sector trips, which in turn account for the majority of groundfish catch. Thus 75% ASM coverage would have a positive influence on the accuracy of catch data, and the proportion of trips where misreporting of discards might occur would be smaller. This should hopefully improve the fit of assessment models and reduce their uncertainty, allowing for higher catch limits, and therefore greater fishing effort, associated with negative impacts on EFH. The balance between these different factors in determining net effects over the short and long term is impossible to estimate.

7.3.1.1.2.4 Sub-option 2D – 100 percent

Sub-option 2D would set a target of 100% ASM coverage for sectors. This level of coverage has an even greater likelihood of reducing effort due to per-trip costs that the sectors cannot accommodate, but also has a greater likelihood of improving catch data, which will in turn contribute to greater certainty in assessment results, and have a positive effect on catch advice. This would lead to greater effort, and larger negative effects on EFH. Again, the balance between these different factors in determining net effects over the short and long term is impossible to estimate.

7.3.1.1.3 Sector Monitoring Standard Option 3: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Catch

While the range of target percentages is the same for Option 3 and Option 2, the resulting overall coverage rates under Option 3 will be greater than Option 2 because the percentage of catch targets are to be achieved for all allocated stocks. Simulation analysis (see Section 7.5.3.1.3) indicates that the impacts of the 25% catch-based option are similar to the sub-option covering 50% of trips, 50% catch based similar to 75% of trips, and 75% catch based similar to 100% of trips. Sub-option D, based on 100% of catch would result in the same target coverage as Option 2, Sub-option D, 100% of trips.

7.3.1.1.3.1 Sub-option 3A – 25 percent

Impacts of this sub-option are expected to be similar to the 50% of trips sub-option described in section 7.3.1.1.2.2, i.e., ranging from positive to negative. The direction and magnitude of effects will depend on whether and how much effort is reduced due to monitoring-associated costs in the short and long run, and the potential for catch limits to increase over the long run in response to higher quality data.

7.3.1.1.3.2 Sub-option 3B – 50 percent

Impacts of this sub-option are expected to be similar to the 75% of trips sub-option described in section 7.3.1.1.2.3, i.e., ranging from positive to negative. The direction and magnitude of effects will depend on whether and how much effort is reduced due to monitoring-associated costs in the short and long run, and the potential for catch limits to increase over the long run in response to higher quality data.

7.3.1.1.3.3 Sub-option 3C – 75 percent

Impacts of this sub-option are expected to be similar to the 100% of trips sub-option described in section 7.3.1.1.2.4, i.e., ranging from positive to negative. The direction and magnitude of effects will depend on whether and how much effort is reduced due to monitoring-associated costs in the short and long run, and the potential for catch limits to increase over the long run in response to higher quality data.

7.3.1.1.3.4 Sub-option 3D – 100 percent

Impacts of this sub-option are also expected to be similar to the 100% of trips sub-option described in section 7.3.1.1.2.4, i.e., ranging from positive to negative. The direction and magnitude of effects will depend on whether and how much effort is reduced due to monitoring-associated costs in the short and long run, and the potential for catch limits to increase over the long run in response to higher quality data.

7.3.1.2 Sector Monitoring Tools (Options for meeting monitoring standards)

One way to provide sectors operational flexibility as well as potential cost savings associated with ASM requirements is to allow them to substitute electronic monitoring for human monitors. While there are still per-trip costs associated with electronic monitoring approaches, aside from the amortization of the initial equipment costs, electronic monitoring is expected to be less expensive than using a human monitor. If approved, these three options could be combined, with sectors choosing approaches that are least burdensome in terms of administration and costs. These options may mitigate some of the cost-related barriers to fishing associated with higher monitoring target rates, allowing vessels to complete more trips. The extent to which the substitution of electronic monitoring for at-sea monitoring mitigates cost-related decreases in effort is difficult to estimate, but greater mitigation is likely for progressively higher ASM target rates (see 7.5.3.2). In general the benefits of electronic monitoring in the context of assessment and specifications setting for the groundfish resource are expected to be similar to those associated with data collected by human monitors, although there may be differences for a few species (see Section 7.2.1.2). Thus over the longer term, and depending on target coverage rate, the use of electronic monitoring (or not) should not change the expected impacts of the various rate sub-options on EFH.

7.3.1.2.1 Sector Monitoring Tools Option 1: Electronic Monitoring in place of Human At-Sea Monitors

Allowing sectors to substitute electronic monitoring for human monitoring may have slight negative impacts to EFH in the short term compared to human at-sea monitors if the substitution facilitates greater fishing effort. Over the longer term, substitution of electronic monitoring for human monitoring should provide similar positive benefits in terms of assessment and management of the resource, leading to increased effort and increased impacts of the fishery on EFH.

7.3.1.2.2 Sector Monitoring Tools Option 2: Audit Model Electronic Monitoring Option (*Preferred Alternative*)

Impacts will be similar to Option 1 above, i.e. potentially low negative impacts to EFH. Audit model EM may further reduce costs to sectors as review of the camera footage will be done for only a subset of trips.

7.3.1.2.3 Sector Monitoring Tools Option 3: Maximized Retention Electronic Monitoring Option (*Preferred Alternative*)

Impacts will be similar to Option 1 above, i.e. potentially low negative impacts to EFH. Maximized retention approaches that combine electronic ASM with dockside review of catch may be more practical for certain vessels, for example for operators where the at-sea protocols associated with the audit method are more challenging due to higher volumes of catch.

7.3.1.3 Total Monitoring Coverage Level Timing

The timing of when coverage targets are announced is generally an administrative measure that will not affect impacts to EFH, but is important to sectors for planning and administrative reasons.

7.3.1.3.1 Coverage Level Timing Option 1: No Action

Under Option 1, the total annual monitoring coverage level is announced upon completion of necessary analyses, and not by a fixed date. This measure is primarily administrative. Therefore, Option 1/No Action would not be expected to have direct or indirect impacts on essential fish habitat.

7.3.1.3.2 Coverage Level Timing Option 2: Knowing Total Monitoring Coverage Level at a Time Certain

Under Option 2, the total annual monitoring coverage level would be announced three weeks prior to the annual sector enrollment deadline. This measure is primarily administrative, however setting a specific deadline could influence the data available for determination of the coverage level, and therefore the coverage level itself. This would not be the case if a fixed percentage was selected (Sector Monitoring Standards and Monitoring Tools, Option 2), but could occur under Option 1/No Action (CV-based coverage rate) or Option 3 (rate based on percent of catch).

If a fixed monitoring percentage (Option 2) is selected in the Sector Monitoring Standards and Monitoring Tools section, Option 2 for a time certain would not be expected to have direct or indirect impacts on essential fish habitat, because the rate would be set at the same fixed value regardless of the timing of the announcement (and in fact, would be generally known as the ongoing rate, until it was revised by the Council). If Option 1 or Option 3 is selected under the Sector Monitoring Standards and Monitoring Tools section, Option 2 for a time certain could affect the monitoring rate. If this monitoring rate was higher than it otherwise would be without the time certain provision, this could lead to lower effort and reduced negative impacts to EFH. Lower effort would not necessarily be the case and would depend on sector's abilities to fund monitoring coverage, combined with NMFS ability to fund shoreside aspects of said coverage. Lower effort and therefore lower impacts would be most likely associated with higher coverage rates.

7.3.1.4 Review Process for Sector Monitoring Coverage

7.3.1.4.1 Coverage Review Process Option 1: No Action

Under Option 1, the efficacy of sector monitoring coverage rates would not be reviewed on a prescribed basis but would be reviewed on occasion using a schedule and method determined by the Council and related to the goals of the program. Efficacy refers to increase in accuracy, maximized value, and minimized costs. This measure is primarily administrative. Therefore, Option 1/No Action would not be expected to have direct or indirect impacts on essential fish habitat.

7.3.1.4.2 Coverage Review Process Option 2: Establish a Review Process for Monitoring Coverage Rates (*Preferred Alternative*)

Under Option 2, the efficacy of sector monitoring coverage rates would be reviewed on a prescribed basis, after two full years of fishing data are available under the revised monitoring program. As above, efficacy refers to increase in accuracy, maximized value, and minimized costs. This measure is primarily administrative. Therefore, Option 2 would not be expected to have direct or indirect impacts on essential fish habitat.

7.3.1.5 Addition to List of Framework Items (*Preferred Alternative*)

This alternative would allow as yet undeveloped monitoring technologies to be considered for adoption through the framework adjustment vs. amendment process. Vessel coverage levels would also be adjustable via framework. Regardless of the management vehicle used, analysis of impacts under NEPA and MSA would occur in that future action. Therefore, this alternative is not expected to have direct or indirect impacts on essential fish habitat.

7.3.2 Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool)

These measures relate to dockside monitoring of landings in both the sector and common pool segments of the fishery.

7.3.2.1 Dockside Monitoring Program (Sectors and Common Pool)

These options consider whether to require dockside monitoring in the fishery. Dockside monitoring data, if utilized effectively, could contribute to better assessment and management of groundfish resources. It also imposes costs on groundfish vessels at the trip level.

7.3.2.1.1 Dockside Monitoring Option 1: No Action (*Preferred Alternative*)

Under Option 1 (No Action), dockside monitoring is not required. This Option is expected to have neutral effects on EFH in the short term, as there would be no required dockside monitoring costs for sector and common pool vessels to accommodate that could in turn influence the magnitude of effort in the fishery and thus the magnitude of impacts to EFH. In the long term, Option 1 might have slight positive impacts to EFH, assuming that the absence of these landings verification data would have a negative effect overall, thus reducing catch limits and reducing effort and impacts to EFH. If dockside monitoring data do not influence overall management and setting of catch limits, these reductions in impacts would not occur.

7.3.2.1.2 Dockside Monitoring Option 2: Mandatory Dockside Monitoring Program for the Commercial Groundfish Fishery

Mandatory dockside monitoring of all trips under Option 2 would impose costs of the fishery, which could serve to limit effort and thus reduce the fishery’s impacts on EFH. In the longer term, if this monitoring leads to better data streams that improve management of the resource, higher catch limits could allow for increased effort and increased impacts to EFH.

7.3.2.2 Dockside Monitoring Program Structure and Design

The options below relate to the design and administration of the dockside monitoring program, if it is adopted under Option 2 above.

7.3.2.2.1 Dockside Monitoring Program Funding Responsibility

As discussed under Option 2, above, the imposition of a dockside monitoring program costs could decrease effort and therefore on the fishery's impacts to EFH in the short term. This would be the case regardless of who is responsible for paying for the monitoring, but if dockside monitoring is the responsibility of the vessel/sector, this could lead to larger decreases in effort.

7.3.2.2.1.1 Dockside Monitoring Program Funding Responsibility Option A – Dealer Responsibility

If dockside monitoring costs are a dealer responsibility, slight declines in effort and therefore slight decrease in short term impacts to EFH could be expected. This is expected due to financial interrelationships between vessels and dealers.

7.3.2.2.1.2 Dockside Monitoring Program Funding Responsibility Option B – Vessel Responsibility

If dockside monitoring costs are a vessel or sector responsibility, slight declines in effort and therefore slight decrease in short term impacts to EFH could be expected. Effects could be greater than under Option A, because vessels or sectors would be directly responsible for costs.

7.3.2.2.2 Dockside Monitoring Program Administration

7.3.2.2.2.1 Dockside Monitoring Program Administration Option A – Individual contracts with dockside monitor providers

Option A would allow sectors to develop individual contracts with DSM providers. This measure could have administrative and other practical benefits for sectors but would not be expected to directly affect the amount of fishing effort or the magnitude of effects on EFH.

7.3.2.2.2.2 Dockside Monitoring Program Administration Option B – NMFS-administered dockside monitoring program

Option B would allow NMFS to administer the DSM program. This measure could have administrative and other practical benefits for NMFS but would not be expected to directly affect the amount of fishing effort or the magnitude of effects on EFH.

7.3.2.2.3 Options for Lower Dockside Monitoring Coverage Levels (20 percent coverage)

These options would allow vessels landing in small, remote ports or with lower amounts of landings to have only 20% dockside monitoring rates. This would reduce costs for these vessels.

In addition to possible options for lower coverage levels in small, remote ports and for smaller vessels with low landings considered in this section, this action also considers options to fully remove dockside monitoring requirements (if implemented) for some vessels based on fishing location (Section 4.6.2 and

4.6.3), that likely include some of the same vessels. Impacts of those options based on fishing location are described below (Section 7.3.6.2 and 7.3.6.2.1).

7.3.2.2.3.1 Option A – Lower coverage levels for ports with low volume of groundfish landings

The vast majority of groundfish landing come through nine ports: New Bedford, Gloucester, Boston, Portland, Chatham, Point Judith, Seabrook, Rye, and Portsmouth. Based on recent landing ports, all other ports would qualify as small and remote. While this lower coverage options encompasses a number of locations, effects on effort are expected to be minor across the fishery because only a small amount of groundfish landings (~5%) are represented at these other ports. Nonetheless, an option for lower DSM coverage in small/remote ports could reduce the cost burden associated with dockside monitoring on vessels landing in these ports, thus reducing the downward pressure on effort associated with monitoring costs. Overall effects of Option A on EFH are expected to be negligible, given the small amount of effort represented.

7.3.2.2.3.2 Option B – Lower coverage levels for vessels with total groundfish landings volumes in the 5th percentile of total annual landings

Option B is expected to have similar impacts to EFH as compared to Option A. Overall a small amount of effort in the fishery could be influenced by this option for lower DSM coverage for vessels, so impacts are not expected to be more than negligible.

7.3.2.2.4 Dockside Monitoring Fish Hold Inspection Requirements

These options relate to inspection of the fish hold of the vessel by dockside monitors. These options are primarily administrative.

7.3.2.2.4.1 Fish Hold Inspection Option A – Dockside monitor fish hold inspections required

Option A would require monitors to inspect the fish hold as part of their data collection procedures for each trip. This option is not expected to influence the amount or location of fishing effort and therefore would not have any direct or indirect impacts on essential fish habitat.

7.3.2.2.4.2 Fish Hold Inspection Option B – Alternatives method for inspecting (cameras)

Option B would authorize monitors to use alternative (e.g. video) methods to inspect the fish hold as part of their data collection procedures for each trip. This option is not expected to influence the amount or location of fishing effort and therefore would not have any direct or indirect impacts on essential fish habitat.

7.3.2.2.4.3 Fish Hold Inspection Option C – No fish hold inspection required, captains sign affidavit

Option C would allow the captain to sign an affidavit certifying that the fish hold was emptied when the trip was offloaded. This affidavit would then accompany dockside monitoring data for the trip. This option is not expected to influence the amount or location of fishing effort and therefore would not have any direct or indirect impacts on essential fish habitat.

7.3.3 Sector Reporting

These options pertain to the frequency of sector reporting and are primarily administrative.

7.3.3.1 Sector reporting Option 1: No Action

Option 1 would continue to require weekly or daily sector reporting, and submission of annual year-end reports. This alternative is primarily administrative and no direct or indirect impacts on essential fish habitat are expected.

7.3.3.2 Sector reporting Option 2 – Grant Regional Administrator the Authority to Streamline Sector Reporting Requirements

Option 2 would authorize the Regional Administrator the authority to streamline sector reporting requirements. This alternative is primarily administrative and no direct or indirect impacts on essential fish habitat are expected.

7.3.4 Funding/Operational Provisions of Groundfish Monitoring (Sectors and Common Pool)

These options are related to changes in monitoring targets depending on the availability of NMFS funding.

7.3.4.1 Funding Provisions Option A: No Action

Under No Action, would continue the requirement that the industry funds ASM costs, even if these costs cannot be covered in full by NMFS. This condition is assumed in the sections related to ASM coverage rates, such that impacts to EFH would be as described in sections 7.3.1.1.1, 7.3.1.1.2, and 7.3.1.1.3 depending on the target coverage rate selected by the Council.

7.3.4.2 Funding Provisions Option 2 – Provisions for an Increase or Decrease in Funding for the Groundfish Monitoring Program

7.3.4.2.1 Funding Provisions Sub-Option 2A – Higher Monitoring Coverage Levels if NMFS Funds are Available (Sectors Only)

Under Sub-option 2A, if additional funding is available, it would be used to increase the monitoring rate beyond the target set by the Council, up to 100%. Because the costs of this additional monitoring would not be borne by sectors/sector vessels, effects on fishing effort and therefore on the magnitude of impacts to EFH are not expected.

7.3.4.2.2 Funding Provisions Sub-Option 2B – Waivers from Monitoring Requirements Allowed (Sectors and Common Pool) (*Preferred Alternative*)

Sub-option 2B would allow for maintenance of effort in the fishery under a waiver if for some reason NMFS has insufficient funds to administer the shoreside aspects of the ASM and dockside monitoring programs. Here, ASM refers to both human and electronic monitoring. Under this sub-option, impacts to EFH would be as described in sections 7.3.1.1.1, 7.3.1.1.2, and 7.3.1.1.3, depending on the target coverage rate selected by the Council.

7.3.5 Management Uncertainty Buffers for the Commercial Groundfish Fishery (Sectors)

These options relate to the management uncertainty buffers used when setting annual catch limits for sectors. If the target is set at 100% (Option B), removing or reducing these buffers would allow for higher catch limits as a proportion of the ABC.

7.3.5.1 Management Uncertainty Buffer Option 1: No Action

Under Option 1 (No Action), the process for setting management uncertainty buffers for the different sub-components of the commercial groundfish fishery would remain. Buffers are either 3, 5, or 7% of the ABC, depending on the stock (see Table 3 in Section 4.5.1 for management uncertainty buffers for each stock). Under this option, impacts to EFH would be as described in sections 7.3.1.1.1, 7.3.1.1.2, and 7.3.1.1.3, depending on the target coverage rate selected by the Council.

7.3.5.2 Management Uncertainty Buffer Option 2 – Elimination of Management Uncertainty Buffer for Sector ACLs with 100 Percent Monitoring of All Sector Trips (*Preferred Alternative*)

Under Option 2, the management uncertainty buffers would be eliminated when setting sector ACLs provided that 100% monitoring is adopted by the Council. This would allow for larger ACLs as a proportion of the ABC for each stock, and could potentially increase effort in the fishery, subject to other constraints (e.g. monitoring costs, choke stocks, etc.). If effort increased under this option, impacts to EFH would also increase relative to those described in the sections related to 100% ASM coverage (7.3.1.1.2.4 and 7.3.1.1.3.4.

7.3.6 Remove Commercial Groundfish Monitoring Requirements for Certain Vessels Fishing Under Certain Circumstances

These options would eliminate monitoring requirements (at-sea monitoring and/or dockside monitoring (if implemented)) for certain vessels based on geographic location of fishing, based on information that groundfish catches in these locations are small.

7.3.6.1 Removal of Monitoring Program Requirements Option 1: No Action (Sectors Only)

Under Option 1 (No Action), there would be no new geographic exemptions from monitoring requirements (some programs already exist). Under this option, impacts to EFH would be as described in sections 7.3.1.1.1, 7.3.1.1.2, and 7.3.1.1.3, depending on the target coverage rate selected by the Council.

7.3.6.2 Removal of Monitoring Program Requirements Option 2 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 72 Degrees 30 Minutes West Longitude

7.3.6.2.1 Removal of Monitoring Program Requirements Sub-option 2A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only)

This option would remove at-sea monitoring requirements for vessels fishing west of the specified longitude. This option could be selected in combination with the option in Section 7.3.6.2. The proportion of total groundfish catch is very small west of this longitude, not exceeding 2% at the stock level since 2015 (Table 67 in Section 6.6.11.2). This suggests that groundfish vessels that would be subject to monitoring are doing very limited fishing west of 72° 30’ W. Thus, sub-option 2A (removal of ASM requirements) is expected to have negligible effects on effort in the fishery overall, and therefore negligible impacts on EFH.

7.3.6.2.2 Removal of Monitoring Program Requirements Sub-option 2B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool)

This option would remove dockside monitoring requirements (if implemented) for vessels fishing west of the specified longitude. This option could be selected in combination with the option in Section 7.3.6.2. The proportion of total groundfish catch is very small west of this longitude, not exceeding 2% at the stock level since 2015 (Table 67 in Section 6.6.11.2). This suggests that groundfish vessels that would be subject to monitoring are doing very limited fishing west of 72° 30’ W. Thus, sub-option 2B (removal of dockside monitoring requirements, if implemented) is expected to have negligible effects on effort in the fishery overall, and therefore negligible impacts on EFH.

7.3.6.3 Removal of Monitoring Program Requirements Option 3 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 71 Degrees 30 Minutes West Longitude (*Preferred Alternative*)

7.3.6.3.1 Removal of Monitoring Program Requirements Sub-option 3A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only) (*Preferred Alternative*)

This option would remove at-sea monitoring requirements for vessels fishing west of the specified longitude. This option could be selected in combination with the option in Section 7.3.6.3. The proportion of total groundfish catch is greater than under Option 2, with a few stocks in particular having relatively large proportions of their catch west of 71° 30' W, including southern windowpane, SNE/MA winter flounder, SNE/MA yellowtail flounder, and ocean pout (Table 70 in Section 6.6.11.2). This suggests that some groundfish vessels that would be subject to monitoring are fishing west of 72° 30' W, such that a removal of monitoring requirements would facilitate their effort by reducing their monitoring costs. Thus, sub-option 3A (removal of ASM requirements) is expected to have slight positive effects on effort in the fishery overall, and therefore slight negative impacts on EFH.

7.3.6.3.2 Removal of Monitoring Program Requirements Sub-option 3B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool) (*Preferred Alternative*)

This option would remove dockside monitoring requirements (if implemented) for vessels fishing west of the specified longitude. This option could be selected in combination with the option in Section 7.3.6.3. The proportion of total groundfish catch is greater than under Option 2, with a few stocks in particular having relatively large proportions of their catch west of 71° 30' W, including southern windowpane, SNE/MA winter flounder, SNE/MA yellowtail flounder, and ocean pout (Table 70 in Section 6.6.11.2). This suggests that some groundfish vessels that would be subject to monitoring are fishing west of 72° 30' W, such that a removal of monitoring requirements would facilitate their effort by reducing their monitoring costs. Thus, sub-option 3B (removal of dockside monitoring requirements, if implemented) is expected to have slight positive effects on effort in the fishery overall, and therefore slight negative impacts on EFH.

7.3.6.4 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements

7.3.6.4.1 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 1: No Action

This option relates to the development of a review process for the various measures that remove monitoring requirements that are based on geographic location (sections 4.6.1, 4.6.2, and 4.6.3). Under Option 1 (No Action) there would continue to be no formal process for reviewing catches associated with vessels exempted from monitoring. No direct or indirect effects on EFH are expected to result from No Action.

7.3.6.4.2 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 2 – Implement a Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements (*Preferred Alternative*)

This option relates to the development of a review process for the various measures that remove monitoring requirements that are based on geographic location (sections 4.6.1, 4.6.2, and 4.6.3). Establishment of a formal review process under Option 2 could improve administration of the monitoring program, but no direct or indirect impacts on EFH are expected.

7.4 Impacts on Endangered and Other Protected Species

The A23 alternatives are evaluated for their impacts on species protected under the Endangered Species Act (ESA) of 1973 and/or the Marine Mammal Protection Act (MMPA) of 1972. Section 6.5 of the Affected Environment Section contains a complete list of protected species (i.e., ESA listed and MMPA protected species) that inhabit the areas of operation for the Northeast multispecies fishery. This impact analysis considers how the fishery may overlap with protected species in time and space, as well as records of protected species interaction with particular gear types predominantly used in the Northeast multispecies fishery (e.g. gillnet, bottom otter trawl).

7.4.1 Commercial Groundfish Monitoring Program Revisions (Sectors Only)

7.4.1.1 Sector Monitoring Standards (Target Coverage Levels)

7.4.1.1.1 Sector Monitoring Standard Option 1: No Action

As provided in Section 4.1.1.1, Option 1/No Action, if adopted, would maintain the monitoring coverage requirements adopted by Amendment 16 and subsequent actions. The monitoring provisions in those actions were specifically adopted for monitoring groundfish catches, albeit additional information on encounters between fishing activity and protected species (i.e., ESA listed and MMPA protected species) is provided via sector monitoring. In fact, since its inception in 2010, the sector monitoring program and the associated coverage levels have provided a wealth of information about protected species interactions in commercial fishing gear, thereby improving the precision of protected species bycatch analyses and resultant bycatch estimates *(*Table 76). Indirectly, this affords positive impacts to protected species, as reducing uncertainty of the bycatch estimates improves assessments of anthropogenic removals from the population, as well as mitigation efforts in forums such as take reduction teams (NEFSC PSB, pers. comm.). Generally, higher levels of coverage may improve the precision of bycatch estimates and capture variability in the bycatch rates. With increased coverage bycatch estimates would be expected to be more representative and may exhibit more stability if the fishery and other factors remain similar from year to year (NEFSC PSB, pers. comm.)[42]. However, given the limited variables on protected species interactions collected by the ASM program, ancillary analysis can be hindered because of lack of data on, for example, pinger use details (NEFSC PSB, pers. comm.). Based on this information, Option 1/No Action, which will maintain monitoring coverage requirements as adopted by Amendment 16 and modified in subsequent actions, is expected to have indirect low positive impacts to protected species.

Relative to Option 1, the range of coverage levels (as a percentage of sector trips) under consideration for Option 2 (25, 50, 75, and 100 percent) are similar to, or higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are within the lower range of coverage levels

[42] The following tool has been developed to explore how projected CV changes with varying levels of observer effort: https://kacurtis.shinyapps.io/obscov/ (NEFSC PSB, pers. comm.).

considered under Option 2 (i.e., 25 percent) and therefore, Option 1/No Action may have similar indirect impacts to protected species as the option for 25 percent coverage under Option 2. However, under Option 2, there are also a range of higher coverage levels (50, 75, and 100 percent) that have never been assigned to the groundfish fishery since FY2010. As described above, higher coverage levels for groundfish sector monitoring result in greater additional information on protected species interactions with fishing activity, which improves the precision of bycatch estimates. Taking into consideration the above information, specifically the range of coverage levels under Option 2, relative to Option 2, Option 1 /No Action is likely to have negligible to indirect negative impacts to protected species.

Relative to Option 1, the range of coverage levels (as a percentage of catch) under consideration for Option 3 (25, 50, 75, and 100 percent) are similar to, or higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent respectively. These coverage levels are within the lower range of coverage levels considered under Option 3 (i.e., 25 percent) and therefore, Option 1/No Action may have similar indirect impacts to protected species as the option for 25 percent coverage under Option 3. However, under Option 3, there are also a range of higher coverage levels (50, 75, and 100 percent) that have never been assigned to the groundfish fishery. Additionally, since this option applies the target coverage level of catch to each allocated groundfish stock, the resulting overall coverage level will be higher in order to achieve the target coverage level for each stock. As described above, higher coverage levels for groundfish sector monitoring result in greater additional information on protected species interactions with fishing activity, which improves the precision of bycatch estimates. Taking into consideration the above information, specifically the range of coverage level under Option 3, relative to Option 3, Option 1 /No Action is likely to have negligible to indirect negative impacts to protected species.

Under Option 1/No Action, at-sea monitors would be used to achieve at-sea monitoring coverage levels. Options in Section 4.1.2 (Sector Monitoring Tools) would allow sectors to use various models of EM in place of at-sea monitors under both Option 2 and Option 3. Currently limited information is collected on protected species and/or protected species bycatch events through EM (e.g., sea turtles and marine mammals are not identified to species; gear attributes (e.g., pinger functionality) not specified) (NEFSC PSB, pers. comm.). In addition, depending on camera placement and percentage of video reviewed, protected species bycatch events may be missed. Given this, use of this technology may result in a loss of data on protected species interactions with fishing gear, and therefore a loss of data to inform protected species bycatch rates (NEFSC PSB, pers. comm.). However, depending on factors such as camera placement, the percentage of video reviewed, and the specificity of data to be recorded (e.g., accurate protected species identification), the loss of this data/information could be mitigated. Based on this, Option 1/No Action, compared to the options in Section 4.1.2 (Sector Monitoring Tools), may have indirect low positive impacts to protected species; rationale supporting this determination is found in section 7.4.1.2.

7.4.1.1.2 Sector Monitoring Standard Option 2: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Trips (*Preferred Alternative*)

Option 2 would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of sector trips - one of a range of four options under consideration (25, 50, 75, and 100 percent). As described in Option 1, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Option 2 would have indirect low positive impacts to protected species for each of the coverage levels under consideration.

Relative to Option 1/No Action, the range of coverage levels (as a percentage of sector trips) under consideration for Option 2 (25, 50, 75, and 100 percent) are similar to, or higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are within the lower range of coverage levels considered under Option 2 (i.e., 25 percent) and therefore, the option for 25 percent coverage under Option 2 may have similar indirect impacts to protected species as Option 1/No Action. However, under Option 2, there are also a range of higher coverage levels (50, 75, and 100 percent) that have never been assigned to the groundfish fishery since FY2010. As described above, higher coverage levels for groundfish sector monitoring result in greater additional information on protected species interactions with fishing activity, which improves the precision of bycatch estimates. With increased coverage bycatch estimates would be expected to be more representative and may exhibit more stability if the fishery and other factors remain similar from year to year (NEFSC PSB, pers. comm.). Taking into consideration the above information, relative to Option 1/No Action, Option 2 is likely to have negligible to indirect low positive to positive impacts to protected species.

Relative to Option 3, Option 2 is expected to have similar indirect positive impacts to protected species for each of the coverage levels options under consideration. As described above, since Option 3 applies the target coverage level of catch to each allocated groundfish stock, the resulting overall coverage level will be higher in order to achieve the target coverage level for each stock. As a result, Option 2 may afford slightly less indirect positive impacts to protected species relative to Option 3.

Under Option 2, at-sea monitors would be used to achieve at-sea monitoring coverage levels. Options in Section 4.1.2 (Sector Monitoring Tools) would allow sectors to use various models of EM in place of at-sea monitors under both Option 2 and Option 3. Currently limited information is collected on protected species and/or protected species bycatch events through EM (e.g., sea turtles and marine mammals are not identified to species; gear attributes (e.g., pinger functionality) not specified) (NEFSC PSB, pers. comm.). In addition, depending on camera placement and percentage of video reviewed, protected species bycatch events may be missed. Given this, use of this technology may result in a loss of data on protected species interactions with fishing gear, and therefore a loss of data to inform protected species bycatch rates (NEFSC PSB, pers. comm.). However, depending on factors such as camera placement, the percentage of video reviewed, and the specificity of data to be recorded (e.g., accurate protected species identification), the loss of this data/information could be mitigated. Given this, compared to the options in Section 4.1.2 (Sector Monitoring Tools), there may be tradeoffs between higher coverage levels under consideration for some sub-options in Section 4.1.1.2 relative to coverage level options in Option 2 and 3, and the potential for a loss of data on protected species interactions with fishing gear (NEFSC PSB, pers. comm.). Given this, Option 2, compared to the options in Section 4.1.2, may have indirect low positive impacts to protected species; rationale supporting this determination is found in section 7.4.1.2.

7.4.1.1.2.1 Sub-option 2A – 25 percent

Sub-option 2A would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of sector trips of 25 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 2A would have indirect low positive impacts to protected species. The impact of a 25 percent coverage rate would likely vary by time and area depending on the realized observed effort. Depending on the times and areas this may represent an increase in coverage, which may result in increased precision of bycatch estimates, or it may represent a decrease in coverage, which may result in decreased precision (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 2A, 25 percent, is similar to the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are within the range of 25 percent and therefore, relative to Option 1, Sub-option 2A is expected to have negligible impacts to protected species. Relative to the coverage levels considered under Sub-options 2B, 2C, and 2D which are all higher than 25 percent, Sub-option 2A would be expected to have indirect low negative to negative impacts to protected species.

7.4.1.1.2.2 Sub-option 2B – 50 percent

Sub-option 2B would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of sector trips of 50 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 2B would have indirect low positive impacts to protected species. A coverage level of 50 percent may increase precision of bycatch estimates. This would vary by distribution of fishing effort and by species given the rarity of the bycatch (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 2B, 50 percent, is higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are lower than 50 percent and therefore, Sub-option 2B may have indirect positive impacts to protected species compared to Option 1/No Action. Relative to the coverage level considered under Sub-option 2A, which is lower than 50 percent, Sub-option 2B would be expected to have indirect lpositive impacts to protected species. Relative to the coverage levels considered under Sub-options 2C and 2D, which are higher than 50 percent, Sub-option 2B would be expected to have indirect low negative to negative impacts to protected species.

7.4.1.1.2.3 Sub-option 2C – 75 percent

Sub-option 2C would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of sector trips of 75 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 2C would have indirect low positive impacts to protected species. A coverage level of 75 percent may increase precision of bycatch estimates. This would vary by distribution of fishing effort and by species given the rarity of the bycatch (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 2C, 75 percent, is higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are all lower than 75 percent and therefore, Sub-option 2C may have indirect positive impacts to protected species compared to Option 1/No Action. Relative to the coverage levels considered under Sub-options 2A and 2B, which is lower than 75 percent, Sub-option 2C would be expected to have indirect low positive impacts to protected species. Relative to the coverage level considered under Sub-option 2D, which are higher than 75 percent, Sub-option 2C would be expected to have indirect low negative impacts to protected species.

7.4.1.1.2.4 Sub-option 2D – 100 percent (*Preferred Alternative*)

Sub-option 2D would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of sector trips of 100 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 2D would have indirect positive impacts to protected species. 100 percent coverage would result in a CV of zero for bycatch estimates (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 2D, 100 percent, is higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are all lower than 100 percent. In addition, coverage levels under Sub-Options 2A, 2B, and 2C are all also lower than 100 percent. Based on this, relative to the coverage levels considered under Option 1, and Sub-options 2A, 2B and 2C, Sub-option 2D would be expected to have indirect low positive to positive impacts to protected species.

7.4.1.1.3 Sector Monitoring Standard Option 3: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Catch

Option 3 would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of catch - one of a range of four options under consideration (25, 50, 75, and 100 percent). As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords low positive impacts to protected species.

Relative to Option 1, the range of coverage levels under consideration for Option 3 (25, 50, 75, and 100 percent) are similar to, or higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are within the lower range of coverage levels considered under Option 3 (i.e., 25 percent) and therefore, the option for 25 percent coverage under Option 3 may have similar indirect impacts to protected species as Option 1/No Action. However, under Option 3, there are also a range of higher coverage levels (50, 75, and 100 percent) that have never been assigned to the groundfish fishery since FY2010. Further, since Option 3 applies the target coverage level of catch to each allocated groundfish stock, the resulting overall coverage level will be higher in order to achieve the target coverage level for each stock (see Section 7.5.3.1.3).As described in Option 1, higher coverage levels for groundfish sector monitoring result in greater additional information on protected species interactions with fishing operations, which improves the precision of bycatch estimates. With increased coverage bycatch estimates would be expected to be more representative and may exhibit more stability if the fishery and other factors remain similar from year to year (NEFSC PSB, pers. comm.). Taking into consideration the above information, relative to Option 1 /No Action, Option 3 is likely to have negligible to indirect positive impacts to protected species.

Relative to Option 2, Option 3 is expected to have similar indirect positive impacts to protected species for each of the coverage levels options under consideration. As described above, since Option 3 applies the target coverage level of catch to each allocated groundfish stock, the resulting overall coverage level will be higher in order to achieve the target coverage level for each stock (see section 7.4.3.1.3). As a result, Option 3 may afford slightly greater indirect positive impacts to protected species relative to Option 2.

Under Option 3, at-sea monitors would be used to achieve at-sea monitoring coverage levels. Options in Section 4.1.2 (Sector Monitoring Tools) would allow sectors to use various models of EM in place of at-sea monitors under both Option 2 and Option 3. Currently limited information is collected on protected species and/or protected species bycatch events through EM (e.g., sea turtles and marine mammals are not identified to species; gear attributes (e.g., pinger functionality) not specified) (NEFSC PSB, pers. comm.). In addition, depending on camera placement and percentage of video reviewed, protected species bycatch events may be missed. Given this, use of this technology may result in a loss of data on protected species interactions with fishing gear, and therefore a loss of data to inform protected species bycatch rates (NEFSC PSB, pers. comm.). However, depending on factors such as camera placement, the percentage of video reviewed, and the specificity of data to be recorded (e.g., accurate protected species identification), the loss of this data/information could be mitigated. Given this, Option 2, compared to the options in Section 4.1.2, may have indirect low positive impacts to protected species; rationale supporting this determination is found in section 7.4.1.2.

7.4.1.1.3.1 Sub-option 3A – 25 percent

Sub-option 3A would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of catch of each allocated groundfish stock of 25 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 3A would have indirect low positive impacts to protected species. The impact of a 25 percent coverage rate would likely vary by time and area depending on the realized observed effort. Depending on the times and areas this may represent an increase in coverage, which may result in increased precision of bycatch estimates, or it may represent a decrease in coverage, which may result in decreased precision (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 3A, 25 percent, is similar to the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are within the range of 25 percent and therefore, relative to Option 1, Sub-option 3A is expected to have negligible impacts to protected species. However, since Option 3 applies the target coverage level of catch to each allocated groundfish stock, the resulting overall coverage level will be higher in order to achieve the target coverage level for each stock (see section 7.5.3.1.3). Simulation analysis (see Section 7.5.3.1.3) indicates that the 25% catch-based option will require an overall coverage rate of 50% of trips in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock, As a result, Sub-option 3A may afford greater indirect positive impacts to protected species relative to Option 1/No Action. Relative to the coverage levels considered under Sub-options 3B, 3C, and 3D which are all higher than 25 percent, Sub-option 3A would be expected to have indirect low negative to negative impacts to protected species.

7.4.1.1.3.2 Sub-option 3B – 50 percent

Sub-option 3B would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of a percentage of catch of each allocated groundfish stock of 50 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 3B would have indirect low positive impacts to protected species. A coverage level of 50 percent may increase precision of bycatch estimates. This would vary by distribution of fishing effort and by species given the rarity of the bycatch (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 3B, 50 percent, is higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are lower than 50 percent and therefore, Sub-option 3B may have indirect positive impacts to protected species compared to Option 1/No Action. Since Option 3 applies the target coverage level of catch to each allocated groundfish stock, the resulting overall coverage level will be higher in order to achieve the target coverage level for each stock (see Section 7.5.3.1.3). Simulation analysis (see Section 7.5.3.1.3) indicates that the 50% catch-based option will require an overall coverage rate of 70% of trips in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. Relative to the coverage level considered under Sub-option 3A, which is lower than 50 percent, Sub-option 3B would be expected to have indirect positive impacts to protected species. Relative to the coverage levels considered under Sub-options 3C and 3D, which are higher than 50 percent, Sub-option 3B would be expected to have indirect low negative to negative impacts to protected species.

7.4.1.1.3.3 Sub-option 3C – 75 percent

Sub-option 3C would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of catch of each allocated groundfish stock of 75 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 3C would have indirect low positive impacts to protected species. A coverage level of 75 percent may increase precision of bycatch estimates. This would vary by distribution of fishing effort and by species given the rarity of the bycatch (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 3C, 75 percent, is higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are all lower than 75 percent and therefore, Sub-option 3C may have indirect positive impacts to protected species compared to Option 1/No Action. Since Option 3 applies the target coverage level of catch to each allocated groundfish stock, the resulting overall coverage level will be higher in order to achieve the target coverage level for each stock (see Section 7.5.3.1.3). Simulation analysis (see Section 7.5.3.1.3) indicates that the 75% catch-based option will require an overall coverage rate of 90% of trips in order to reliably achieve the target percent coverage of total catch for each allocated groundfish stock. Relative to the coverage levels considered under Sub-options 3A and 3B, which is lower than 75 percent, Sub-option 3C would be expected to have indirect low positive impacts to protected species. Relative to the coverage level considered under Sub-option 3D, which are higher than 75 percent, Sub-option 3C would be expected to have indirect low negative impacts to protected species.

7.4.1.1.3.4 Sub-option 3D – 100 percent

Sub-option 3D would revise the total monitoring coverage level to be a fixed annual target coverage level as a percentage of catch of each allocated groundfish stock of 100 percent. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Similar to Option 1/No Action, Sub-option 3D would have indirect positive impacts to protected species. 100 percent coverage would result in a CV of zero for bycatch estimates (NEFSC PSB, pers. comm.).

Relative to Option 1/No Action, the coverage level considered under Sub-option 3D, 100 percent, is higher than the target and realized coverage levels documented since the groundfish sector monitoring program was established (FY2010-2017; see Table 64). Specifically, target and realized coverage levels from FY2010-FY2017 have ranged from 14-38 percent, and 14-32 percent, respectively, resulting in an average target and realized coverage level of 25 percent and 22 percent, respectively. These coverage levels are all lower than 100 percent and therefore, Sub-option 2D may have indirect positive impacts to protected species compared to Option 1/No Action. In addition, coverage levels under Sub-Options 3A, 3B, and 3C are all also lower than 100 percent. Based on this, relative to the coverage levels considered under Option 1, and Sub-options 3A, 3B and 3C, Sub-option 3D would be expected to have indirect low positive to positive impacts to protected species.

7.4.1.2 Sector Monitoring Tools (Options for meeting monitoring standards)

Analytical Approach:

For the following options being considered as options for sector monitoring tools that meet monitoring standards, a comparison of Option 1/No Action (Section 7.4.1.1.1) to all of the options in Section 4.1.2 (Sector Monitoring Tools) (Options 1, 2, and 3) is provided below. Each option is then compared to Option 2 (Section 7.4.1.1.2) and Option 3 (Section 7.4.1.1.3), in which at-sea monitors would be used to achieve the target coverage level, and to the other options in Section 4.1.2.

Analyzing Sub-Options relative to No Action (Option 1) in Section 4.1.1:

In Section 4.2.1, Option 1 would require EM coverage levels to be designated based upon specified coverage rates identified under Sector Monitoring Standard Option 2 (Section 4.1.1.2) (25, 50, 75, and

100 percent) or Sector Monitoring Standard Option 3 (Section 4.1.1.3) (25, 50, 75, and 100 percent), while Options 2 and 3 require that EM cameras are on 100 percent of trips.

Given the above, there may be tradeoffs between the higher coverage levels under consideration for Options 1, 2,and 3 relative to Option 1/No Action in Section 4.1.1: Sector Monitoring Standards, and the potential for a loss of data on protected species interactions with fishing gear, since currently little to no information is collected on protected species and/or protected species bycatch events through EM (e.g., sea turtles and marine mammals are not identified to species; gear attributes (e.g., pinger functionality) not specified) (NEFSC PSB, pers. comm EM may be able to capture some of the interactions between protected species and fishing gear; however, given the nature of EM, some key gear information used to inform the bycatch event is likely to be lost if not paired with eVTR to record key gear information such as mesh size, soak duration, and gear length. Additional information such as pinger functionality on gillnets after an incidental marine mammal take would likely be lost even with eVTR (NEFSC PSB, pers. comm.). In addition, depending on the configuration of the cameras, bycatch events may be missed, specifically under circumstance in which animals are not brought on the vessel, and into camera view. For example, marine mammals and sea turtles are known to sometimes fall out of a gillnet during the haulback, so positioning a camera to view the net as it is coming out of the water would be crucial to ensure bycatch events occurring during haulback operations are recorded; otherwise incidental takes like these would be unobserved if cameras were primarily aimed at fish processing on deck. Incidental takes could also be disentangled by the crew before the net comes over the side, so a camera positioned to observe this would ensure bycatch estimates are not biased low (NEFSC PSB, pers. comm.). Given this, camera placement is expected to have a large impact on detection of protected species bycatch events.

Video reviewers would collect counts of discards of protected species where possible. However, if the data fields for EM are not descriptive enough to identify the species of marine mammal, sea turtle, or fish, or the gear associated with the interaction is not documented, estimating bycatch rates will be impossible from this data. In addition, depending on camera angle, and/or the percentage of the video reviewed, rare bycatch events may also be missed. In addition, EM would also likely miss opportunistic data collection of protected species encounters where an at-sea monitor would record seeing an animal around the vessel or in the general area. Sub-sampling of the video footage also limits the usefulness of the data. If, for example, only 20% of the video footage is reviewed for quality assurance, then 80% of the hauls are effectively not sampled for protected species. One possible way to address this could be through use of an algorithm that identifies bycatch of interest in the non-reviewed portions (NEFSC PSB, pers. comm.). Given the above considerations, under EM, there is likely to be a loss of data on protected species interactions compared to the information collected from at-sea monitors, even at higher coverage levels for EM

In addition to the above, the lack of biological samples returned would be another key primary data piece lost if at-sea monitors were not on board. These biological samples play a key role in ancillary assessments such as diet analysis, health assessments, and population assessments (age/size/sex composition of animals removed from the population) (NEFSC PSB, pers. comm.). Currently at-sea monitors are not required to bring back biological samples of protected species, but in the past have provided useful samples for studies of protected species diet.

How the information collected through EM could affect protected species bycatch estimates and marine mammal stock assessments is highly dependent on camera location, the degree to which all footage (or all footage with protected species bycatch) is effectively reviewed, what information is recorded about the bycatch event, how extensive the implementation of EM is across fisheries, and how accessible the data is to bycatch analysts (NEFSC PSB, pers. comm.). For example, with 100 percent coverage, accurate species ID, proper camera placement, 100 percent data review for protected species, and sharing of all relevant data, then EM could be very insightful and significantly improve bycatch estimates and stock assessments; under such operating conditions, any potential loss of data on protected species interactions through the use of EM could be mitigated. With poor camera placement, limited video review, no species identification, and no access to the actual footage, EM could not be used to inform bycatch estimates and stock assessments (NEFSC PSB, pers. comm.). EM could also potentially hinder the ability to accurately classify fisheries in the MMPA List of Fisheries (i.e., removing or placing species in Cat I, II, or III fisheries), because there would not be accurate information on the magnitude of protected species bycatch (NEFSC PSB, pers. comm.).

Based on this information, Options 1, 2, and 3 may have indirect low negative impacts to protected species, when compared to the impacts of section 4.1.1's No Action (Option 1) (see Section 7.4.1.1.1 for impacts). However, as outlined above, with a properly designed protocol, including specific camera angles and data recording standards, EM could potentially document more protected species interactions and therefore, has the potential to be beneficial for some aspects of protected species data collection., In addition, the use of EM, if approved as a sector monitoring tool, would be a choice for individual vessels to make and not a requirement. Currently, only a small percentage of the groundfish fishery (~10 percent) participate in the EM projects through Exempted Fishing Permits (EFPs). Taking these factors into consideration, any indirect negative impacts to protected species from any potential loss of data on protected species interactions through the use of EM may, to some extent, be mitigated, and would not be expected to have a significant adverse impact.

7.4.1.2.1 Sector Monitoring Tools Option 1: Electronic Monitoring in place of Human At-Sea Monitors

Option 1 would allow sectors to use EM in place of at-sea monitors at the selected coverage rate. This option is expected to have similar indirect low negative impacts to protected species as provided in Section 7.4.1.2.

When compared to Sector Monitoring Standards Option 2 and Option 3 in Section 4.1.1 (Sector Monitoring Standards) in which at-sea monitors would be used to achieve monitoring standards, Option 1 may have indirect low negative to negative impacts on protected species because of the potential loss of data on protected species interactions compared to the information collected from at-sea monitors. However, as noted above, any indirect negative impacts to protected species from any potential loss of data on protected species interactions through the use of EM would not be expected to have a significant adverse impact.

Compared to Sector Monitoring Tools Options 2 and 3, Option 1 would be expected to have negligible impacts on protected species as either of these Options may result in the loss of data on protected species interactions and therefore, result in similar levels of impacts to protected species (i.e., indirect low negative).

7.4.1.2.2 Sector Monitoring Tools Option 2: Audit Model Electronic Monitoring Option (*Preferred Alternative*)

Option 2 would allow sectors to use the audit model EM in place of at-sea monitors, in which cameras are run on 100 percent of trips. This would potentially allow for more opportunity to see protected species interactions relative to the lower potential coverage rates (25, 50, and 75 percent) under consideration in Sector Monitoring Standards Option 2 and Option 3. At the same time, however, as described above in Section 7.4.1.2, if the data fields for EM are not descriptive enough to identify the species of marine mammal, sea turtle, or fish, or the gear associated with the interaction, estimating bycatch rates will be impossible from this data, and so there may be tradeoffs in terms of data that could still be lost even at 100 percent coverage of trips. Additionally, the percentage of the video reviewed will also impact the level of information collected on protected species bycatch events, and therefore the level of benefit to protected species. Although the cameras may be on 100 percent of the time, if only a small percentage of that video is reviewed, some bycatch events may be missed. Option 2, therefore, may have indirect low negative impacts to protected species. However, as noted above, any indirect negative impacts to protected species from any potential loss of data on protected species interactions through the use of EM would not be expected to have a significant adverse impact.

When compared to Sector Monitoring Standards Option 2 and Option 3 in Section 4.1.1 (Sector Monitoring Standards) in which at-sea monitors would be used to achieve monitoring standards, Option 2 may have indirect low negative to negative impacts on protected species because of the potential loss of data on protected species interactions compared to the information collected from at-sea monitors. However, as noted above, any indirect negative impacts to protected species from any potential loss of data on protected species interactions through the use of EM would not be expected to have a significant adverse impact.

Compared to Option 1 and Option 3, Option 2 would be expected to have negligible impacts on protected species as either of these Options may result in the loss of data on protected species interactions and therefore, result in similar levels of impacts to protected species (i.e., indirect low negative).

7.4.1.2.3 Sector Monitoring Tools Option 3: Maximized Retention Electronic Monitoring Option (*Preferred Alternative*)

Option 3 would allow sectors to use the maximized retention model EM in place of at-sea monitors, in which cameras are run on 100 percent of trips. This would potentially allow for more opportunity to see protected species interactions relative to the lower potential coverage rates (25, 50, and 75 percent) under consideration in Sector Monitoring Standards Option 2 and Option 3. At the same time, however, as described in Section 7.4.1.2, if the data fields for EM are not descriptive enough to identify the species of marine mammal, sea turtle, or fish, or the gear associated with the interaction, estimating bycatch rates will be impossible from this data, and so there may be tradeoffs in terms of data that could still be lost even at 100 percent coverage of trips. Additionally, the percentage of the video reviewed will also impact the level of information collected on protected species bycatch events, and therefore the level of benefit to protected species. Although the cameras may be on 100 percent of the time, if only a small percentage of that video is reviewed, some bycatch events may be missed. Option 3, therefore, may have indirect low negative impacts to protected species. However, as noted above, any indirect negative impacts to protected species from any potential loss of data on protected species interactions through the use of EM would not be expected to have a significant adverse impact.

When compared to Sector Monitoring Standards Option 2 and Option 3 in Section 4.1.1 (Sector Monitoring Standards) in which at-sea monitors would be used to achieve monitoring standards, Option 3 may have indirect low negative to negative impacts on protected species because of the potential loss of data on protected species interactions compared to the information collected from at-sea monitors. However, as noted above, any indirect negative impacts to protected species from any potential loss of data on protected species interactions through the use of EM would not be expected to have a significant adverse impact.

Compared to Option 1 and Option 2, Option 3 would be expected to have negligible impacts on protected species as either of these Sub-Options may result in the loss of data on protected species interactions and therefore, result in similar levels of impacts to protected species (i.e., indirect low negative).

7.4.1.3 Total Monitoring Coverage Level Timing

7.4.1.3.1 Coverage Level Timing Option 1: No Action

Option 1/No Action would maintain the current process in which the total monitoring coverage level is available from NMFS once the necessary analysis is complete. Option 1/No Action would not be expected to have direct or indirect impacts on protected species, as this is an administrative measure and so it does not, in and of itself, change fishing effort or fishing behavior.

7.4.1.3.2 Coverage Level Timing Option 2: Knowing Total Monitoring Coverage Level at a Time Certain

Similar to Option 1/No Action, Option 2 is not expected to impact protected species. Establishing a requirement for knowing the total monitoring coverage level at a time certain is an administrative measure, and would not have a direct or indirect impact on protected species because it does not, in and of itself, change fishing effort or fishing behavior.

7.4.1.4 Review process for Sector Monitoring Coverage

7.4.1.4.1 Coverage Review Process Option 1: No Action

Option 1/No Action would not establish a review process to evaluate the efficacy of sector monitoring coverage rates, and would maintain the current process in which the groundfish monitoring program is to be periodically reviewed as part of the goals and objectives of the groundfish sector monitoring program. Option 1/No Action would not be expected to have direct or indirect impacts on protected species, as this is an administrative measure and so it does not, in and of itself, change fishing effort or fishing behavior.

7.4.1.4.2 Coverage Review Process Option 2: Establish a Review Process for Monitoring Coverage Rates (*Preferred Alternative*)

Similar to Option 1/No Action, Option 2 is not expected to impact protected species. Establishing a review process to evaluate the efficacy of sector monitoring coverage rates is an administrative measure, and would not have a direct or indirect impact on protected species because it does not, in and of itself, change fishing effort or fishing behavior.

7.4.1.5 Addition to List of Framework Items (*Preferred Alternative*)

This option is an administrative measure, and is not expected to have a direct or indirect impact on protected species because it does not, in and of itself, change fishing effort or fishing behavior.

This option would add new sector monitoring tools to the list of framework items. Impacts to protected species would depend on the nature of new monitoring tools and the extent to which ancillary information on protected species interactions in commercial fishing gear is provided by these additional monitoring tools; such impacts would likely be indirect (see Section 7.4.1.1.1 for more information on the impacts of monitoring coverage and Section 7.4.1.2 for more information on the impacts of monitoring tools such as EM).

This option would also add vessel coverage levels to the list of framework items. Impacts to protected species would be similar to impacts of monitoring coverage, as discussed in Section 7.4.1.1.1.

7.4.2 Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool)

7.4.2.1 Dockside Monitoring Program (Sectors and Common Pool)

7.4.2.1.1 Dockside Monitoring Option 1: No Action (*Preferred Alternative*)

Option 1/No Action would continue to maintain no requirement for dockside monitoring for the commercial groundfish fishery. Dockside monitoring does not affect protected species; this option is therefore not expected to have direct or indirect impacts on protected species.

7.4.2.1.2 Dockside Monitoring Option 2: Mandatory Dockside Monitoring Program for the Commercial Groundfish Fishery

Option 2 would establish the requirement of a dockside monitoring program for the entire commercial groundfish fishery. Although the accuracy of landing information may improve as a result of this option, it would not improve information on protected species, as protected species are illegal to bring to the dock and therefore would not be monitored better. Dockside monitoring does not affect protected species; this option is therefore not expected to have direct or indirect impacts on protected species.

7.4.2.2 Dockside Monitoring Program Structure and Design

7.4.2.2.1 Dockside Monitoring Program Funding Responsibility

7.4.2.2.1.1 Dockside Monitoring Program Funding Responsibility Option A – Dealer Responsibility

This option would determine the funding responsibility for dockside monitoring. This is an administrative measure and would not have any direct or indirect impacts on protected species. Additionally, dockside monitoring does not affect protected species.

7.4.2.2.1.2 Dockside Monitoring Program Funding Responsibility Option B – Vessel Responsibility

This option would determine the funding responsibility for dockside monitoring. This is an administrative measure and would not have any direct or indirect impacts on protected species. Additionally, dockside monitoring does not affect protected species.

7.4.2.2.2 Dockside Monitoring Program Administration

7.4.2.2.2.1 Dockside Monitoring Program Administration Option A – Individual contracts with dockside monitor providers

This option would determine the program administration for dockside monitoring. This is an administrative measure and would not have any direct or indirect impacts on protected species. Additionally, dockside monitoring does not affect protected species.

7.4.2.2.2.2 Dockside Monitoring Program Administration Option B – NMFS-administered dockside monitoring program

This option would determine the program administration for dockside monitoring. This is an administrative measure and would not have any direct or indirect impacts on protected species. Additionally, dockside monitoring does not affect protected species.

7.4.2.2.3 Options for Lower Dockside Monitoring Coverage Levels (20 percent coverage)

7.4.2.2.3.1 Option A – Lower coverage levels for <u>ports</u> with low volumes of groundfish landings

This option would require lower coverage for vessels or dealers in small, remote ports. Dockside monitoring does not affect protected species; this option is therefore not expected to have direct or indirect impacts on protected species.

7.4.2.2.3.2 Option B – Lower coverage levels for <u>vessels</u> with total groundfish landings volumes in the 5th percentile of total annual landings

This option would require lower coverage for low volume vessels or dealers that receive landings from low volume vessels. Dockside monitoring does not affect protected species; this option is therefore not expected to have direct or indirect impacts on protected species.

7.4.2.2.4 Dockside Monitoring Fish Hold Inspection Requirements

7.4.2.2.4.1 Fish Hold Inspection Option A – Dockside monitor fish hold inspections required

This option would require dockside monitor fish hold inspections. Dockside monitoring does not affect protected species; this option is therefore not expected to have direct or indirect impacts on protected species.

7.4.2.2.4.2 Fish Hold Inspection Option B – Alternatives method for inspecting (cameras)

This option would allow for the use of cameras as an alternative to dockside monitors directly inspecting fish holds. Dockside monitoring does not affect protected species; this option is therefore not expected to have direct or indirect impacts on protected species.

7.4.2.2.4.3 Fish Hold Inspection Option C – No fish hold inspection required, captain signs affidavit

This option would not require dockside monitor fish hold inspections and instead would require captains to sign an affidavit verifying all catch has been offloaded. Dockside monitoring does not affect protected species; this option is therefore not expected to have direct or indirect impacts on protected species.

7.4.3 Sector Reporting

7.4.3.1 Sector reporting Option 1: No Action

Option 1/No Action would maintain the current sector reporting requirements. Option 1/No Action would not be expected to have direct or indirect impacts on protected species, as this is an administrative measure and so it does not, in and of itself, change fishing effort or fishing behavior.

7.4.3.2 Sector reporting Option 2 – Grant Regional Administrator the Authority to Streamline Sector Reporting Requirements

Similar to Option 1/No Action, Option 2 is not expected to impact protected species. Granting the Regional Administrator the authority to streamline sector reporting requirements is an administrative measure, and would not have a direct or indirect impact on protected species because it does not, in and of itself, change fishing effort or fishing behavior.

7.4.4 Funding/Operational Provisions of Groundfish Monitoring (Sectors and Common Pool)

7.4.4.1 Funding Provisions Option A: No Action

Option 1/No Action would maintain the industry-funded monitoring requirement. The funding requirement is an administrative measure that would not be expected to have direct impacts on protected species. However, indirectly, this measure could have impacts on protected species, as this could influence monitoring coverage rates. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords low positive impacts to protected species. Additionally, this measure could have direct impacts on protected species, as there is the potential for lower fishing effort should NMFS not have sufficient funding for its shoreside costs, which would require vessels to reduce fishing effort to match available funding. As interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, any decrease in either of these factors will reduce the potential for protected species interactions with gear. Therefore, Option 1/No Action has the potential to reduce interaction risks for protected species, which could provide some benefit to protected species. However, as interactions can still occur, even under a reduced effort scenario, direct impacts to protected species are expected to be low negative. Given the above, Option 1/No Action is expected to result in direct low negative impacts and indirect low positive impacts to protected species.

Compared to Sub-Option 2A, this measure would likely have neutral to indirect low negative impacts, as there is a potential for higher monitoring coverage levels under Sub-Option 2A, but a change in fishing effort under Sub-Option 2A is not expected. Compared to Sub-Option 2B, Option 1/No Action would likely have indirect low positive impacts to protected species, as there a potential for lower monitoring coverage levels under Sub-Option 2B. Additionally, Option1/No Action could potentially have direct positive impacts on protected species when compared to Sub-Option 2B, as there is the potential for lower effort under Option 1/No Action, should NMFS not have sufficient funding for its shoreside costs, which would require vessels to reduce fishing effort to match available funding. As interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, any decrease in either of these factors will reduce the potential for protected species interactions with gear. Therefore, Option 1/No Action has the potential to reduce interaction risks for protected species. Option 1/No Action could potentially have low positive impacts on protected species compared to Sub-Option 2B. Impacts to protected species from Option 1/No Action, therefore, are somewhat unclear, as it is not known whether or not NMFS would have funding available for its shoreside costs.

7.4.4.2 Funding Provisions Option 2 – Provisions for an Increase or Decrease in Funding for the Groundfish Monitoring Program

7.4.4.2.1 Funding Provisions Sub-Option 2A – Higher Monitoring Coverage Levels if NMFS Funds are Available (Sectors Only)

Sub-Option 2A would allow for at-sea monitoring at higher coverage levels than the target coverage required (see Section 4.1.1), up to 100 percent, provided that NMFS has determined funding is available to cover the additional administrative costs to NMFS and sampling costs to industry in a given year. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Sub-Option 2A could potentially result in higher monitoring levels, which would be expected to have indirect low positive impacts on protected species. Sub-Option 2A will also not result in any potential change in effort relative to current operating conditions, and therefore, new or elevated interaction risks to protected species are not expected. Specifically, interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, with any increase in either of these factors increasing the potential for protected species interactions with gear. As Sub-Option 2A will not change any of these factors, while interactions are possible, they are not expected to increase or decrease under this sub-option and therefore, direct impacts to protected species are likely to be low negative. Given the above, indirectly, Sub-Option 2A may have low positive impacts to protected species, while directly, impacts to protected species are expected to be low negative.

Compared to Option 1/No Action, the impacts of Sub-Option 2A are somewhat unclear because it is unclear whether or not NMFS would have the funding available to cover additional administrative costs to NMFS and sampling costs to industry in a given year. The federal government may provide the funding to cover additional administrative costs to NMFS and sampling costs to industry, which would allow for at-sea monitoring at higher coverage levels than the target coverage required (see Section 4.1.1), up to 100 percent, in which case then Sub-Option 2A would have indirect positive impacts compared to Option 1/No Action. If the federal government did not have funding available for additional monitoring coverage, then impacts to protected species would be similar to those under Option 1/No Action, and therefore, relative to Option 1, would result in negligible impacts to protected species. Additionally, unlike Option 1/No Action, Sub-Option 2A does not allow for a potential decrease in effort (see Option 1 for more details). As there is the potential for lower effort under Option 1/No Action relative to Sub-Option 2A, relative to Option 1/No Action, Sub-Option 2A could potentially have direct low negative impacts on protected species, as this measure does not have the potential to result in a reduction of fishing effort. Compared to Sub-Option 2B, Sub-Option 2A would have indirect low positive impacts, as there is a potential for lower monitoring coverage levels under Sub-Option 2B.

7.4.4.2.2 Funding Provisions Sub-Option 2B – Waivers from Monitoring Requirements Allowed (Sectors and Common Pool) (*Preferred Alternative*)

Sub-Option 2B would allow vessels to be issued waivers to exempt them from industry-funded monitoring requirements, for either a trip or the fishing year, if coverage was unavailable due to insufficient funding for NMFS shoreside costs for the specified target coverage level. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species. Sub-Option 2B could potentially result in lower monitoring levels, which would be expected to have indirect low negative impacts on protected species. Sub-Option 2B will also not result in any potential change in effort relative to current operating conditions, and therefore, new or elevated interaction risks to protected species are not expected. Specifically, interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, with any increase in either of these factors increasing the potential for protected species interactions with gear. As Sub-Option 2B will not change any of these factors, while interactions are possible, they are not expected to increase or decrease under this sub-option and therefore, direct impacts to protected species are likely to be low negative. Given the above, the impacts of Sub-Option 2B on protected species are expected to be (directly and indirectly) low negative.

Compared to Option 1/No Action, Sub-Option 2B would have indirect low negative impacts to protected species, as there is a potential for lower monitoring coverage levels under Sub-Option 2B. Additionally, unlike Option 1/No Action, Sub-Option 2B does not allow for a potential decrease in effort (see Option 1 for more details). As there is the potential for lower effort under Option 1/No Action relative to Sub-Option 2B, relative to Option 1/No Action, Sub-Option 2B could potentially have direct low negative impacts on protected species, as this measure does not have the potential to result in a reduction of fishing effort. Impacts to protected species from Sub-Option 2B, therefore, are somewhat unclear, as it is not known whether or not NMFS would have funding available for its shoreside costs. Compared to Sub-Option 2A, Sub-Option 2B would have indirect low negative impacts, as there is a potential for higher monitoring coverage levels under Sub-Option 2A.

7.4.5 Management Uncertainty Buffers for the Commercial Groundfish Fishery (Sectors)

7.4.5.1 Management Uncertainty Buffer Option 1: No Action

Option 1/No Action would maintain the current process in place for setting management uncertainty buffers for groundfish stocks for the different sub-components of the commercial groundfish fishery. Option 1/No Action would likely have neutral to low negative impacts to protected species, as management uncertainty buffers are a part of the ACL-setting process, designed to constrain fishing effort to allowable levels. Maintaining current management uncertainty buffers would likely keep the groundfish fishery operating at current levels, and changes in effort would not be expected. As interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, any decrease in either of these factors will reduce the potential for protected species interactions with gear. With fishing effort remaining the same, interactions with protected species are still possible, however, elevated interactions would not be expected. Therefore, impacts to protected species would be low negative.

Compared to Option 2, Option 1/No Action may have neutral to low positive impacts to protected species, as there is the potential for an increase in effort under Option 2. However, with 100 percent monitoring required should Option 2 be selected, Option 2 would provide indirect positive impacts to protected species as there would be additional information on protected species interactions with commercial fishing gear, which in turn, could be used to inform future protected species management measure to minimize such gear interactions. As described above, the additional information on encounters between fishing activity and protected species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so Option 2, indirectly, affords positive impacts to protected species. Therefore, relative to Option 2, Option 1/ No Action may result in indirect negative impacts to protected species since there is no potential for an increase monitoring coverage as there is under Option 2. Further, it may be difficult to predict how changes to the management uncertainty buffers would influence fishing effort.

7.4.5.2 Management Uncertainty Buffer Option 2 – Elimination of Management Uncertainty Buffer for Sector ACLs with 100 Percent Monitoring of All Sector Trips (*Preferred Alternative*)

Option 2 would revise the management uncertainty buffer for the sector ACL for all allocated groundfish stocks to be zero, if the option for 100 percent at-sea monitoring, whether as a fixed percentage of sector trips (Section 4.1.1.2) or as a percentage of catch (Section 4.1.1.3) is selected. It is difficult to predict whether the removing the management uncertainty buffers would result in substantial increases in fishing effort. This has the potential to increase fishing effort since setting the buffer to zero would result in higher sector ACLs. As interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, any decrease in either of these factors will reduce the potential for protected species interactions with gear. Therefore, Option 2 has the potential to increase interaction risks for protected species and therefore, is likely to result in low negative to negative impacts on protected species. However, with 100 percent monitoring required should Option 2 be selected, Option 2 would provide indirect positive impacts to protected species as there would be additional information on protected species interactions with commercial fishing gear, which in turn, could be used to inform future protected species management measure to minimize such gear interactions. Based on the above information, impacts to protected species from Option 2 may range from direct low negative to negative impacts, to indirect low positive impacts.

Compared to Option 1/No Action, Option 2 is expected to have neutral to negative impacts, as there is the potential for an increase in fishing effort under Option 2. However relative to Option 1/ No Action, Option 2 may also result in indirect positive impacts to protected species through the increase in additional information on protected species interactions with commercial fishing gear provided through higher levels of monitoring, as 100 percent monitoring is required for this option to be selected. As described above, the additional information on encounters between fishing activity and protected and endangered species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates, and so indirectly affords positive impacts to protected species.

7.4.6 Remove Commercial Groundfish Monitoring Requirements for Certain Vessels Fishing Under Certain Circumstances

7.4.6.1 Removal of Monitoring Program Requirements Option 1: No Action (Sectors Only)

Option 1/No Action would maintain the existing measures for removal of groundfish monitoring program coverage requirements. These include the removal of at-sea monitoring coverage requirement for sector vessels fishing exclusively with extra-large mesh (ELM) gillnets of 10 inches (25.4 cm) or greater on a sector trip fishing exclusively in the SNE/MA and Inshore GB Broad Stock. Additionally, sector vessels fishing on these non-ASM sector trips and fishing exclusively within the footprint and season of either the Nantucket Shoals Dogfish Exemption Area, the Eastern Area of the Cape Cod Spiny Dogfish Exemption Area, and SNE Dogfish Gillnet Fishery Exemption Area are removed from the requirement to only use 10+ inch mesh on these excluded trips in order to target dogfish with 6.5 inch mesh on the same trip, and are thus also excluded from the at-sea monitoring coverage requirement. However, these spiny dogfish exemptions are handled through sector operations plans. As has previously been discussed in past actions (FW 55), sector ELM trips overlap in time and space with observed takes of marine mammals throughout the northeast, particularly in the GOM (BSA 1), Inshore GB (BSA 2), and SNE (BSA 4) (Figure 43). The exempted dogfish fisheries overlap in time and space with observed takes marine mammals to the east of Cape Cod and in southern New England.

The removal of the ASM requirement for a sub-set of sector trips had the potential to create an economic incentive to target non-groundfish stocks like skates, monkfish, and dogfish using 10”+ mesh. Although this had the potential to increase fishing effort, effort is still constrained by quota allocations for these non-groundfish stocks. As a result, there is the potential that although effort could increase, the increase in effort will result in quotas being attained faster. ASM was paid for by NMFS from on May 1st, 2010 through December 31st, 2015. Over this time, sector vessels targeted non-groundfish stocks while on sector trips with very low catch of groundfish. As a portion of the fishery was already exhibiting this behavior when there was not an economic incentive, fishing effort present in these dogfish exemption areas is likely to be consistent with previous fishing years.

Based on the above information, Option 1/No Action has the potential to result in direct and indirect impacts to protected species. Direct impacts to protected species are likely to be seen via changes in fishing behavior resulting from the economic incentive created from existing measures for removal of groundfish monitoring program coverage requirements. As noted above, this could equate to increased effort and therefore, the potential for increased interactions with protected species; however, as also noted above, under this same scenario, quota constraints are likely to limit any significant increase in effort. In fact, redirecting effort to these stocks may result in quotas being caught faster. If quota is reached faster, this equates to gear being present for less time in the water. As interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, any decrease in either of these factors will reduce the potential for protected species interactions with gear. As a result, direct impacts to protected species are expected to be low negative.

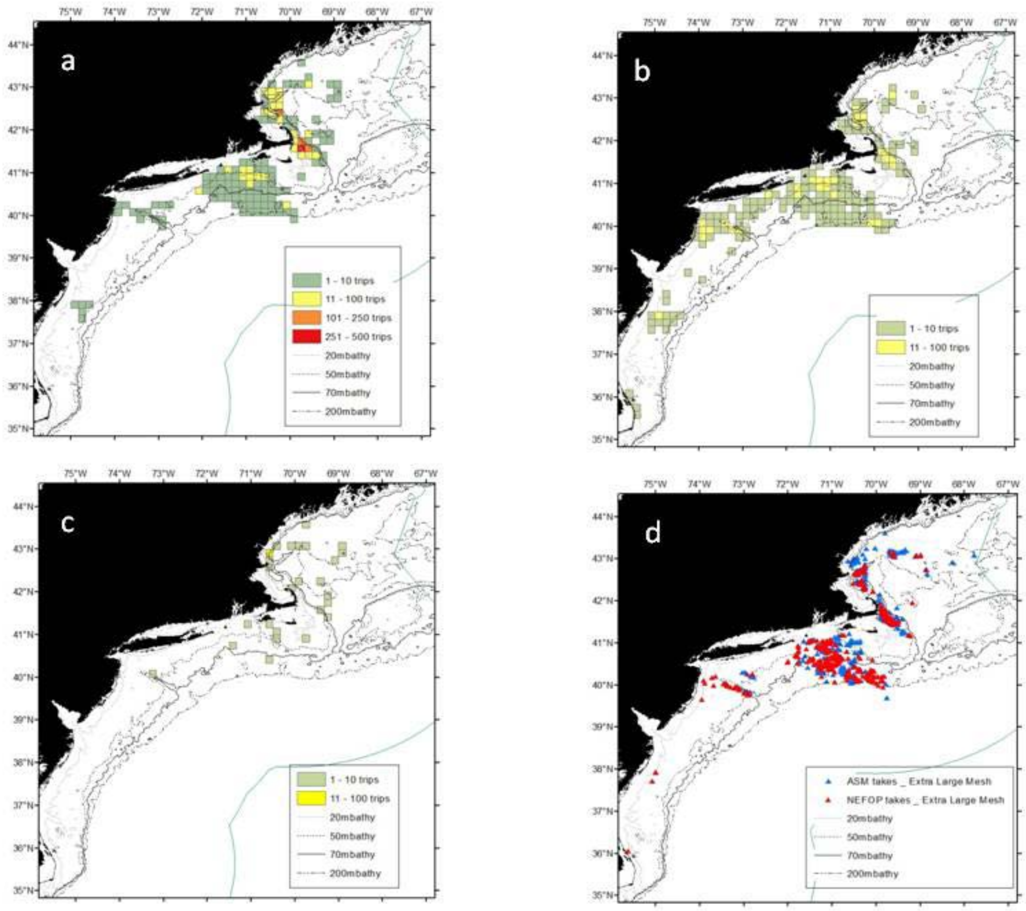
Indirectly, the existing measures for removal of groundfish monitoring program coverage requirements under Option 1/No Action may also result in low negative impacts to protected species. As noted previously, since its inception in 2010, at-sea monitoring (ASM) data have provided a wealth of information about protected species interactions in commercial fishing gear, particularly in the extra-large mesh (>=8") sink gillnet fisheries (NEFSC PSB pers. comm); however, as evidenced by measures implemented in FW55, removal of any level of at-sea monitoring can result in a decrease in protected species bycatch information that previously would have been used to improve bycatch estimates and precision, as well as inform potential protected species management decisions. For instance, from 2010-2014, the number of hauls observed by ASM in the extra-large-mesh (ELM) fishery exceeded the number of hauls observed by traditional Northeast Fisheries Observer Program (NEFOP) observers, constituting 60% of all observed ELM hauls; moreover, ASM documented 63% of all protected species interactions in the ELM fisheries (NEFSC PSB pers. comm).

While ASM data have supplemented NEFOP data in the Gulf of Maine and southern New England regions (Figure 43a,b), they have also provided information about ELM fishing practices and bycatch where NEFOP coverage did not Figure 43c,d). The amount of information ASM data provide to protected species bycatch analyses improves the precision of bycatch estimates. For example, the addition of ASM information to an analysis of gray seal bycatch rates from May 2010-April 2011 reduced the coefficient of variation (CV) around the bycatch rates in almost all strata (Table 76, Graham *et al.* in review). Reducing uncertainty of bycatch estimates improves assessments of anthropogenic removals from the population, as well as mitigation efforts in forums such as take reduction teams (NEFSC PSB, pers. comm). As the existing measures for removal of monitoring requirements under Option 1/No Action remove ASM coverage requirements for particular sector trips (see description above), the full informational benefits provided by current ASM coverage levels in assessing protecting species bycatch has likely been reduced (see above), thereby affecting the precision of protected species bycatch estimates and reducing available information for protected species management decisions. Specifically, as provided in Table 77, the ASM data collected on ELM trips in the two broad stock areas (BSAs 2 and 4) before FW55 was implemented contributed information to marine mammal bycatch assessments. However, after FW55, there were few observed marine mammal takes on ELM trips in these areas from 2016-2018 due to the measure removing ASM coverage. Any observations made in these areas over this time frame are suspected to have come from NEFOP coverage based on patterns in the observational data.

Based on the above information, impacts to protected species from Option 1/No Action are expected to be (directly and indirectly) low negative. Relative to Option 2 and Option 3, Option 1/No Action would be expected to have low positive impacts to protected species, as both Option 2 and Option 3 would allow for the removal of ASM requirements in other areas, in addition to the existing measures for removal of groundfish monitoring program coverage requirements under Option 1/No Action.

Figure 43 - a) Number of ASM trips in extra-large (>=8") mesh gillnet gear, 2010-2014; b) Number of NEFOP trips in extra-large (>=8") mesh gillnet gear, 2010-2014; c) ASM extra-large mesh trips in

10' squares where there was no NEFOP coverage; d) Observed interactions between extra-large mesh gillnet gear and protected species (birds, cetaceans, seals, turtles).



Provided by NEFSC, Protected Species Branch.

Table 76 - Comparison of estimated bycatch rates, coefficient of variation (CV) and 95% confidence intervals (CI) from a log-normal distribution after pooling NEFOP observer data with ASM data for gray seals in gillnet gear.

NEFOP					GILLNET	ASM+NEFOP				
Number of Hauls	Gray Seal Takes	Bycatch Rate	CV	95% CI	Strata	Num of Hauls	Gray Seal Takes	Bycatch Rate	CV	95% CI
1,796	33	0.0184	0.18	0.013-0.026	All	7,850	161	0.0205	0.08	0.017-0.024
1,060	2	0.0019	0.50	0.001-0.005	Inshore GOM	4,621	15	0.0032	0.21	0.002-0.005
357	3	0.0084	0.46	0.004-0.020	Offshore GOM	1,393	5	0.0036	0.37	0.002-0.007
379	28	0.0739	0.20	0.050-0.109	SNE	1,836	141	0.0768	0.09	0.065-0.091
90	1	0.0111	0.72	0.003-0.039	Dogfish	714	1	0.0014	0.72	0.000-0.005
199	11	0.0553	0.29	0.031-0.097	Monkfish	919	71	0.0773	0.12	0.061-0.097
1,287	3	0.0023	0.48	0.001-0.006	Multispeci es	5,028	11	0.0022	0.24	0.001-0.003
220	18	0.0818	0.23	0.052-0.128	Skate	1,189	78	0.0656	0.10	0.054-0.080
657	18	0.0274	0.22	0.018-0.042	Jan-Apr 2011	1,728	86	0.0498	0.11	0.040-0.061
630	13	0.0206	0.33	0.011-0.039	May-Aug 2010	3,484	59	0.0169	0.13	0.013-0.022
509	2	0.0039	0.60	0.001-0.012	Sept-Dec 2010	2,638	16	0.0061	0.19	0.004-0.009

Provided by NEFSC, Protected Species Branch.

Table 77 - Summary of ASM & NEFOP 2010-2018 (calendar year) observed hauls in broad stock areas 2 and 4. Hauls missing latitude or longitude are excluded.

Broad Stock Area	Source	Mesh Category	Year Category	Hauls	Seabirds	Turtles	Marine Mammals	Total Protected Species
Inshore GB Stock Area 2	ASM	ELM	2010-2015	2397	187	4	220	411
			2016-2018	54	2	0	10	12
		non-ELM	2010-2015	2313	724	0	22	746
			2016-2018	50	58	0	0	58
	NEFOP	ELM	2010-2015	701	41	1	90	132
			2016-2018	510	104	0	61	165
		non-ELM	2010-2015	865	329	0	4	333
			2016-2018	289	925	0	1	926
SNE/MA Stock Area 4	ASM	ELM	2010-2015	2392	13	15	256	284
			2016-2018	5	0	0	2	2
		non-ELM	2010-2015	135	5	2	1	8
			2016-2018	5	1	0	1	2
	NEFOP	ELM	2010-2015	3967	18	22	386	426
			2016-2018	3934	10	5	187	202
		non-ELM	2010-2015	8050	49	5	12	66
			2016-2018	10446	92	5	9	106

*Note, no protected fish species were included in this summary. Provided by NEFSC, Protected Species Branch.

7.4.6.2 Removal of Monitoring Program Requirements Option 2 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 72 Degrees 30 Minutes West Longitude

7.4.6.2.1 Removal of Monitoring Program Requirements Sub-option 2A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only)

Sub-Option 2A would remove the at-sea monitoring (ASM) coverage requirement for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a sector trip.

Since ASM is an industry-funded program, removing this requirement for a sub-set of sector trips may create an economic incentive to fish in the area west of 72 degrees 30 minutes west longitude. The removal of the ASM requirement for a sub-set of sector trips has the potential to create an economic incentive to target non-groundfish stocks like skates, monkfish, dogfish, and fluke in the area west of 72 degrees 30 minutes west longitude. Although this has the potential to increase fishing effort, effort would still be constrained by quota allocations for these non-groundfish stocks. As a result, there is the potential that although effort will increase, the increase in effort will result in quotas being attained faster.

Based on the above information, Sub-Option 2A has the potential to result in direct and indirect impacts to protected species. Direct impacts to protected species are likely to be seen via changes in fishing behavior resulting from the economic incentive created this exemption. As noted above, this could equate to increased effort and therefore, the potential for increased interactions with protected species; however, as also noted above, under this same scenario, quota constraints are likely to limit any significant increase in effort. In fact, redirecting effort to these stocks may result in quotas being caught faster. If quota is reached faster, this equates to gear being present for less time in the water. As interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, any decrease in either of these factors will reduce the potential for protected species interactions with gear. As a result, direct impacts to protected species are expected to be low negative.

Indirectly, the existing measures for removal of groundfish monitoring program coverage requirements under Option 1/No Action may result in low negative impacts to protected species. As noted previously, since its inception in 2010, ASM data have provided a wealth of information about protected species interactions in commercial fishing gear (NEFSC PSB pers. comm). As noted above, the additional information on encounters between fishing activity and protected and endangered species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates. As the measures for removal of groundfish monitoring program coverage requirements under Sub-Option 2A would remove ASM coverage requirements for a particular sector trips (see description above), along with existing measures for removal of groundfish monitoring program coverage requirements (see Option 1/No Action), the full informational benefits provided by current ASM coverage levels in assessing protecting species bycatch would likely be reduced. This in turn will affect the precision of protected species bycatch estimates and reduce available information for protected species management decisions. Given this, indirectly, Sub-Option 2A results in low negative impacts to protected species.

Based on the above information, impacts to protected species from Sub-Option 2A are expected to be (directly and indirectly) low negative. Relative to Option 1/No Action, Sub-Option 2A would be expected to have low negative to negative impacts to protected species, as this sub-option has the potential to increase effort, and would allow for removal of ASM coverage requirements in other areas, in addition to the removal of ASM coverage requirements under Option 1/No Action. Compared to Sub-Option 3A, impacts to protected species would be similar, as these sub-options are close in area. Sub-Option 3A would cover a larger area for removal of ASM coverage requirements than Sub-Option 2A, so impacts to protected species may be slightly less negative for Sub-Option 2A relative to Sub-Option 3A. Relative to both Sub-Options 2B and 3B, Sub-Option 2A would have negative impacts, as Sub-Options 2B and 3B would remove dockside monitoring requirements, and dockside monitoring does not affect protected species.

7.4.6.2.2 Removal of Monitoring Program Requirements Sub-option 2B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool)

Sub-Option 2B would remove the requirement for dockside monitoring coverage (if implemented) for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a sector trip. Dockside monitoring does not affect protected species, and so removal of dockside monitoring coverage requirement (if implemented) would have no direct or indirect impacts on protected species. Therefore, Sub-option 2B would have no direct or indirect impacts on protected species. This option is expected to have, indirectly, low positive impacts compared to Sub-Option 2A, removal of at-sea monitoring coverage requirements for vessels fishing exclusively west of 72 degrees 30 minutes west longitude, since dockside monitoring does not affect protected species.

7.4.6.3 Removal of Monitoring Program Requirements Option 3 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 71 Degrees 30 Minutes West Longitude (*Preferred Alternative*)

7.4.6.3.1 Removal of Monitoring Program Requirements Sub-option 3A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only) (*Preferred Alternative*)

Sub-Option 3A would remove the at-sea monitoring (ASM) coverage requirement for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a sector trip.

Since ASM is an industry-funded program, removing this requirement for a sub-set of sector trips may create an economic incentive to fish in the area west of 71 degrees 30 minutes west longitude. The removal of the ASM requirement for a sub-set of sector trips has the potential to create an economic incentive to target non-groundfish stocks like skates, monkfish, dogfish, and fluke in the area west of 71 degrees 30 minutes west longitude. Although this has the potential to increase fishing effort, effort would still be constrained by quota allocations for these non-groundfish stocks. As a result, there is the potential that although effort will increase, the increase in effort will result in quotas being attained faster.

Based on the above information, Sub-Option 3A has the potential to result in direct and indirect impacts to protected species. Direct impacts to protected species are likely to be seen via changes in fishing behavior resulting from the economic incentive created this exemption. As noted above, this could equate to increased effort and therefore, the potential for increased interactions with protected species; however, as also noted above, under this same scenario, quota constraints are likely to limit any significant increase in effort. In fact, redirecting effort to these stocks may result in quotas being caught faster. If quota is reached faster, this equates to gear being present for less time in the water. As interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species, any decrease in either of these factors will reduce the potential for protected species interactions with gear. As a result, direct impacts to protected species are expected to be low negative.

Indirectly, the existing measures for removal of groundfish monitoring program coverage requirements under Option 1/No Action may result in low negative impacts to protected species. As noted previously, since its inception in 2010, at-sea monitoring (ASM) data have provided a wealth of information about protected species interactions in commercial fishing gear (NEFSC PSB pers. comm). As noted above, the additional information on encounters between fishing activity and protected and endangered species provided via sector monitoring improves the precision of protected species bycatch analyses and resultant bycatch estimates. As the measures for removal of groundfish monitoring program coverage requirements under Sub-Option 3A would remove ASM coverage requirements for particular sector trips (see description above), along with existing measures for removal of groundfish monitoring program coverage requirements (see Option 1/No Action), the full informational benefits provided by current ASM coverage levels in assessing protecting species bycatch would likely be reduced. This in turn will affect the precision of protected species bycatch estimates and reducing available information for protected species management decisions. Given this, indirectly, Sub-Option 3A results in low negative impacts to protected species.

Based on the above information, impacts to protected species from Sub-Option 3A are expected to be (directly and indirectly) low negative. Relative to Option 1/No Action, Sub-Option 3A would be expected to have low negative to negative impacts to protected species, as this sub-option has the potential to increase effort, and would allow for removal of ASM coverage requirements in other areas, in addition to the removal of ASM coverage requirements under Option 1/No Action. Compared to Sub-Option 3A, impacts to protected species would be similar, as these sub-options are close in area. Sub-Option 3A would cover a larger area for removal of ASM coverage requirements than Sub-Option 2A, so impacts to protected species may be slightly less negative for Sub-Option 2A relative to Sub-Option 3A. Relative to both Sub-Options 2B and 3B, Sub-Option 2A would have negative impacts, as Sub-Options 2B and 3B would remove dockside monitoring requirements, and dockside monitoring does not affect protected species.

7.4.6.3.2 Removal of Monitoring Program Requirements Sub-option 3B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool) (*Preferred Alternative*)

Sub-Option 3B would remove the requirement for dockside monitoring coverage (if implemented) for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a sector trip. Dockside monitoring does not affect protected species, and so the removal of dockside monitoring coverage requirement (if implemented) would have no direct or indirect impacts on protected species. Therefore, Sub-option 3B would have no direct or indirect impacts on protected species. This option is expected to have, indirectly, low positive impacts compared to Sub-Option 3A, removal of at-sea monitoring coverage requirements for vessels fishing exclusively west of 71 degrees 30 minutes west longitude, since dockside monitoring does not affect protected species.

7.4.6.4 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements

7.4.6.4.1 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 1: No Action

This option would not establish a review process for any measures that remove groundfish monitoring program requirements for certain vessels based on catch composition (Removal of Monitoring Program Requirements Option 1, Option 2, and Option 3). This measure is administrative in nature, and is not expected to have a direct or indirect impact on protected species because it does not, in and of itself, change fishing effort or fishing behavior.

7.4.6.4.2 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 2 – Implement a Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements (*Preferred Alternative*)

This option would establish a review process for any measures that remove groundfish monitoring program requirements for certain vessels based on catch composition (Removal of Monitoring Program Requirements Option 1, Option 2, and Option 3). This measure is administrative in nature, and is not expected to have a direct or indirect impact on protected species because it does not, in and of itself, change fishing effort or fishing behavior.

7.5 IMPACTS ON HUMAN COMMUNITIES – ECONOMIC

7.5.1 Background

Long-run economic impacts from improved monitoring are difficult to estimate quantitatively, as the feedback between accurate catch data and either higher sector sub-ACLs or improved industry stability are indirect and difficult to quantify. Accurate sector-level catch monitoring was first addressed in the Amendment 13, which placed responsibility for monitoring landings and discards on sectors via their operations plans (NEFMC, 2003). Sector operations plans were required to demonstrate how each sector would accurately document landings and discards for managed species subject to their respective catch allocations (at that time these allocations were referred to as "quota," they are now called "sector ACE"). Amendment 16 subsequently expanded the sector allocation program and adopted changes to the sector monitoring requirements (NEFMC, 2009). This amendment recognized the need for "enhanced" monitoring requirements relative to those specified in Amendment 13, "because of the necessity to accurately monitor sector catch—both landings and discards". Section 6.6.10.1outlines the current status of monitoring requirements and their evolution since the adoption of Amendment 16.

Section 6.6.10.5 summarizes analyses designed to assess the degree to which current monitoring requirements are meeting the requirement of accurate monitoring of sector-level catch. These analyses underwent a formal peer review in April of 2019 (See Appendix V). The resulting report concluded that current monitoring requirements were insufficient for accurate catch monitoring: "The analyses suggest that estimates of discards on unobserved trips derived from discards rates on observed trips may not be accurate, and [are] likely to be an underestimated reflection of actual discards". Importantly, these analyses and the subsequent peer review report, particularly when taken together with the federal criminal case presented against Carlos Rafael (the primary fisherman involved in misreporting from one large sector) and both the Northeast Science Center and the U.S. Coast Guard reports on potential stock-level area misreporting, support economic theory that a primary driver for mis-estimated catch is circumvention of the market for annual ACE leases.

Economic considerations are central to sector monitoring standards (coverage levels), which in turn are central to the long-run benefits derived from this fishery. In the case of catch accounting there is a trade-off between the costs of monitoring catch and the potential for improving fishery performance through a robust and enforceable ACE lease market and increased catch stability. To that end, accurate (or "improved") catch accounting may ensure that:

1. Fishing practices are accurately and properly incentivized by price signals derived from the ACE lease market;
2. Fair and equitable distribution of benefits from the harvest of federal fishery resources between and among fisherman, fish dealers, seafood consumers and other interested parties;
3. Improved stability and reliability of fish stock assessments and the allocations derived therefrom; and,
4. Respect for and validation of the rules governing the sector-based allocation system.

Prior to the widespread adoption of the sector system in 2010 under Amendment 16, fishing practices such as gear choice, fishing location, and other operational considerations were dictated by Days-at-Sea restrictions in combination with trip limits and other "input" controls. Under the sector system, which includes leasing ACE between sectors, these are driven instead by constraints imposed by the price of ACE leases and any frictions in the ACE lease market. Rather than regulations specifying where and how to fish, as from 2006-2010, under an ACE lease system most aspects of operations are driven by lease price signals, themselves a reflection of abundance or scarcity of quota[43]. If a species with a high, or low, lease price is caught in a given area, fishing pressure either increases or decreases in that area in response. The choices of where and how to fish are made by individual fisherman, not regulators. ACE lease prices, however, provide these signals only when catch is accurately monitored. Circumventing the ACE lease market through catch misreporting mutes the price signal and fails to properly direct fishing practices. In these circumstances, the operations of the fishery deviate from those of a comprehensively monitored fishery under prevailing ACE allocations in ways that harm the stability and equitability of the fishery.

Incentives to circumvent ACE lease markets are present (Appendix V) . Four inequities result:

1. ACE lease markets are "incomplete": fisherman leasing in ACE do not pay its true cost, and fisherman leasing out ACE are insufficiently compensated.
2. Stock assessments that depend on catch information are deprived of accurate data, perhaps leading to a second-order effect where assessment quality is degraded, though inaccurate catch alone is unlikely to be the sole, or even the primary, cause of such degraded assessments.
3. To the extent that unaccounted for catch is a cause of unstable or unreliable assessments and low fishery allocations, fish dealers and consumers are deprived of the benefits of stable or even increasing catch.
4. In a fishery where sector-level self-governance is at the core of the regulatory system, incentives that erode trust between fishermen, sectors, regulators and the public may create a negative feedback loop where circumventing regulations leads to loss of trust on all sides, inducing further circumvention of regulations.

The costs of catch monitoring were analyzed in Amendment 16 (NEFMC, 2009). Two reports estimating monitoring costs were presented to the Council at that time (Turris and McElderry 2008; McElderry and Turris 2008). Based on the data and assumptions embedded in those reports, estimates for ASM costs per monitored sea day were between a low of $600 and a high of $1,000 ($707 and $1,178, respectively, in 2018$). Electronic monitoring was incorporated as well, with daily sea day rates between $150 and $200 ($177 and $235 in 2018$). Fleet-wide annual costs were extrapolated from these estimates based on 28k total days absent, yielding a total annual monitoring cost of between $7.26mil and $11.8mil. The 2009 analysis noted that efficiencies derived from ACE leasing would result in fewer than 28k monitored sea days, and costs would likely be lower. The document goes on to state that *"by FY 2012, sectors will be required to provide an at-sea monitoring program; at that time, the issue facing vessel owners is whether sector operations can support the monitoring program expense."* This did not come to pass, and vessel owners have yet to face the issue of whether sector operations can support industry-funded monitoring.

Section 6.6.10.3 discusses the trajectory of monitoring funding from the time it was intended to shift from government-subsidized to industry-funded in 2012. A report presented to the NEFMC in June of 2015 summarized the potential impacts of shifting from government to industry funding at that time, concluding in part that:

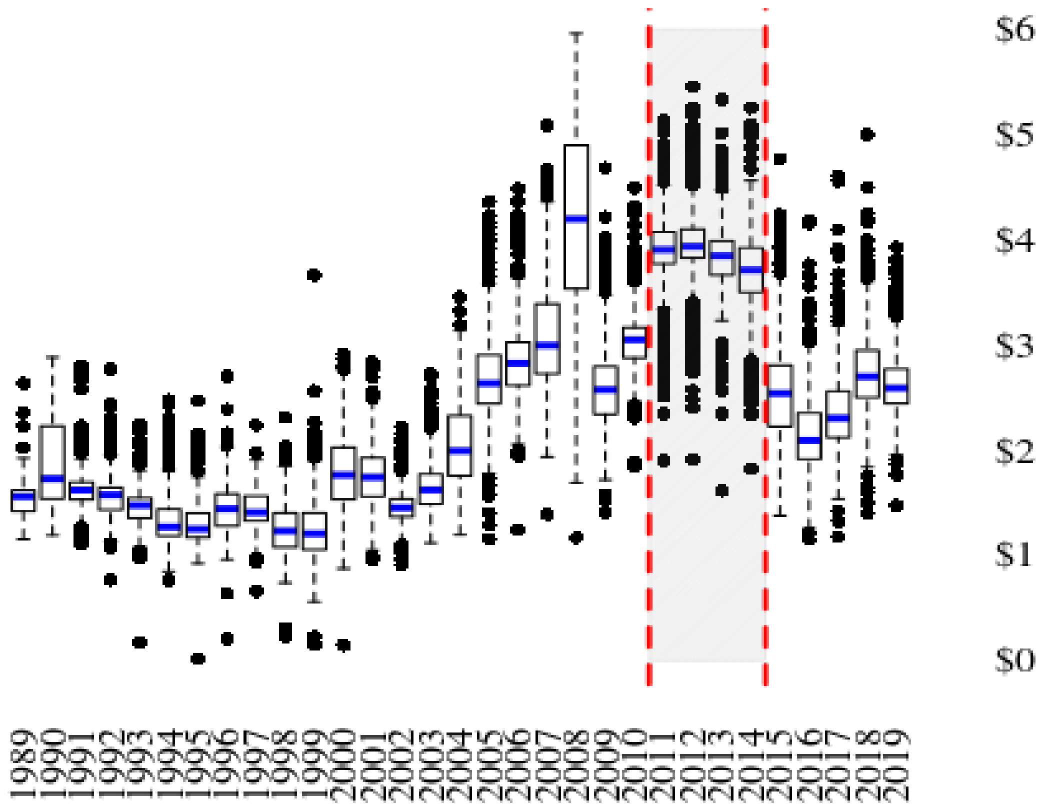
> *"The cost of ASM coverage was roughly 25% of net owner's share of fishing revenues (RTO) in 2014, down from just over 40% in 2013. Returns to owner are estimated to have declined annually from 2010-13, with an uptick in 2014. This report is restricted to the groundfish fishery in isolation. As demonstrated in Table 6, vessels engaged in the groundfish fishery do generate the majority of their revenues from this fishery, but not all—10-40% of vessel-level revenues*

[43] Regulation-based fishing requirements such as minimum mesh and fish sizes, broad area closures and vessel upgrade restrictions also drive fishing operations.

appear to be generated in other fisheries. Implied reductions in aggregate vessel level profits will be mitigated by participation in other fisheries which are exempt from ASM coverage requirements. In the future it may be more meaningful to examine the potential impact of industry-funded ASM in light of total enterprise profits, for example at the vessel or owner level. This will be the basis for future work on this issue. The fact remains that almost 40 percent of active vessels are estimated to have earned negative returns to owner from the groundfish fishery portion of their business in FY 2014, and this number has been increasing since 2010. Predictions for FY 2015 are that nearly 60% of the fleet could see negative returns to owner when full 2015 ASM costs are factored in. This is an over-estimate, as the industry will only be responsible for ASM marginal costs from late summer onward, but it indicates that industry funded ASM could result in restructuring of the fleet, though changes are hard to predict since at least parts of the fishery have remained active despite estimated negative returns. Additionally, profit declines may have second-order effects such as the laying off of crew, reductions in maintenance and safety expenditures, etc, and these reductions in necessary inputs affect upstream shoreside markets. Reductions in profits due to industry-funded ASM may impede the ability for owners to make capital investments and may affect the ability of domestic producers to compete in the ever-more-globalized marketplace." (Demarest 2015)

The intervening four years have seen substantial changes in the fishery, driven instead by substantial reductions in allocations of several key fish stocks. Table 15 in Section 6.6 shows that total revenues from the groundfish fishery have declined from a high of $129mil in FY2011 to a low of $68mil in FY2017. This was driven by ACE reductions for cod and yellowtail flounder stocks primarily, consequent to reductions and reconsideration of these stocks' estimated biomass. Another critical change, unforeseen in 2015, is that fuel prices have dropped, alleviating some of the negative economic impacts from these reduced allocations (Figure 44).

Figure 44 - Fuel prices from 1989 to 2019 (2018$).



Starting in Fishing Year 2019, sector monitoring targets were assessed uniquely for each Standardized Bycatch Reporting Methodology-defined (SBRM) strata, and ASM coverage levels were allowed to vary across sector based on each sector's SBRM fleet composition[44]). Werner and Demarest (2019) provided an estimate of the impacts stemming from this change, noting especially that should sectors become responsible for the costs of monitoring, the SBRM fleet composition of each sector may lead to disproportionate impacts across sectors. The present analysis of Amendment 23 options does not attempt to estimate costs differentially based on sector's SBRM fleet composition. Instead, for most monitoring options, the target coverage specified in the relevant option is assumed to correspond to the coverage that sectors would be responsible for funding (i.e. 25% coverage = 25% ASM coverage, etc.)[45].

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[44] See the 2019 SBRM methodology with observer sea day allocation for more information: https://www.nefsc.noaa.gov/publications/tm/tm255/tm255.pdf

[45] The No Action alternative is analyzed at both 13%, the average ASM portion of the combined coverage target for sectors, and 22%, the total target (the average combined ASM and NEFOP coverage). For the purposes of analyzing costs and impacts of the 100% coverage options, in accounting for NEFOP coverage a 91% ASM coverage rate was assumed.

7.5.2 Approach and economic models

Primarily, this Amendment focuses on varying levels of direct catch monitoring for trips regulated under the sector provisions of the Northeast Multispecies Fishery Management Plan. The impacts of monitoring catch are primarily a function of time spent fishing. Vessels that make more trips under the groundfish fishery FMP, and/or fish for more time, will experience higher monitoring costs than those fishing less. Section 6.6 includes background information on relevant fishery trends for this action including fishing effort by vessel size, days absent categories, landing ports, etc.

Several models and tools are used to analyze the alternatives and options under consideration. The economic analyses focus on four dimensions of distributional effects: days absent, sectors, vessel size and home port. Where appropriate, landed pounds and/or revenues are reported as a proxy for shoreside effects. Amendment 16 to the Groundfish FMP requires that sectors are responsible for the costs of monitoring.

It is important to note that the primary purpose of the monitoring cost estimates developed for this action is to help the Council and public compare alternatives. These cost estimates are not predictions of actual monitoring costs in either the short or long term. These analyses are intended to highlight the potential magnitude of differences in costs and benefits between the alternatives under consideration. If selected, the estimates of costs presented in this document should not be considered actual predictions. Costs will vary based on many factors, some of which are explained in these analyses (e.g. review rates for electronic monitoring, possible economies of scale, technological improvements, or changes in fleet participation and effort over time).

7.5.2.1 Timeframe

All analyses presented here estimate short-run effects, generally with a one-year duration[46]. Short-run economic consequences are estimated along two dimensions: monitoring costs and fishery impacts.

7.5.2.2 Monitoring Costs: Static Approach

Monitoring costs are estimated statically by applying the cost of each monitoring technology (i.e. human or electronic) to 2018 realized fishery data using relevant parameters such as fishing time, vessel size, gear type, and home port. Low and high estimates (median plus or minus one standard deviation) are reported for the fleet as well as per vessel, trip and day. Details on estimation methods and sources of variability are provided in the Cost Efficiency Model description (Section 7.5.2.4.1) and the source paper, included as Appendix IV. This approach provides an approximate cost estimate but the underlying static assumption[47] fails to account for changes induced by those costs: some vessels will fish less, some more. These analyses provide an estimate of cost if the all sector vessels in the commercial groundfish fishery used the same monitoring tool. While this is not realistic if there are multiple tools available, these estimates do provide a possible upper-bound for each monitoring coverage level and tool under consideration.

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[46] Because EM costs change substantially by year, costs are reported for EM models across three years separately.

[47] Specifically, that all other conditions remain unchanged with the exception of additional monitoring costs.

7.5.2.3 Fishery Impacts: Dynamic Approach

In contrast to the static approach, the dynamic approach does allow for possible changes in effort and participation. The dynamic approach is an analysis of potential changes when additional monitoring costs are considered. This captures the first-order effects of increased operating costs as some vessels choose to lease their ACE and either stop fishing or switch fisheries, while others increase their groundfish fishing effort by leasing in quota. Using the Quota Change Model (7.5.2.4.2) to estimate which vessels and trips are likely to take place when operating costs are increased, the dynamic impacts analysis provides an estimate of how the distribution of revenues and, of particular importance, profits will change under the myriad monitoring cost scenarios under consideration. These analyses present a potentially more realistic estimate of monitoring costs across the fishery by taking into account possible shifts in effort as a result of increased monitoring costs.

Impacts are reported for six metrics[48]:

1. Gross revenues, the sum of all revenue generated on a groundfish trip from all landed species;
2. ASM costs, estimated dynamically as the sum of industry-funded costs associated with trips as modeled under the QCM;
3. Cost of operations, including the cost of ice, fuel, food, the value of all utilized ACE, sector and landing fees but not including the ASM costs estimated above, crew wages or shares, or owner shares;
4. Operational profits, the difference between gross revenues and the cost of operations and monitoring;
5. Profit percent, the proportion of gross revenues represented by operational profits; and,
6. Change in operating profit percent relative to the Status Quo[49].

An important consideration in interpreting the results of the dynamic models on fishery impacts is that increased operating costs may increase aggregate operating profits. The intuition is straightforward: if relatively inefficient vessels with relatively higher operating costs and lower operating profits choose to decrease participation in the groundfish fishery, ACE will flow–via leasing–to more efficient vessels with lower operating costs and higher profits. This result has been demonstrated in previous analyses with reductions in critical ACE allocations such as witch flounder and Gulf of Maine cod, as well as in previous iterations of industry funded monitoring analyses,[50] ACE reductions increase operating costs in two ways, first by increasing ACE lease costs[51] and second through costs consistent with avoidance of constraining stocks.

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[48] Cases where MSA confidentiality regulations (i.e. "rule of three") prohibit providing estimates are handled by reporting "C" in their place.

[49] The Status Quo is a synthetic version of FY18, where actual FY18 realized values across the first five metrics mentioned above are replicated using the QCM. It is described in further detail later in this document.

[50] See: https://s3.amazonaws.com/nefmc.org/151201_FW55_econ_impacts_supp_CKD2.pdf
https://s3.amazonaws.com/nefmc.org/170117_SSC_witch_fl_QCM_v2.pdf

[51] Changing lease prices are explicitly not modeled in the QCM, so this aspect does not apply to model results though changes in lease prices is expected.

The fact that increased operating costs may induce higher operating profits implies that policy makers should more prominently consider factors beyond gross revenues, such as changes in fishery participation across vessel size classes, ports and gear types, as well as the distribution of fishing costs.

An additional "blended" static and dynamic analysis was completed to model a vessel's selection into one of the three monitoring technologies: human observers, EM Audit and EM Max Retention. Since this action may approve both EM models as voluntary equivalent substitutes for human observers these analyses included cost estimates if each vessel selected the lowest cost technology under each coverage rate alternative (25%-100%). The details of the blended analysis are included in Section 7.5.3.2.2.

Finally, these economic analyses also include a "subsidy" scenario. This was included to recognize that substantial federal funding has been secured to support at-sea monitoring in the groundfish fishery in 2019, 2020, and possibly beyond. Section 6.6.10.3 includes more detailed information about the level of federal appropriations that have been available to support monitoring in the northeast groundfish fishery.

In a November 26, 2019, letter, NMFS announced that, subject to available funding, industry review costs for an EM audit model would be reimbursable in years 1 and 2, and that in years 3 and beyond NMFS would reimburse the costs of the minimum review rate with industry paying for any addition review. Congress provided $10.3 million for groundfish at-sea monitoring in NMFS' 2018, 2019, and 2020 appropriations. It is possible that some of these funds, and possibly even additional funds in the future may be available to cover costs of monitoring in the commercial groundfish fishery. The funding to date is sufficient to continue reimbursing sectors for 100 percent of their monitoring costs in fishing year 2020. This provides additional economic stability for sector vessels for the near term, but it is unknown whether Congressional appropriations to cover industry's monitoring costs will continue.

To be clear, the alternatives in this document do not assume any federal support, this action is designed as an industry funded program. However, since these funds have been earmarked for this purpose, analyses have been included to capture the potential effects some federal funding may provide. This analysis is described in more detail in Section 7.5.3.2.2, but in summary, separate scenarios were developed with some costs being removed to show the overall impacts on overall revenues and profits..

7.5.2.4 Quantitative Models

The PDT used two models (described below) to quantitatively estimate and summarize the costs of various options under the Sector Monitoring Standards and Sector Monitoring Tools alternatives.

7.5.2.4.1 Cost Efficiency Model

The Cost Efficiency Model focuses on quantifying costs for three technologies suitable for independent catch monitoring in the Northeast US commercial groundfish fishery:

1. Human at-sea monitors/observers (ASM),
2. Electronic monitoring with video recording cameras (EM) using an Audit model and
3. EM using a Maximum Retention model.

Each of these technologies differ in the data they provide, the quality of those data, their up-front and life cycle costs, and their impact on various components of the fishing fleet. The analyses estimate costs associated with each technology and provide estimates for fleet-wide costs based on which vessels are likely to opt into each technology under the various alternatives and options considered.

For ASM costs, estimates are based on Ardini et. al. (2019), with modifications as described in Demarest et. al. (2019). As described in the latter paper, “Since there has been limited variability in ASM coverage rates, there is some level of uncertainty regarding how costs change when coverage is increased or decreased. We expect that higher coverage rates will decrease observer travel costs since there will be a greater pool of available observers to cover trips. The analyses are less certain how a change in coverage may affect seaday rates. The model estimates costs at increased rates as a function of the current contracted rates, with the following assumptions: 70% of the sea day cost is fixed to cover the actual cost of having a monitor at sea, 10% scales based on the number of trips covered, 10% scales based on the total number of observers required to cover the specified level of coverage and 10% of the cost scales based on the coverage rate.” We use a Monte Carlo approach[52] to estimate a distribution of likely ASM costs.

For EM costs, estimates are based on cost functions constructed from data provided by four EM service providers for four separate EM program aspects:

1. Equipment;
2. Field services;
3. Data review; and,
4. Data storage.

These functions randomly select input variables from the four providers. This approach was used to maintain data confidentiality (provider-level costs are easily inferred), but a drawback of this is that it washes out a lot of the variance in potential costs, particularly the common situation where providers optimize around different component of cost. Combining what should be inseparable components yields costs centralized around a mean that may not adequately capture the true cost from any one provider. Last, we add additional uncertainty to model variables that we have lower confidence in, based on conversations from program participants and/or actual data from pilot programs.

Equipment One-time EM equipment costs are estimated per-vessel, and include all hardware and software required for a fully functioning EM system. These do not include labor or travel costs for installation, which are included in the field services costs. We assumed three cameras are required for a system on all vessels with hook gear, and for all vessels that are less than 40 feet long. Four cameras are required for vessels using all other gear types greater than 40 feet in length.

Field services Field services include all field-based technical support such as equipment installation and maintenance, travel to and from vessels, support and feedback in case of equipment malfunction and data transfers. Where other aspects of an EM program such as equipment costs or data storage costs scale linearly with effort or are otherwise invariant, field services costs are highly variable based on the fleet’s geographic composition, program design, and the desired level of operator interaction. These costs are also impacted by the enthusiasm for participation by the fleet—if vessels are committed to the process, it will run more efficiently. If they are not, costs will increase as installations are rescheduled, or proper care and maintenance of on-board EM systems do not occur.

Field services are one of the most difficult aspects of EM costs to model. Further, field services, more than other aspects of EM costs, change with time. Costs are front loaded in the first year of programs when equipment installations occur and captains are getting familiar with the systems and processes and

[52] Simulation used to model the probability of different outcomes based on repeated random sampling.

require more support. Subsequent year field service costs include maintenance costs (which decline by half in year two, by a third in year 3 and by a quarter in year four, after which they are fixed) and other costs, fixed for each year and include on-call phone response to service events plus costs for data transfer to and from the vessel. Travel costs are estimated similarly for install and maintenance. The model assumes technicians are traveling from one of six ports: Portland, ME, Gloucester, MA, Boston, MA, Chatham, MA, New Bedford, MA or Point Judith, RI.

The R package gmapsdistance was used to identify which of these six ports was closest to the vessel home port and the associated distance and travel time. The model assumes travel costs are reimbursed at the technicians hourly rate, mileage is reimbursed at $0.54/mile, per diem is between $40 and $61 and lodging is between $120-$150/night. Consistent with federal travel regulations, lodging is only incurred if the technician is traveling over 50 miles. We assume installations are scheduled back to back in each home port. This likely overestimates installation efficiency. Maintenance and scheduling assumptions may, however, underestimate efficiency and we believe these assumptions are therefore unbiased.

Maintenance costs are estimated assuming: (1) Vessels require a visit from a technician at a rate of every 7th trip with a maximum of three visits per vessel. (2) Each maintenance check takes 4 hours and is performed by the technician at the lower hourly wage rate. (3) Two vessels can be checked per location per day but a technician spends a maximum of three days in a row in a port. (4) Technicians travel to and from their base port to the vessel's home port after each three day stay is completed.

Other costs include one technician on-call for phone response to service events and the cost to mail hard drives from the vessel after every trip plus an additional half hour for handling and tracking data. Many pilot programs mail hard drives after two or three trips are completed, which could be implemented as a cost savings measure but also increases the likelihood of lost or corrupted data.

Review Costs Video footage review is a substantial component of overall EM program costs. There are two common methods for estimating video review costs. The first is a "ratio method," which estimates the amount of time required for an analyst to review a set amount of footage based on a ratio of review time to total video footage. This estimate is multiplied by the hourly wage of an analyst to estimate cost. However, the ratio of review time to footage time is highly variable and is impacted by many factors, themselves quite variable, which include, but are not limited to, the skill and experience of the reviewer, the catch handling capabilities of the crew, the quality of the video footage, the gear type and the species composition (both total number and type of species) of the catch, and the program design. Using data from pilot projects in the region, we estimate a regression to relate review time to these other variables. Importantly, the variable that had the largest impact on review times was the individual vessel (standardizing for catch composition, gear type, trip length, etc.).

Estimating the amount of footage requiring review is a challenge. One aspect of this challenge depends on the design of the program and whether transit times are reviewed, or if only haul back and catch handling/sorting require review. Another aspect is estimating the relationship between fishing effort and sorting/catch handling time.

The model estimates review costs as a function of transit time (duration), the amount of time it takes to review transit time footage, fishing time, the amount of time it takes to review fishing time, footage/data preparation time and an hourly rate for a reviewer. The total cost is the sum of these costs. These are estimated separately for each program design. Under this, it is assumed that review costs scale linearly with fishing effort.

Fishing time is estimated based on observer-collected data on fishing duration (the time fishing gear is in the water) for observed trips. Using these data, fishing time is modeled for non-observed trips using other effort proxies such as total trip duration and number of hauls are reported for all trips on VTRs. To estimate time fishing, observer data from 2013-2017 is used and modeled, by gear type, the relationship between fishing time and total trip duration. These models were then used to estimate fishing duration for all FY18 trips.

Data storage There are two main options for storing data: cloud storage and on site servers. On site storage can be a less expensive option when the exact amount of data to be stored is known and servers of the appropriate size can be built; or when data locations are remote and (slow) internet speeds or other expenses prohibit sending data to the cloud. Additionally, federal data redundancy requirements impose costs for on site server storage that could require building the same storage center in two locations. These cost estimates assume EM data will be stored in the cloud. Estimating prices for cloud based storage is relatively straightforward and many companies, such as Amazon and Google, list their price structures publicly (Table 9). Estimating the volume of data created is more complex, as it is a function of numerous technical variables and policy decisions. Video footage data volume is primarily based on four variables:

1. Resolution (pixel dimensions) - Also referred to as frame size this is the amount of pixels an image contains. It is specified as the number of horizontal pixels by the number of vertical pixels. For example a resolution of 1280x720 is the minimum resolution to be considered high definition.

2. Frame Rate (frames per second) - The number of individual frames in each second of video recorded.

3. Bit rate (MBPS-mega bits per second) - The number of bits that are processed in a unit of time or the amount of data used for each second of video. For example most DVDs are 4-8 MBPS while a Blu-ray is 25 MBPS. Most cameras record at varying bit rates and allow you to set a maximum bit rate.

4. Subject (what you are recording) - video records a still image and software converts that to moving images. Two videos of the same duration taken with the same camera with identical resolution, frame rate and bit rate can create different amounts of data depending on how they are rendered and the content of their images. For example a two minute recording of a blank wall will be much smaller in size than a two minute recording of a kayaker going through whitewater. These variables also impact the quality of the video, noting that this is also related to external variables such as lens cleanliness and the amount of ambient light.

EM video quality specifications are mostly in the form of performance requirements specifying data needs and objectives (i.e. systems must be able to “Identify, count, and assign a catch disposition–kept or discarded–for individual catch items” or “Obtain an accurate estimated length per catch item, sufficient to obtain a weight estimate from length:weight keys” (NMFS 2016[53]).

The latest draft specifications from the Northeast Fisheries Science Center adopt some minimum technical specifications: “Camera resolution must be a minimum of 1,280 x 720 (720p) for enhanced identification and measurement during video review” and “Each camera must record at a speed of no less than 15 unique frames per second when the use of a video monitoring system is required” (NMFS 2016).

The cost of storage is mainly a function of data volume, defined as the footage duration multiplied by the GBPH. For our estimations we assumed fishing footage would be captured at a higher quality than transit footage. Assuming Amazon and Google provide similar services, we use Amazon’s price structure as it is slightly less expensive, particularly if there is no need for frequent data access, unlikely in most management scenarios. Amazon Glacier’s November, 2017 pricing, as utilized here, is: Storage, per

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[53] NEFSC 2016. Fisheries Sampling Branch Observer Operations Manual. https://www.nefsc.noaa.gov/fsb/manuals/2016/Operations_Manual.pdf

GB/Month = $0.004; Put, per 1k requests = $0.05; Get, per 1k requests = $0.025; Access, per GB = $0.0025.

The full model is described in Appendix VI.

7.5.2.4.2 Quota Change Model

The Quota Change Model (QCM) is used to analyze the impacts of each combination of measures on the sector portion of the groundfish fishery, which comprises over 98% of commercial groundfish landings and revenues. The QCM is a Monte Carlo simulation model that selects from existing records the trips most likely to take place under new regulatory conditions. This model is used to estimate impacts from regulatory changes. Trips likely to occur in the future are selected based on how efficient actual fishing trips were during the most recent year for which data exist (the reference year, in this case FY18). This efficiency-based selection is derived from three factors: (1) fishing costs, (2) ACE expended and (3) inter-annual changes in allocations that may render a stock or stocks more constraining, or less, in the prediction year.

The model does not estimate changes in ACE lease prices, the real margin at which changes in sector sub-ACLs are experienced by fisherman but it does account for changes in allocations by assigning a higher likelihood of a trip being replicated when the allocations for stocks caught on that trip are increasing or when that stock has otherwise not been a constraint on fishing effort. And vice versa–-the probability of a trip being selected into the prediction year’s pool of trips goes down if that trip caught stock(s) that are likely to be constraining due to decreasing allocations.

A large pool of actual trips is created from a reference data set, where the composition of this pool is conditioned on each trip’s revenues, fishing costs and utilization of allocated ACE. An implicit assumption is that the most likely trips to take place in the FY being analyzed are those fishing efficiently under the new sector sub-ACLs. The more efficiently a trip uses its ACE, the more likely that trip is to be drawn into the sample pool. ACE efficiency is determined by the ratio of ACE expended to net revenues on a trip, iterated over each of the 17 allocated stocks. Operating profits are calculated as gross revenues minus trip costs minus the opportunity cost of quota, where trip costs are based on observer data and quota opportunity costs are estimated from an inter-sector lease value model (details on the methods can be found in Murphy et al. 2015).

After the sample pool has been constructed, trips are pulled from the pool at random, summing the ACE expended for the 17 allocated stocks as each trip is drawn. When one stock’s ACE reaches the sector sub-ACL limit, no further trips from that broad stock area are selected. The model continues selecting trips until sector sub-ACLs are achieved in all three broad stock areas or, alternatively, if sub-ACLs are reached for one of the unit stocks, the trip selection process ends for all broad stock areas at once. This selection process forms a “synthetic fishing year” and a number of years, typically 500, are drawn to form a model. Median values and confidence intervals for all draws in a model are reported.

By running simulations based on actual fishing trips, the model implicitly assumes that:

- stock conditions, fishing practices and harvest technologies existing during the data period are representative;
- trips are repeatable;
- demand for groundfish is constant, noting that fish prices do vary between the reference population and the sample population, but this variability is consistent with the underlying price/quantity relationship observed during the reference period;
- as ACE leases are contracted at the vessel level, allocations to individual sectors are not influential in the ultimate allocation of ACE;

- quota opportunity costs and operating costs are both constant; and,
- ACE flows seamlessly from lesser to lessee such that fishery-wide caps can be met without leaving ACE for constraining stocks stranded.

Some or all of these assumptions will surely not hold–fishermen will continue to develop their technology and fishing practices to increase their efficiency, market conditions will induce additional behavioral changes, and fishery stock conditions are highly dynamic. Fuel prices and other operating costs may change due to larger economic shifts or shore-side industry consolidation.

The net effect of the constraints imposed by these assumptions is unclear. The selection algorithm draws only efficient trips—if fishermen make relatively less efficient trips the model estimates will be biased high. Fishermen, however, are generally good at their job, and through a combination of technological improvement (gear rigging, equipment upgrades, etc.) or behavioral modifications, they are likely to improve on their ability to avoid constraining stocks. If fishermen are able to make these adjustments, the model predictions will be biased low.

Furthermore, the model will under-predict true landings and/or revenues if stock conditions for non-constraining stocks improve, if demand for groundfish rises, or if fishing practices change and fishermen become more efficient at maximizing the value of their ACE. Conversely, the model will over-predict true landings and/or revenues if stock conditions of non-constraining stocks decline, markets deteriorate or fishing costs increase. Importantly, the model will over-predict landings and revenues if stock conditions for constraining stocks improve substantially and/or fishermen are unable to avoid the stock—in this circumstance, better than expected stock conditions will lead to worse than anticipated fishery performance. The opposite is also true—if a stock predicted to be constraining to the fishery becomes easier to avoid due to technological or behavioral improvements in targeting, or due to declining stock conditions, the model will under-predict revenues.

The QCM is used here to capture fishery wide behavioral changes with respect to increases in operating costs as monitoring costs are shifted from government subsidies to industry responsibility. Groundfish catch is maximized by the constrained optimization algorithm, which accounts for revenues generated on groundfish trips and the costs of obtaining those revenues. Catch of non-groundfish stocks on groundfish trips are captured in the model, but not explicitly modeled.

The QCM is calibrated using FY18 input data (actual fishing trips) and FY18 Sector sub-ACLs, to create a "status quo" scenario which is then compared to various scenarios reflecting the additional costs imposed by the industry-funded monitoring. Changes in fleet composition, operating costs and profits are reported.

7.5.2.5 Establishing the Status Quo

Analyzing the impacts of improved catch accounting across the various options requires a distinction between the No Action alternative, which here includes industry funded monitoring, and contemporary conditions, which do not. Under the "Status Quo" or contemporary conditions, monitoring costs are zero because in fishing year 2018 sectors were responsible for negotiating contracts for monitoring but were reimbursed by NOAA for 100% of these expenses. Evaluating change relative to the No Action alternative alone would underestimate true impacts. The Status Quo is a replication of FY18, which includes federal funding for monitoring costs.

To distinguish between effects driven by the model and effects driven by the regulatory changes, the QCM was parameterized to mimic FY18 as closely as possible using both FY18 fishing trips and FY18 sector sub-ACLs. The following tables provide context on the model's ability to replicate realized FY18 metrics. Bottom line: the QCM was able to closely replicate FY18 across nearly all margins; therefore, is a useful tool for distinguishing effects driven by the model from the impacts of the regulatory changes considered in this Amendment[54]. Table 78 shows that the estimates for revenues, costs, and profits are very similar between FY18 realized, and model predictions for FY18. These similarities hold true for the subsequent metrics presented in the following tables (i.e. by stock, homeport, vessel size, etc.) (Table 79 - Table 82). Table 83-Table 86 show the dynamic impacts of monitoring under Status Quo for similar categories, days absent, vessel home port, vessel size class, and sector. Under this scenario, monitoring costs are assumed to be 0.

Table 78 - Comparison of summary estimates for realized FY18 and QCM-generated Status Quo simulation (2018$, millions).

Model	Gross rev	Gfish_gross	Ops cost	Sector cost	Quota cost	ASM cost	Operating profit
FY18 - Realized	70.9	49.4	12.3	2.0	5.4	0	51.3
FY18 - Prediction (SQ)	70.6	49.1	12.1	1.9	5.4	0	51.1

Table 79 - Comparison of fishing effort estimates for realized FY18 and QCM-generated Status Quo simulation (thousands of days/trips).

Model	Crew days	Days Absent	N trips
FY18 - Realized	39.14	10.57	7.17
FY18 - Prediction (SQ)	38.73	10.50	7.06

Table 80 - Comparison of stock level estimates for realized FY18 and QCM-generated Status Quo simulation (2018$, millions).

Stock	subACL (mt)	Real Catch(mt)	Pred Catch(mt)	Real Util	Pred Util	Real Gross	Pred Gross	Pct Diff, Gross
GB Haddock	28,857	4,590	4,353	0.16	0.15	7.75	7.44	-4%
GOM	8,643	2,843	2,908	0.33	0.34	6.26	6.43	2.7%
Redfish	10,696	5,369	5,189	0.50	0.49	5.92	5.70	-3.7%
Pollock	37,163	3,482	3,249	0.09	0.09	5.42	5.23	-3.5%
Plaice	1,550	1,071	1,125	0.69	0.73	4.84	5.08	5%
White	2,713	2,096	2,162	0.77	0.80	4.36	4.52	3.7%
GB Cod	1,083	726	735	0.67	0.68	3.13	3.16	1%
GB Winter	725	420	363	0.58	0.50	3.02	2.67	-11.6%
Witch	830	799	830	0.96	1.00	2.77	2.88	4%
GOM	377	310	302	0.82	0.80	1.61	1.58	-1.9%
SNE Winter	456	229	224	0.50	0.49	1.38	1.39	0.7%
GB Haddock	15,491	637	622	0.04	0.04	1.02	1.02	0%
GOM Winter	339	91	98	0.27	0.29	0.53	0.57	7.5%

[54] Realized metrics for all metrics analyzed fall within the QCM's 99% confidence intervals.

Stock	subACL (mt)	Real Catch(mt)	Pred Catch(mt)	Real Util	Pred Util	Real Gross	Pred Gross	Pct Diff, Gross
GB Cod	252	107	105	0.42	0.41	0.49	0.48	-2%
CC/GOM Yellowtail	381	165	179	0.43	0.47	0.37	0.40	8.1%
GB Yellowtail	167	28	20	0.17	0.12	0.10	0.08	-20%
SNE/MA Yellowtail	34	7	7	0.21	0.21	0.03	0.03	0%

Table 81 - Comparison of vessel home port level estimates for realized FY18 and QCM-generated Status Quo simulation (2018$, millions. "p5" and "p95" are 95% confidence intervals).

Port	Real Gross	Pred Gross	Pct Diff, Gross	p5 Pred Gross	p95 Pred Gross
CT PORTS	0.0	0.0		0.0	0.0
OTHER MA PORTS	3.8	3.8	-1.3%	3.2	4.5
BOSTON	13.8	11.7	-14.7%	10.7	12.9
CHATHAM	0.6	0.4	-38.7%	0.3	0.5
GLOUCESTER	13.1	13.4	1.8%	12.4	14.4
NEW BEDFORD	6.0	6.6	9.3%	5.6	7.6
OTHER ME PORTS	1.5	1.8	24.7%	1.6	2.0
PORTLAND	6.6	8.6	29.2%	7.4	9.8
NH PORTS	1.5	1.5	6.2%	1.4	1.7
NY PORTS	0.0	0.0		0.0	0.0
OTHER RI PORTS	0.3	0.3	-3.3%	0.2	0.5
POINT JUDITH	0.9	1.0	7.5%	0.8	1.2
OTHER NORTHEAST PORTS	1.2	0.0		2.0	3.0

Table 82 - Comparison of vessel size class estimates for realized FY18 and QCM-generated Status Quo simulation (2018$, millions).

Size Class	Real Gross	Pred Gross	Pct Diff, Gross	p5 Pred Gross	p95 Pred Gross
<30'	0.00	0.03		0.00	0.08
30'to<50'	6.64	7.03	5.9%	6.50	7.55
50'to<75'	17.46	17.04	-2.4%	15.60	18.41
75'+	25.27	25.20	-0.3%	23.51	27.30

Table 83 - Estimated dynamic impacts of monitoring under the Status Quo, aggregate fleet totals by days absent category (2018$, mil).

Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)
<=5	0.2	0	0.1	0.1	70.9
>5, <=20	1.9	0	0.5	1.3	72.5
>20, <=50	7.8	0	2.3	5.6	71.2
>50, <=80	6.3	0	2.2	4.1	65.0
>80, <=160	27.7	0	7.5	20.3	73.1
>160	*27.0*	*0*	*7.0*	*19.9*	*73.9*

Table 84 - Estimated dynamic impacts of monitoring under the Status Quo, aggregate fleet totals by vessel home port (2018$, mil).

Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational	Profit (%)
CT PORTS	0.2	0	0.0	0.1	75.2
OTHER MA PORTS	5.7	0	1.9	3.9	67.3
BOSTON	16.4	0	4.6	11.8	71.9
CHATHAM	4.7	0	0.8	4.0	83.4
GLOUCESTER	16.5	0	4.5	12.0	72.9
NEW BEDFORD	11.4	0	3.5	7.9	69.5
OTHER ME PORTS	2.1	0	0.7	1.4	67.2
PORTLAND	5.5	0	1.6	4.0	71.7
NH PORTS	2.2	0	0.7	1.5	69.2
NY PORTS	0.5	0	0.1	0.5	89.3
OTHER RI PORTS	0.4	0	0.2	0.3	62.5
POINT JUDITH	2.4	0	0.6	1.8	74.0
OTHER NORTHEAST PORTS	C	C	C	C	C

Table 85 - Estimated dynamic impacts of monitoring under the Status Quo, aggregate fleet totals by vessel size class (2018$, mil).

Size Class	Gross Rev	ASM Cost	Cost of Ops	Operationa l Profit	Profit (%)
30'to<50'	14.7	0	3.7	11.0	74.7
50'to<75'	23.4	0	6.0	17.4	74.5
75'+	32.8	0	9.9	22.9	69.9

Table 86 - Estimated dynamic impacts of monitoring under the Status Quo, aggregate fleet totals by sector (2018$, mil).

Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)
Sustainable Harvest Sector	24.7	0	6.9	17.8	72.2
Northeast Fishery Sector II	14.5	0	3.8	10.7	73.9
Northeast Fishery Sector VI	5.5	0	1.5	4.0	72.5
Northeast Fishery Sector XIII	5.3	0	1.9	3.5	65.3
Northeast Fishery Sector VIII	5.1	0	1.5	3.6	70.9
Georges Bank Cod Fixed Gear Sector	4.8	0	0.8	4.0	83.8
Maine Coast Community Sector	2.6	0	0.7	1.9	71.9
Northeast Fishery Sector XI	2.1	0	0.7	1.5	69.5
Sustainable Harvest Sector - Inshore	1.9	0	0.8	1.2	60.7
Northeast Fishery Sector V	1.8	0	0.4	1.4	79.1
Northeast Fishery Sector XII	1.3	0	0.4	1.0	73.3
Northeast Coastal Communities Sector	C	C	C	C	C
Northeast Fishery Sector III	0.5	0	0.2	0.3	64.2
Northeast Fishery Sector X	0.1	0	0.0	0.1	66.5
Northeast Fishery Sector VII	C	C	C	C	C

C – Confidential data

7.5.2.6 Qualitative Tools - Compliance and Enforceability Scores

This section includes a description of the compliance and enforceability scores assigned to alternatives throughout the document, which follow a qualitative analytical approach based on assessing the risk of noncompliance and enforceability of alternatives. Not all alternatives are expected to directly affect the risk of non-compliance and enforceability and thus are not assigned scores, but relevant insights may be described. Definitions and theoretical basis for scoring are as follows:

COMPLIANCE: Here, compliance is defined as the extent to which participants activities are in accordance with all rules and regulations. Relevant rules and regulations for this action may include retention and reporting requirements both at-sea and dockside. Examples of non-compliance include illegal discarding of legal sized stocks, stock area or stock misreporting (species substitution), or non-reporting (black fish). Each alternative is scored based on the risk of non-compliance ranging between "High", "Medium", and "Low". The risk of non-compliance is represented by first, the opportunity for non-compliant behavior, such as, the proportion of time, catch, or other metric of effort, that illegal behavior is not readily detected, as outlined by the Discard Incentive Model (Section 6.6.10.5.1 and Appendix V, #1a), and second, the potential economic benefit of noncompliance, or cost of compliance, as represented by possible impacts on ACE lease prices (more constraining to less constraining), costs of landing, or other model parameters. Actual compliance may vary substantially from the risk for non-compliance. True compliance in the fishery is unknown, and depends on a variety of socio-economic factors, including societal norms, which are not represented here. Compliance scores are an indicator of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

ENFORCEABILITY: Enforceability is defined here as the ability for enforcement officials (NOAA OLE or US Coast Guard) to detect and prosecute violations. Each alternative was scored depending on the degree of enforceability that is expected under each between “Low” to “High, where low is little to no ability for enforcement to detect and act on violations, and high is a great capability to detect and act on violations. This score directly depends on the proportion of time that independent records are created that can be compared with self-reported information to detect violations. Secondary factors that may be discussed in conjunction with scoring includes the quality of information collected and its utility for enforcement. Observers and dockside monitors are not enforcement agents but their independent records, which include observations of potential illegal activities, can be used by enforcement to identify and prosecute violations.

Table 87 - Compliance and enforceability scores for Amendment 23 alternatives. Note not all alternatives are included for administrative measures or alternatives that do not have direct impacts on compliance and enforceability, as defined above.

Alternative		Compliance (at-sea or dockside, as relevant)	Enforceability
Human At-Sea Monitors- Fixed rate	Status Quo-22%	Low	Low
	25%	Low	Low
	50%	Low	Medium
	75%	Medium-High	Medium-High
	100%	High	High
Human At-Sea Monitors-Percentage of catch	25% of catch (50% coverage)	Low	Low to medium
	50% of catch (70% coverage)	Medium	Medium
	75% of catch (90% coverage)	High	High
	100% of catch (100% coverage)	High	High
EM	Audit	High	High
	Max Retention	High	High
	In place of humans	Depends on ASM Coverage Low-High	Depends on ASM coverage Low-High
DSM	Status quo (0%)	Low to Medium	Low
	100% individual-based	High	High
	100% NMFS based	High	High
	Sector-funded	High	High
	Dealer-funded	High	High
	Exemptions for small vessels	Medium to High	Medium to High
	Exemptions for small ports	Medium to High	Medium to High

7.5.3 Commercial Groundfish Monitoring Program Revisions (Sectors Only)

7.5.3.1 Sector Monitoring Standards (Target Coverage Levels)

7.5.3.1.1 Sector Monitoring Standard Option 1: No Action

Sector costs and fishery impacts

Under Option 1/No Action, groundfish monitoring coverage levels would remain as defined in Amendment 16 and subsequent framework actions (FW 48 and FW 55 in particular). The target at-sea monitoring/electronic monitoring coverage level must meet the 30 percent CV precision-based standard for estimating stock level discards for all sectors, as specified in the SBRM Report[55] A minimum coverage level based on this CV standard is appropriate for sector monitoring purposes if there is no evidence that behavior on observed and unobserved trips differs in meaningful ways (i.e. statistically different). If there is such evidence, a higher coverage level may be required to ensure discards are estimated accurately. As previously noted, statistically significant behavior differences along several dimensions critical to catch monitoring were documented (Appendix V); therefore, the No Action option may not meet either the stated purpose for this amendment, or the legal requirements for catch monitoring.

Impacts of the No Action alternative in the context of industry funded monitoring costs, and the costs of industry funded ASM coverage in particular, are a function of the coverage levels emerging from the current SBRM standard. Since 2010, the combined NEFOP and ASM target coverage level has averaged ~22%. The ASM component of this has averaged ~13%. Both 22% and 13% No Action Coverage levels are provided for comparison.

Therefore, these analyses include estimated sector monitoring costs under the No Action at both 13% and 22% coverage, the former representing the average 2010-2017 ASM component of the combined coverage target and the latter the combined coverage target over those years. At 13% coverage, the annual industry component of fleet-wide ASM costs are estimated to be between $0.86 and $0.93 mil. At 22% coverage, this increases to between $1.45 and $1.57 mil. These costs are spread across the fleet as detailed in the following tables (Table 88 - Table 95).

Costs scale linearly as coverage levels increase, and the $0.64 mil difference between 13% and 22% coverage is a suitable proxy for the value of the NEFOP contribution toward a combined coverage target.

The QCM is run incorporating monitoring costs associated with both 13% and 22% coverage levels. An annual monitoring cost is estimated for each vessel and apportioned to trips by days absent. At 13% coverage, the estimated realized ASM cost is $0.9 mil, essentially in line with the midpoint of the low and high estimates static estimates. Dynamically estimated realized costs may differ from static costs due to changes in who fishes and who opts to lease out their ACE as costs increase. At 22% coverage dynamic ASM costs are estimated to be $1.5 mil (Table 96 - Table 103).

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[55] See the 2019 SBRM methodology with observer sea day allocation for more information: https://www.nefsc.noaa.gov/publications/tm/tm255/tm255.pdf

As predicted by the QCM, aggregate fleet-wide revenues are estimated to be lower at 13% coverage than at 22% coverage, with gross revenues of $70.8 mil at 13% and $71.3 mil at 22%. Status Quo (zero ASM costs) gross revenues are in line with those of 13%, at $70.9 mil. As previously noted, increased costs may induce higher aggregate gross revenues as fisherman with higher operating expenses to exit the fishery, freeing up ACE to be used by more efficient fisherman. Note that efficiency here is a function of fishing practices, prevailing ACE allocations and environmental conditions, and not solely a function of skipper and crew skill. Some vessels and ports are better suited to prevailing conditions than others, independent of a vessel and crew's production efficiency.

Higher gross revenues are not as important to fisherman as operating profits, which are estimated at $51.3 mil, $50.4 mil, and $50.2 mil for the Status Quo, 13% and 22% coverage, respectively. The higher gross revenues predicted under the No Action at 22% coverage do not compensate for the higher operating costs, and here the Status Quo (with no ASM costs) is estimated to yield approximately $0.9 mil higher operating profits than No Action at 13% and approximately $1.1 mil higher operating profits than at 22% coverage.

These two versions of the No Action option capture the magnitude of the monitoring subsidy currently provided to the groundfish fleet, as they represent the costs the industry would currently be required to fund in the absence of government support. If a subsidy continued in the future, these analyses help capture the magnitude of potential savings, or reduced costs associated if monitoring was funded by outside sources, at least in the short term.

The following tables demonstrate that these costs and benefits are not uniformly distributed across the fleet. As operating costs increase, smaller vessels and those with lower groundfish fishery participation are more negatively impacted, while larger vessels and those participating more intensively may see increased gross revenues and operating profits.

Overall, if the method for setting target coverage levels remains the same (No Action) and industry bears the cost for monitoring there will be **negative** economic impacts relative to status quo, since industry has been reimbursed for most, and in some years all monitoring costs.

Table 88 - Estimated static costs of monitoring under No Action at 13% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	6	7	0.27	0.28	0.07	0.07	0.08	0.08
>5, <=20	41	43	1.31	1.39	0.07	0.08	0.08	0.08
>20, <=50	166	177	3.61	3.84	0.08	0.09	0.08	0.08
>50, <=80	101	108	7.24	7.74	0.1	0.11	0.08	0.08
>80,	296	323	7.78	8.51	0.19	0.21	0.08	0.08
>160	249	274	12.47	13.72	0.33	0.36	0.08	0.08
TOTAL	*860*	*933*	-	-	-	-	-	-

Table 89 - Estimated static costs of monitoring under No Action at 22% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	11	11	0.45	0.47	0.12	0.12	0.13	0.14
>5, <=20	69	73	2.22	2.34	0.12	0.13	0.13	0.14
>20, <=50	280	298	6.09	6.48	0.14	0.15	0.13	0.14
>50, <=80	171	183	12.2	13.05	0.17	0.18	0.13	0.14
>80,	497	544	13.09	14.31	0.33	0.36	0.13	0.14
>160	419	461	20.96	23.06	0.55	0.61	0.13	0.14
TOTAL	*1,447*	*1,569*	-	-	-	-	-	-

Table 90 - Estimated static costs of monitoring under No Action at 13% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
OTHER MA PORTS	68.2	73.7	3.25	3.51	0.12	0.13	0.08	0.08
BOSTON	176.2	193.2	7.66	8.4	0.28	0.31	0.08	0.08
CHATHAM	48.9	51.2	2.22	2.33	0.06	0.06	0.08	0.08
GLOUCESTER	204.4	221.5	6.01	6.52	0.14	0.15	0.08	0.08
NEW BEDFORD	123.7	136.4	9.52	10.49	0.39	0.43	0.08	0.08
OTHER ME PORTS	42.1	44.9	3.24	3.46	0.09	0.1	0.08	0.08
PORTLAND	54.4	60	6.04	6.66	0.37	0.41	0.08	0.08
NH PORTS	59.2	63.5	4.94	5.29	0.1	0.11	0.08	0.08
NY PORTS	12.6	13.1	2.52	2.63	0.07	0.07	0.08	0.08
OTHER RI PORTS	5.3	5.8	1.76	1.94	0.33	0.36	0.08	0.08
POINT JUDITH	50.5	53.6	2.97	3.15	0.08	0.09	0.08	0.08
OTHER NORTHEAST	C	C	C	C	C	C	C	C

C – Confidential data

Table 91 - Estimated static costs of monitoring under No Action at 22% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
OTHER MA PORTS	114.9	124	5.47	5.9	0.21	0.22	0.13	0.14
BOSTON	296.2	324.8	12.88	14.12	0.47	0.51	0.13	0.14
CHATHAM	82.6	86.6	3.75	3.93	0.1	0.1	0.13	0.14
GLOUCESTER	344	372.8	10.12	10.96	0.23	0.25	0.13	0.14
NEW BEDFORD	207.8	229	15.99	17.62	0.66	0.72	0.13	0.14
OTHER ME PORTS	70.9	75.7	5.46	5.83	0.15	0.16	0.13	0.14
PORTLAND	91.4	100.7	10.15	11.19	0.63	0.69	0.13	0.14
NH PORTS	99.8	107	8.32	8.92	0.17	0.18	0.13	0.14
NY PORTS	21.3	22.2	4.27	4.44	0.11	0.12	0.13	0.14
OTHER RI PORTS	8.8	9.8	2.95	3.25	0.55	0.61	0.13	0.14
POINT JUDITH	85.3	90.4	5.02	5.32	0.14	0.14	0.13	0.14
OTHER NORTHEAST	C	C	C	C	C	C	C	C

C – Confidential data

Table 92 - Estimated static costs of monitoring under No Action at 13% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	282	299	3.10	3.29	0.08	0.09	0.08	0.08
50'to<75'	282	307	5.22	5.68	0.16	0.18	0.08	0.08
75'+	296	327	10.58	11.67	0.42	0.47	0.08	0.08

Table 93 - Estimated static costs of monitoring under No Action at 22% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	475	505	5.22	5.55	0.14	0.14	0.13	0.14
50'to<75'	474	516	8.78	9.55	0.28	0.30	0.13	0.14
75'+	498	549	17.77	19.59	0.71	0.78	0.13	0.14

Table 94 - Estimated static costs of monitoring under No Action at 13% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	225.7	248.7	9.4	10.36	0.39	0.43	0.08	0.08
Northeast Fishery Sector II	165.1	178.2	6.6	7.13	0.13	0.14	0.08	0.08
Northeast Fishery Sector XIII	71.9	79	4.8	5.27	0.29	0.32	0.08	0.08
Northeast Fishery Sector VI	63.4	69.9	9.06	9.99	0.44	0.49	0.08	0.08
Northeast Fishery Sector VIII	56.9	62.7	7.11	7.84	0.33	0.36	0.08	0.08
Northeast Fishery Sector XI	58.1	62.3	5.28	5.66	0.1	0.11	0.08	0.08
Georges Bank Cod Fixed Gear Sector	46.1	48.3	2.3	2.42	0.06	0.06	0.08	0.08
Northeast Fishery Sector V	45.4	47.5	3.03	3.17	0.07	0.07	0.08	0.08
Maine Coast Community Sector	40.2	43.6	2.68	2.91	0.12	0.13	0.08	0.08
Sustainable Harvest Sector - Inshore	30.3	32.8	3.79	4.09	0.12	0.12	0.08	0.08
Northeast Fishery Sector XII	28.6	30.1	4.09	4.31	0.07	0.08	0.08	0.08
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector III	10.7	11.3	1.34	1.41	0.06	0.07	0.08	0.08
Northeast Fishery Sector X	5.2	5.4	0.74	0.77	0.07	0.07	0.08	0.08
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 95 - Estimated static costs of monitoring under No Action at 22% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	379.1	417.7	15.8	17.4	0.66	0.72	0.13	0.14
Northeast Fishery Sector II	277.9	300.1	11.12	12	0.21	0.23	0.13	0.14
Northeast Fishery Sector XIII	120.9	132.8	8.06	8.85	0.49	0.54	0.13	0.14
Northeast Fishery Sector VI	106.5	117.4	15.22	16.78	0.74	0.82	0.13	0.14
Northeast Fishery Sector VIII	95.5	105.3	11.94	13.16	0.56	0.61	0.13	0.14
Northeast Fishery Sector XI	97.8	104.9	8.89	9.54	0.17	0.18	0.13	0.14
Georges Bank Cod Fixed Gear Sector	77.8	81.6	3.89	4.08	0.1	0.1	0.13	0.14
Northeast Fishery Sector V	76.7	80.3	5.12	5.35	0.11	0.12	0.13	0.14
Maine Coast Community Sector	67.7	73.3	4.51	4.89	0.2	0.22	0.13	0.14
Sustainable Harvest Sector - Inshore	51	55.1	6.38	6.89	0.19	0.21	0.13	0.14
Northeast Fishery Sector XII	48.3	50.9	6.9	7.27	0.12	0.13	0.13	0.14
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector III	18.1	19	2.26	2.38	0.11	0.11	0.13	0.14
Northeast Fishery Sector X	8.7	9.1	1.24	1.3	0.11	0.12	0.13	0.14
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 96 - Estimated dynamic impacts of monitoring under No Action at 13% coverage, aggregate fleet totals by days absent category (2018$, mil).

Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
<=5	0.2	0.0	0.1	0.1	68.1	0.0
>5, <=20	1.8	0.0	0.5	1.3	70.1	0.0
>20, <=50	7.8	0.2	2.3	5.4	68.9	-3.6
>50, <=80	6.3	0.1	2.2	4.0	63.3	-2.4
>80, <=160	27.7	0.3	7.4	19.9	71.9	-2.0
>160	27.0	0.3	7.0	19.7	73.0	-1.0
TOTAL	*70.8*	*0.9*	*19.5*	*50.4*	*71.2*	*-1.2*

Table 97 - Estimated dynamic impacts of monitoring under No Action at 22% coverage, aggregate fleet totals by days absent category (2018$, mil).

Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
<=5	0.2	0.0	0.1	0.1	66.0	0.0
>5, <=20	1.8	0.1	0.5	1.2	69.1	-7.7
>20, <=50	7.8	0.3	2.2	5.3	67.8	-5.4
>50, <=80	6.2	0.2	2.1	3.9	62.8	-4.9
>80, <=160	27.5	0.5	7.3	19.7	71.6	-3.0
>160	27.8	0.4	7.3	20.0	72.1	0.5
TOTAL	*71.3*	*1.5*	*19.5*	*50.2*	*70.4*	*-1.6*

Table 98 - Estimated dynamic impacts of monitoring under No Action at 13% coverage, aggregate fleet totals by vessel home port (2018$, mil).

Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
CT PORTS	0.2	0.0	0.0	0.1	75.2	0.0
OTHER MA PORTS	5.7	0.1	1.9	3.8	66.1	-2.6
BOSTON	16.3	0.2	4.6	11.5	70.7	-2.5
CHATHAM	4.7	0.1	0.8	3.9	82.4	-2.5
GLOUCESTER	16.4	0.2	4.5	11.8	71.6	-1.7
NEW BEDFORD	11.4	0.1	3.5	7.8	68.5	-1.3
OTHER ME PORTS	2.1	0.0	0.7	1.4	65.0	0.0
PORTLAND	5.5	0.1	1.6	3.9	70.6	-2.5
NH PORTS	2.2	0.1	0.7	1.4	66.3	-6.7
NY PORTS	0.5	0.0	0.1	0.5	87.3	0.0
OTHER RI PORTS	0.4	0.0	0.2	0.3	60.9	0.0
POINT JUDITH	2.4	0.1	0.6	1.7	71.7	-5.6
OTHER NORTHEAST PORTS	C	C	C	C	C	0.0

Table 99 - Estimated dynamic impacts of monitoring under No Action at 22% coverage, aggregate fleet totals by vessel home port (2018$, mil).

Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
CT PORTS	0.2	0.0	0.0	0.1	76.6	0.0
OTHER MA PORTS	5.8	0.1	1.8	3.8	66.2	-2.6
BOSTON	16.6	0.3	4.7	11.6	70.1	-1.7
CHATHAM	4.8	0.1	0.8	3.9	81.5	-2.5
GLOUCESTER	16.4	0.4	4.4	11.7	71.2	-2.5
NEW BEDFORD	11.7	0.2	3.6	8.0	67.7	1.3
OTHER ME PORTS	2.1	0.1	0.7	1.3	63.7	-7.1
PORTLAND	5.3	0.1	1.5	3.7	69.6	-7.5
NH PORTS	2.2	0.1	0.7	1.4	64.6	-6.7
NY PORTS	0.6	0.0	0.1	0.5	85.5	0.0
OTHER RI PORTS	0.4	0.0	0.1	0.2	58.6	-33.3
POINT JUDITH	2.2	0.1	0.6	1.6	70.3	-11.1
OTHER NORTHEAST PORTS	C	C	C	C	C	0.0

Table 100 - Estimated dynamic impacts of monitoring under No Action at 13% coverage, aggregate fleet totals by vessel size class (2018$, mil).

Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
30'to<50'	14.6	0.3	3.7	10.6	72.7	-3.6
50'to<75'	23.4	0.3	6.0	17.2	73.2	-1.1
75'+	32.7	0.3	9.8	22.6	69.0	-1.3

Table 101 - Estimated dynamic impacts of monitoring under No Action at 22% coverage, aggregate fleet totals by vessel size class (2018$, mil).

Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
30'to<50'	14.6	0.5	3.7	10.5	71.6	-4.5
50'to<75'	23.6	0.5	5.9	17.2	72.8	-1.1
75'+	33.1	0.5	9.9	22.6	68.5	-1.3

Table 102 - Estimated dynamic impacts of monitoring under No Action at 13% coverage, aggregate fleet totals by sector (2018$, mil).

Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
Sustainable Harvest Sector	24.7	0.2	6.8	17.6	71.3	-1.1
Northeast Fishery Sector II	14.5	0.2	3.8	10.5	72.6	-1.9
Northeast Fishery Sector VI	5.5	0.1	1.5	3.9	71.3	-2.5
Northeast Fishery Sector XIII	5.4	0.1	1.9	3.4	63.9	-2.9
Northeast Fishery Sector VIII	5.0	0.1	1.5	3.5	69.7	-2.8
Georges Bank Cod Fixed Gear Sector	4.8	0.0	0.8	4.0	82.9	0.0
Maine Coast Community Sector	2.6	0.0	0.7	1.8	70.2	-5.3
Northeast Fishery Sector XI	2.1	0.1	0.6	1.4	66.7	-6.7
Sustainable Harvest Sector - Inshore	1.9	0.0	0.8	1.1	58.9	-8.3
Northeast Fishery Sector V	1.8	0.0	0.4	1.4	76.6	0.0
Northeast Fishery Sector XII	1.3	0.0	0.4	1.0	70.8	0.0
Northeast Coastal Communities Sector	C	C	C	C	C	0.0
Northeast Fishery Sector III	0.5	0.0	0.2	0.3	62.0	0.0
Northeast Fishery Sector X	0.1	0.0	0.0	0.1	62.4	0.0
Northeast Fishery Sector VII	C	C	C	C	C	0.0

Table 103 - Estimated dynamic impacts of monitoring under No Action at 22% coverage, aggregate fleet totals by sector (2018$, mil).

Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
Sustainable Harvest Sector	25.0	0.4	6.9	17.7	70.9	-0.6
Northeast Fishery Sector II	14.5	0.3	3.7	10.5	72.3	-1.9
Northeast Fishery Sector VI	5.5	0.1	1.5	3.8	70.4	-5.0
Northeast Fishery Sector XIII	5.3	0.1	1.9	3.4	62.9	-2.9
Northeast Fishery Sector VIII	5.3	0.1	1.6	3.7	68.9	2.8
Georges Bank Cod Fixed Gear Sector	4.8	0.1	0.8	3.9	82.2	-2.5
Maine Coast Community Sector	2.6	0.1	0.7	1.8	69.4	-5.3
Northeast Fishery Sector XI	2.2	0.1	0.7	1.4	65.0	-6.7
Sustainable Harvest Sector - Inshore	1.9	0.1	0.7	1.2	59.2	0.0
Northeast Fishery Sector V	1.8	0.1	0.4	1.3	74.9	-7.1
Northeast Fishery Sector XII	1.3	0.1	0.4	0.9	69.2	-10.0
Northeast Coastal Communities Sector	C	C	C	C	C	0.0
Northeast Fishery Sector III	0.5	0.0	0.2	0.3	63.0	0.0
Northeast Fishery Sector X	0.1	0.0	0.0	0.1	61.6	0.0
Northeast Fishery Sector VII	C	C	C	C	C	0.0

Compliance and Enforceability

Here, compliance is defined as the extent to which participants activities are in accordance with all rules and regulations. Relevant rules and regulations for this action may include retention and reporting requirements both at-sea and dockside. Examples of non-compliance include illegal discarding of legal sized stocks, stock area or stock misreporting (species substitution), or non-reporting (black fish). The risk of non-compliance is represented by first, the opportunity for non-compliant behavior, such as, the proportion of time, catch, or other metric of effort, that illegal behavior is not readily detected, as outlined by the Discard Incentive Model (Section 6.6.10.5.1 and Appendix V, #1a), and second, the potential economic benefit of noncompliance, or cost of compliance, such as represented by possible impacts on ACE lease prices (in qualitative terms). In other words, how likely is it for someone to be noncompliant when given the opportunity? The discard incentive model discusses how at current levels of at-sea monitoring, fishermen can derive considerable economic benefit, with few probable costs, by discarding illegally on unobserved trips. Therefore, this level of at-sea coverage represents a high risk of non-compliance for the fishery since there is both greater opportunity and economic incentive for noncompliance on unobserved trips. Resultantly, the compliance score for this alternative is '**low**'. Actual compliance may vary substantially from the risk for non-compliance. True non-compliance in the fishery is unknown, and depends on a variety of socio-economic factors, including societal norms, which are not represented here. Compliance scores are an indicator of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

Enforceability is defined here as the ability for enforcement officials (NOAA OLE or US Coast Guard) to detect and prosecute violations. Some violations are difficult, if not impossible, to enforce under the status quo. For example, retention requirements mandate all legal-sized allocated groundfish to be landed, however, without an observer onboard, enforcement agents have noted that it is nearly impossible to detect if illegal discarding has occurred (see Attachment 1 of Appendix V, #1a). Observers are not enforcement agents but their records, which include observations of potential illegal activities, can be used by enforcement to identify and prosecute violations. At current levels of monitoring coverage, there is no information confirming catch and discards on the majority of trips at sea, and almost no information confirming landings dockside, therefore the enforceability score for this option is '**low**'.

7.5.3.1.2 Sector Monitoring Standard Option 2: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Trips (*Preferred Alternative*)

7.5.3.1.2.1 Sub-option 2A – 25 percent

Sector costs and fishery impacts

At a 25% target coverage, fleet-wide ASM costs are estimated to be between $1.64 and $1.8 mil. These costs scale linearly with time spent fishing–nearly all vessels have similar per-day costs, while per-trip costs are higher for vessels making longer trips. Vessels with lower groundfish participation–those fishing less than 20 days annually–have low per-vessel costs, cumulatively accounting for less than 6% of the aggregate statically-estimated monitoring cost associated with this option. Estimates at the vessel size class, home port and sector levels are differentiated primarily by intensity of fishery participation.

Sub-option 2A has statically estimated costs that are nearly identical to those of the No Action alternative at 22% ASM coverage, with a difference of only $0.23 mil. Static costs are $0.87 mil higher than the No Action at 13% ASM coverage (Table 104 - Table 107).

Fishery impacts are estimated using the QCM. The dynamically-estimated ASM cost is $1.7 mil, just slightly lower than the midpoint of the low and high static estimates ($1.72). Increased monitoring costs under this sub-option induce higher fishery gross revenues relative to the Status Quo, generating an additional $0.6 mil. Operating profits, however, are reduced by $-1.1 mil (Table 108 - Table 111).

Sub-option 2A is estimated to generate fleet-wide gross revenues of $71.5 mil, slightly higher than those estimated at 22% coverage ($71.3 mil) and $0.6 mil higher than the Status Quo. Relative to the No Action at 13% coverage, revenues differ only by $0.7 mil.

Revenues are not as important to fisherman as operating profits, and the higher gross revenues predicted under the 25% coverage are somewhat eroded by higher operating costs. Operating profits are estimated at $50.2 mil for sub-option 2A, lower than Status Quo profits ($51.3 mil) and those estimated for 13% coverage ($50.4 mil). Profits for sub-option 2A are identical, however, to those estimated for the No Action at 22% coverage ($50.2 mil). Overall, this option is unlikely to have outcomes that differ substantially from No Action in terms of fleet operations and the function and structure of the ACE lease market. This is particularly true if monitoring costs continue to be subsidized, as they have been in past years, which in case there would be **neutral impacts** relative to Status Quo.

The following tables demonstrate that static costs and dynamic impacts are not uniformly distributed across the groundfish fleet, signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be more negative on individual vessels, particularly since opportunities for cost-efficiencies may be limited under 25% coverage (i.e., ASM serve as the DSM).

Table 104 - Estimated static costs of monitoring under Sub-option 2A at 25% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	12	13	0.51	0.54	0.13	0.14	0.15	0.16
>5, <=20	78	83	2.51	2.68	0.14	0.15	0.15	0.16
>20, <=50	317	341	6.9	7.41	0.16	0.17	0.15	0.16
>50, <=80	193	209	13.81	14.94	0.19	0.2	0.15	0.16
>80, <=160	564	624	14.84	16.43	0.37	0.41	0.15	0.16
>160	475	530	23.77	26.51	0.63	0.7	0.14	0.16
TOTAL	*1,640*	*1,800*	-	-	-	-	-	-

Table 105 - Estimated static costs of monitoring under Sub-option 2A at 25% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
OTHER MA PORTS	130.1	142.2	6.2	6.77	0.23	0.25	0.15	0.16
BOSTON	335.9	373.2	14.6	16.22	0.53	0.59	0.15	0.16
CHATHAM	93.3	98.8	4.24	4.49	0.11	0.12	0.15	0.16
GLOUCESTER	389.8	427.6	11.46	12.58	0.26	0.29	0.15	0.16
NEW BEDFORD	235.7	263.4	18.13	20.26	0.74	0.83	0.14	0.16
OTHER ME PORTS	80.3	86.7	6.18	6.67	0.17	0.18	0.15	0.16
PORTLAND	103.6	115.8	11.52	12.87	0.71	0.79	0.14	0.16
NH PORTS	113	122.6	9.42	10.21	0.19	0.21	0.15	0.16
NY PORTS	24.1	25.3	4.82	5.06	0.13	0.13	0.15	0.16
OTHER RI PORTS	10	11.2	3.35	3.74	0.63	0.7	0.14	0.16
POINT JUDITH	96.5	103.3	5.67	6.08	0.15	0.16	0.15	0.16
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 106 - Estimated static costs of monitoring under Sub-option 2A at 25% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	538	577	5.91	6.34	0.15	0.16	0.15	0.16
50'to<75'	538	592	9.95	10.97	0.31	0.34	0.15	0.16
75'+	565	631	20.16	22.53	0.81	0.90	0.14	0.16

Table 107 - Estimated static costs of monitoring under Sub-option 2A at 25% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	430.1	480.3	17.92	20.01	0.75	0.83	0.14	0.16
Northeast Fishery Sector II	314.8	344	12.59	13.76	0.24	0.26	0.15	0.16
Northeast Fishery Sector XIII	137.1	152.6	9.14	10.17	0.56	0.62	0.14	0.16
Northeast Fishery Sector VI	120.8	135	17.26	19.29	0.84	0.94	0.14	0.16
Northeast Fishery Sector VIII	108.4	121.1	13.55	15.14	0.63	0.7	0.14	0.16
Northeast Fishery Sector XI	110.8	120.1	10.07	10.92	0.19	0.21	0.15	0.16
Georges Bank Cod Fixed Gear Sector	88	93.2	4.4	4.66	0.11	0.12	0.15	0.16
Northeast Fishery Sector V	86.8	91.7	5.78	6.11	0.13	0.13	0.15	0.16
Maine Coast Community Sector	76.7	84.1	5.11	5.61	0.23	0.25	0.15	0.16
Sustainable Harvest Sector - Inshore	57.8	63.2	7.23	7.9	0.22	0.24	0.15	0.16
Northeast Fishery Sector XII	54.6	58.1	7.8	8.3	0.14	0.15	0.15	0.16
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector III	20.5	21.7	2.56	2.71	0.12	0.13	0.15	0.16
Northeast Fishery Sector X	9.8	10.4	1.4	1.48	0.12	0.13	0.15	0.16
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 108 - Estimated dynamic impacts of monitoring under Sub-option 2A at 25% coverage, aggregate fleet totals by days absent category (2018$, mil).

Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
<=5	0.2	0.0	0.1	0.1	66.0	0.0
>5, <=20	1.8	0.1	0.5	1.3	69.0	0.0
>20, <=50	7.9	0.3	2.2	5.3	67.4	-5.4
>50, <=80	6.5	0.2	2.2	4.1	62.7	0.0
>80, <=160	27.4	0.6	7.3	19.5	71.2	-3.9
>160	27.7	0.5	7.2	19.9	72.0	0.0
TOTAL	*71.5*	*1.7*	*19.5*	*50.2*	*70.2*	*-1.6*

Table 109 - Estimated dynamic impacts of monitoring under Sub-option 2A at 25% coverage, aggregate fleet totals by vessel home port (2018$, mil).

Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
CT PORTS	0.2	0.0	0.0	0.1	77.0	0.0
OTHER MA PORTS	5.9	0.1	1.9	3.8	65.6	-2.6
BOSTON	16.8	0.4	4.6	11.8	70.2	0.0
CHATHAM	4.8	0.1	0.8	3.9	81.4	-2.5
GLOUCESTER	16.4	0.4	4.4	11.6	70.8	-3.3
NEW BEDFORD	11.8	0.2	3.6	8.0	67.2	1.3
OTHER ME PORTS	2.1	0.1	0.7	1.4	63.7	0.0
PORTLAND	5.0	0.1	1.4	3.4	68.9	-15.0
NH PORTS	2.2	0.1	0.7	1.4	64.3	-6.7
NY PORTS	0.5	0.0	0.1	0.5	85.0	0.0
OTHER RI PORTS	0.4	0.0	0.2	0.3	62.4	0.0
POINT JUDITH	2.4	0.1	0.6	1.6	70.0	-11.1
OTHER NORTHEAST PORTS	C	C	C	C	C	0.0

Table 110 - Estimated dynamic impacts of monitoring under Sub-option 2A at 25% coverage, aggregate fleet totals by vessel size class (2018$, mil).

Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
30'to<50'	14.6	0.6	3.6	10.4	71.5	-5.5
50'to<75'	24.1	0.6	6.1	17.5	72.4	0.6
75'+	32.7	0.6	9.8	22.3	68.1	-2.6

Table 111 - Estimated dynamic impacts of monitoring under Sub-option 2A at 25% coverage, aggregate fleet totals by sector (2018$, mil).

Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
Sustainable Harvest Sector	24.8	0.5	6.8	17.5	70.5	-1.7
Northeast Fishery Sector II	14.5	0.3	3.7	10.5	72.0	-1.9
Northeast Fishery Sector VI	5.6	0.1	1.5	3.9	70.6	-2.5
Northeast Fishery Sector XIII	5.5	0.1	1.9	3.5	62.5	0.0
Northeast Fishery Sector VIII	5.2	0.1	1.5	3.6	68.6	0.0
Georges Bank Cod Fixed Gear	4.8	0.1	0.8	4.0	81.9	0.0
Maine Coast Community Sector	2.7	0.1	0.7	1.9	69.3	0.0
Northeast Fishery Sector XI	2.2	0.1	0.6	1.4	64.6	-6.7
Sustainable Harvest Sector - Inshore	1.9	0.1	0.7	1.1	58.5	-8.3
Northeast Fishery Sector V	1.8	0.1	0.4	1.3	74.2	-7.1
Northeast Fishery Sector XII	1.3	0.1	0.4	0.9	69.3	-10.0
Northeast Coastal Communities Sector	C	C	C	C	C	0.0
Northeast Fishery Sector III	0.5	0.0	0.2	0.3	62.7	0.0
Northeast Fishery Sector X	0.1	0.0	0.0	0.1	61.0	0.0
Northeast Fishery Sector VII	C	C	C	C	C	0.0

Compliance and Enforceability

The risk of non-compliance with ASM based on a fixed percentage of trips depends on the coverage rate selected. Because the compliance score depends on both the opportunity to be noncompliant and the economic incentive to be noncompliant, there is less compliance risk for violations at sea when the coverage rate is high. However, the risk for noncompliance at 50% observer coverage might be more similar to the risk of noncompliance at 25% observer coverage because of the incentive effect. That is, the incentive to misreport catch or landings may increase substantially if it means catch of certain stocks is more constraining some proportion of the time. For example, if 50% of the time catch limits are more binding since an observer is onboard, fishermen may fish differently, or pay higher prices to lease stocks that they may encounter, since they cannot as readily illegally discard. Therefore, if an observer is not onboard, the incentive to illegally discard, which includes the cost of quota, may be higher and just as, if not more catch may be discarded at this coverage rate as at the 25% coverage rate, when the incentive effect isn't as strong. At a 75% coverage level, a potentially strong incentive effect is counteracted by a lower opportunity. Now, only on a minority of trips can quota costs be evaded, which limits the amount of potential illegal activity somewhat, but not entirely. Fishermen can strategically alter their pre-catch behavior depending on whether they have an observer onboard, to the extent that it is feasible, fishermen may choose to take longer trips or have more profitable trips when an observer is not onboard, however, it becomes much more difficult to maintain profitable business operations if it is dependent on illegal activity on a minority of trips.

Relative to No Action, the impact of moving to 25% fixed rate coverage depends on the target CV coverage rate in any given year. Between FY 2010 and FY 2018, the ASM target coverage rate was between 8% and 30%, with the most recent five-year average being 13.2%. If future coverage rates are similar, slight to moderate increases in the percentage of at-sea monitoring coverage is expected to have a neutral effect on compliance, since the No Action, 25%, and 50% coverage levels all receive a 'low' compliance score. Major increases in at-sea coverage are expected to have positive impacts on compliance, as the risk for noncompliance decreases at 75% and is very low at 100% coverage, reflected in the compliance scores at these levels of coverage.

Enforceability is expected to scale mostly linearly at different levels of at-sea observer coverage. More information available to enforcement officials will support their ability to detect and prosecute violations. In addition, other types of information may also support their operations, for example, at more equal proportions of observer coverage differences in pre-catch behavior may be more readily identified, so that enforcement may better target their efforts on likely offenders.

Relative to No Action, the impact on enforceability of moving to 25% fixed rate coverage depends on the target CV coverage rate in any given year. Between FY 2010 and FY 2018, the ASM target coverage rate was between 8% and 30%, with the most recent five-year average being 13.2%. If future coverage rates are similar, slight increases in the percentage of at-sea monitoring coverage is expected to have a neutral effect on enforceability, since the No Action and 25% coverage levels receive a 'low' compliance score. Increases in at-sea monitoring coverage are expected to have positive impacts on enforceability, as enforceability increases as the more monitoring reports and independently verified information is generated. At 50% coverage, there is expected to be a positive impact on enforceability, medium-high positive impact at 75%, and strongly positive impact at 100% coverage, reflected in the compliance scores at these levels of coverage.

For the reasons described above, the compliance score at 25% coverage is similar to the status quo alternative, at '**low**'. For the reasons described above, enforceability at 25% coverage is therefore '**low**'.

Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

7.5.3.1.2.2 Sub-option 2B – 50 percent

Sector costs and fishery impacts

At a 50% target coverage, fleet-wide ASM costs are estimated to be between $3.24 and $3.54 mil. Static costs under sub-option 2B are estimated to differ from the No Action at 22% coverage by $1.97 mil, and from the No Action at 13% coverage by $2.61 mil (Table 112 - Table 115).

Fishery impacts are estimated using the QCM. The dynamically-estimated ASM cost for sub-option 2B is $3.3 mil, slightly lower than the midpoint of the low and high static estimates ($3.39). Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $0.2 mil, but reducing operating profits by $-3.1 mil (Table 116 - Table 119).

Sub-option 2B is estimated to generate fleet-wide gross revenues of $71.1 mil, slightly lower than those estimated at 22% coverage ($71.3 mil) and $0.2 mil higher than the Status Quo. Relative to the No Action at 13% coverage, revenues differ by $0.3 mil.

Revenues are not as important to fisherman as operating profits, and the higher gross revenues predicted under the 50% coverage sub-option are eroded by higher operating costs. Operating profits are estimated at $48.2 mil, lower than profits estimated for the Status Quo ($51.3 mil), the No Action at 13% coverage ($50.4 mil), and the No Action at 22% ASM ($50.2 mil); therefore, **negative** economic impacts compared to No Action in terms of increased monitoring costs. Operating profits differ from sub-option 2A (25% coverage) by $-2 mil. If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

The following tables demonstrate that static costs and dynamic impacts are not uniformly distributed across the groundfish fleet signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be more negative on individual vessels, particularly since opportunities for cost-efficiencies may be limited under 50% coverage (i.e., ASM serves as the DSM).

Compliance and Enforceability

For the reasons described previously, the compliance score at 50% coverage is similar to the status quo alternative and 25% coverage, at '**low**'. For the reasons described above, enforceability at 50% coverage is therefore '**medium**'.

Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

Table 112 - Estimated static costs of monitoring under Sub-option 2B at 50% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	24	26	1.01	1.07	0.27	0.28	0.3	0.31
>5, <=20	155	164	5	5.31	0.27	0.29	0.3	0.31
>20, <=50	630	674	13.71	14.66	0.32	0.34	0.3	0.31
>50, <=80	384	413	27.41	29.49	0.37	0.4	0.29	0.31
>80, <=160	1,112	1,224	29.26	32.21	0.73	0.81	0.29	0.31
>160	936	1,037	46.8	51.84	1.23	1.37	0.29	0.31
TOTAL	*3,241*	*3,538*	-	-	-	-	-	-

Table 113 - Estimated static costs of monitoring under Sub-option 2B at 50% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
OTHER MA PORTS	257.5	279.8	12.26	13.32	0.46	0.5	0.29	0.31
BOSTON	662.1	730.6	28.79	31.77	1.05	1.15	0.29	0.31
CHATHAM	186.2	196.4	8.46	8.93	0.22	0.23	0.3	0.31
GLOUCESTER	770.7	840.5	22.67	24.72	0.52	0.57	0.29	0.31
NEW BEDFORD	464	514.8	35.69	39.6	1.46	1.62	0.28	0.31
OTHER ME PORTS	159.4	171.2	12.26	13.17	0.34	0.36	0.29	0.31
PORTLAND	204	226.3	22.67	25.15	1.4	1.55	0.28	0.31
NH PORTS	224.1	241.8	18.68	20.15	0.38	0.41	0.29	0.31
NY PORTS	48.2	50.4	9.63	10.09	0.25	0.26	0.3	0.31
OTHER RI PORTS	19.8	21.9	6.59	7.31	1.23	1.37	0.28	0.31
POINT JUDITH	191.8	204.6	11.29	12.04	0.31	0.33	0.3	0.31
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 114 - Estimated static costs of monitoring under Sub-option 2B at 50% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	1,069	1,142	11.74	12.55	0.30	0.33	0.30	0.31
50'to<75'	1,062	1,162	19.66	21.53	0.62	0.68	0.29	0.31
75'+	1,111	1,233	39.68	44.04	1.59	1.76	0.28	0.31

Table 115 - Estimated static costs of monitoring under Sub-option 2B at 50% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	846.5	938.9	35.27	39.12	1.47	1.63	0.28	0.31
Northeast Fishery Sector II	623.1	677	24.92	27.08	0.47	0.51	0.29	0.31
Northeast Fishery Sector XIII	270.1	298.6	18.01	19.91	1.09	1.21	0.29	0.31
Northeast Fishery Sector VI	237.8	263.9	33.97	37.7	1.66	1.85	0.28	0.31
Northeast Fishery Sector XI	219.6	237	19.96	21.54	0.39	0.42	0.29	0.31
Northeast Fishery Sector VIII	213.3	236.7	26.66	29.58	1.24	1.38	0.28	0.31
Georges Bank Cod Fixed Gear	175.4	185.2	8.77	9.26	0.22	0.23	0.3	0.31
Northeast Fishery Sector V	173.1	182.3	11.54	12.15	0.25	0.27	0.3	0.31
Maine Coast Community Sector	151.6	165.3	10.11	11.02	0.45	0.49	0.29	0.31
Sustainable Harvest Sector - Inshore	114.5	124.4	14.31	15.55	0.44	0.47	0.29	0.31
Northeast Fishery Sector XII	108.8	115.3	15.54	16.48	0.28	0.3	0.3	0.31
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector III	40.8	43.1	5.1	5.39	0.24	0.26	0.3	0.31
Northeast Fishery Sector X	19.6	20.6	2.8	2.95	0.25	0.26	0.3	0.31
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 116 - Estimated dynamic impacts of monitoring under Sub-option 2B at 50% coverage, aggregate fleet totals by days absent category (2018$, mil).

Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
<=5	0.2	0.0	0.1	0.1	60.6	0.0
>5, <=20	1.7	0.1	0.4	1.1	65.6	-15.4
>20, <=50	7.6	0.6	2.1	4.8	63.8	-14.3
>50, <=80	6.3	0.4	2.1	3.7	59.5	-9.8
>80, <=160	27.5	1.2	7.3	19.0	69.2	-6.4
>160	27.8	1.0	7.3	19.5	70.3	-2.0
TOTAL	*71.1*	*3.3*	*19.3*	*48.2*	*67.8*	*-5.5*

Table 117 - Estimated dynamic impacts of monitoring under Sub-option 2B at 50% coverage, aggregate fleet totals by vessel home port (2018$, mil).

Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
CT PORTS	0.2	0.0	0.0	0.1	76.6	0.0
OTHER MA PORTS	5.6	0.3	1.8	3.6	63.8	-7.7
BOSTON	16.4	0.7	4.5	11.1	68.0	-5.9
CHATHAM	4.7	0.2	0.8	3.7	79.5	-7.5
GLOUCESTER	15.9	0.8	4.2	10.9	68.6	-9.2
NEW BEDFORD	12.4	0.5	3.8	8.1	65.5	2.5
OTHER ME PORTS	2.1	0.2	0.7	1.2	59.7	-14.3
PORTLAND	5.3	0.2	1.5	3.6	67.3	-10.0
NH PORTS	2.2	0.2	0.7	1.3	59.0	-13.3
NY PORTS	0.5	0.0	0.1	0.4	80.8	-20.0
OTHER RI PORTS	0.3	0.0	0.1	0.2	55.3	-33.3
POINT JUDITH	2.2	0.2	0.6	1.4	65.5	-22.2
OTHER NORTHEAST PORTS	C.0	C.0	C.0	C.0	C.0	0.0

Table 118 - Estimated dynamic impacts of monitoring under Sub-option 2B at 50% coverage, aggregate fleet totals by vessel size class (2018$, mil).

Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
30'to<50'	14.3	1.1	3.5	9.7	67.9	-11.8
50'to<75'	23.5	1.1	5.8	16.6	70.5	-4.6
75'+	33.2	1.2	10.0	22.1	66.4	-3.5

Table 119 - Estimated dynamic impacts of monitoring under Sub-option 2B at 50% coverage, aggregate fleet totals by sector (2018$, mil).

Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
Sustainable Harvest Sector	25.7	0.9	7.0	17.8	69.2	0.0
Northeast Fishery Sector II	14.0	0.6	3.6	9.8	70.0	-8.4
Northeast Fishery Sector VI	5.2	0.2	1.4	3.5	67.6	-12.5
Northeast Fishery Sector XIII	5.3	0.3	1.9	3.2	59.3	-8.6
Northeast Fishery Sector VIII	5.5	0.2	1.6	3.7	66.8	2.8
Georges Bank Cod Fixed Gear	4.7	0.2	0.8	3.8	80.2	-5.0
Maine Coast Community Sector	2.6	0.2	0.7	1.7	66.3	-10.5
Northeast Fishery Sector XI	2.1	0.2	0.6	1.3	59.1	-13.3
Sustainable Harvest Sector - Inshore	1.9	0.1	0.7	1.1	56.3	-8.3
Northeast Fishery Sector V	1.7	0.2	0.4	1.2	69.3	-14.3
Northeast Fishery Sector XII	1.3	0.1	0.3	0.8	65.4	-20.0
Northeast Coastal Communities Sector	C	C	C	C	C	0.0
Northeast Fishery Sector III	0.5	0.0	0.1	0.3	59.9	0.0
Northeast Fishery Sector X	0.1	0.0	0.0	0.1	55.1	0.0
Northeast Fishery Sector VII	C	C	C	C	C	0.0

7.5.3.1.2.3 Sub-option 2C – 75 percent

Sector costs and fishery impacts

At a 75% target coverage, fleet-wide ASM costs are estimated to be between $4.57 and $5.2 mil. Static costs under sub-option 2C are estimated to differ from the No Action at 22% coverage by $3.63 mil, and from the No Action at 13% coverage by $4.27 mil (Table 120 - Table 123).

Fishery impacts are estimated using the QCM. The dynamically-estimated ASM cost for sub-option 2C is $4.9 mil, slightly lower than the midpoint of the low and high static estimates ($4.885). Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $1.4 mil, but reducing aggregate operating profits by $-3.7 mil (Table 124 - Table 127).

Sub-option 2C is estimated to generate fleet-wide gross revenues of $72.3 mil, higher than those estimated at 22% coverage ($71.3 mil) and $1.4 mil higher than the Status Quo. Relative to the No Action at 13% coverage, revenues differ by $1.5 mil.

Revenues are not as important to fisherman as operating profits, and the higher gross revenues predicted under the 75% coverage sub-option are eroded by higher operating costs. Operating profits are estimated at $47.6 mil, lower than profits estimated for the Status Quo ($51.3 mil), the No Action at 13% coverage ($50.4 mil), and the No Action at 22% ASM ($50.2 mil); therefore, **negative** economic impacts compared to No Action in terms of increased monitoring costs. Operating profits differ from sub-option 2A (25% coverage) by $-2.6 mil, and from sub-option 2B (50% coverage) by $-0.6 mil. If monitoring costs continue to be subsidized, as they have been in past years, negative economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

The following tables demonstrate that static costs and dynamic impacts are not uniformly distributed across the groundfish fleet, signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be more negative on individual vessels, however, opportunities for cost-efficiencies may exist under 75% coverage (i.e., when the ASM serves as the DSM).

Compliance and Enforceability

For the reasons described previously, the compliance score at 75% is '**medium**', which is conservative based on the assumption that illegal activity will be highly incentivized on the remainder of trips. For the reasons described above, enforceability at 75% coverage is therefore '**medium-high'**.

Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

Table 120 - Estimated static costs of monitoring under Sub-option 2C at 75% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	34	38	1.43	1.59	0.38	0.42	0.42	0.46
>5, <=20	220	244	7.09	7.87	0.38	0.43	0.42	0.46
>20, <=50	893	998	19.41	21.69	0.46	0.51	0.42	0.46
>50, <=80	543	610	38.77	43.55	0.53	0.59	0.42	0.46
>80, <=160	1,567	1,795	41.24	47.24	1.03	1.18	0.41	0.46
>160	1,318	1,518	65.9	75.89	1.74	2	0.4	0.46
TOTAL	*4,575*	*5,202*	-	-	-	-	-	-

Table 121 - Estimated static costs of monitoring under Sub-option 2C at 75% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
OTHER MA PORTS	363.7	412	17.32	19.62	0.65	0.74	0.41	0.46
BOSTON	932.7	1070.8	40.55	46.56	1.47	1.69	0.41	0.46
CHATHAM	264.2	291.8	12.01	13.26	0.31	0.34	0.42	0.46
GLOUCESTER	1087.9	1236.2	32	36.36	0.73	0.83	0.41	0.46
NEW BEDFORD	653.1	753.2	50.24	57.94	2.06	2.38	0.4	0.46
OTHER ME PORTS	225.5	253	17.35	19.46	0.48	0.54	0.42	0.46
PORTLAND	287.1	331.2	31.9	36.8	1.97	2.27	0.4	0.46
NH PORTS	316.9	356.8	26.41	29.73	0.54	0.61	0.42	0.46
NY PORTS	68.4	75.1	13.68	15.02	0.36	0.39	0.42	0.46
OTHER RI PORTS	27.8	32.1	9.27	10.69	1.74	2.01	0.4	0.46
POINT JUDITH	271.8	303	15.99	17.82	0.43	0.48	0.42	0.46
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 122 - Estimated static costs of monitoring under Sub-option 2C at 75% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	1,513	1,691	16.63	18.58	0.43	0.48	0.42	0.46
50'to<75'	1,497	1,708	27.73	31.62	0.87	0.99	0.41	0.46
75'+	1,564	1,804	55.86	64.43	2.24	2.58	0.40	0.46

Table 123 - Estimated static costs of monitoring under Sub-option 2C at 75% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	1191.6	1373.9	49.65	57.25	2.07	2.38	0.4	0.46
Northeast Fishery Sector II	880	996.9	35.2	39.88	0.67	0.76	0.42	0.46
Northeast Fishery Sector XIII	380.4	437.4	25.36	29.16	1.54	1.77	0.4	0.46
Northeast Fishery Sector VI	334.7	386.1	47.82	55.16	2.34	2.7	0.4	0.46
Northeast Fishery Sector XI	310.5	349.7	28.23	31.79	0.55	0.61	0.42	0.46
Northeast Fishery Sector VIII	300.2	346.3	37.53	43.28	1.75	2.01	0.4	0.46
Georges Bank Cod Fixed Gear Sector	248.9	275.1	12.45	13.76	0.31	0.34	0.42	0.46
Northeast Fishery Sector V	245.7	271	16.38	18.07	0.36	0.39	0.42	0.46
Maine Coast Community Sector	214	243.2	14.26	16.21	0.63	0.72	0.41	0.46
Sustainable Harvest Sector - Inshore	161.6	183.2	20.2	22.89	0.61	0.7	0.41	0.46
Northeast Fishery Sector XII	154.3	171.1	22.04	24.45	0.4	0.44	0.42	0.46
Northeast Coastal	C	C	C	C	C	C	C	C
Northeast Fishery Sector III	57.9	64	7.24	8.01	0.35	0.38	0.42	0.46
Northeast Fishery Sector X	27.9	30.7	3.98	4.38	0.35	0.39	0.42	0.46
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 124 - Estimated dynamic impacts of monitoring under Sub-option 2 at 75% coverage, aggregate fleet totals by days absent category (2018$, mil).

Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
<=5	0.2	0.0	0.0	0.1	58.9	0.0
>5, <=20	1.8	0.2	0.5	1.1	62.1	-15.4
>20, <=50	7.6	0.9	2.1	4.6	60.6	-17.9
>50, <=80	6.3	0.6	2.2	3.6	56.7	-12.2
>80, <=160	28.0	1.7	7.5	18.7	67.0	-7.9
>160	28.4	1.5	7.4	19.5	68.9	-2.0
TOTAL	*72.3*	*4.9*	*19.7*	*47.6*	*65.8*	*-6.7*

Table 125 - Estimated dynamic impacts of monitoring under Sub-option 2C at 75% coverage, aggregate fleet totals by vessel home port (2018$, mil).

Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
CT PORTS	0.2	0.0	0.0	0.1	76.0	0.0
OTHER MA PORTS	5.6	0.4	1.8	3.4	61.2	-12.8
BOSTON	16.9	1.0	4.7	11.2	66.0	-5.1
CHATHAM	4.8	0.3	0.8	3.7	77.6	-7.5
GLOUCESTER	16.2	1.1	4.3	10.8	66.8	-10.0
NEW BEDFORD	12.4	0.7	3.8	7.9	63.7	0.0
OTHER ME PORTS	2.1	0.2	0.7	1.2	56.5	-14.3
PORTLAND	5.3	0.3	1.5	3.5	65.4	-12.5
NH PORTS	2.1	0.3	0.6	1.2	54.9	-20.0
NY PORTS	0.5	0.1	0.1	0.4	77.2	-20.0
OTHER RI PORTS	0.4	0.0	0.1	0.2	56.8	-33.3
POINT JUDITH	2.3	0.3	0.6	1.4	61.1	-22.2
OTHER NORTHEAST PORTS	C.0	C.0	C.0	C.0	C.0	0.0

Table 126 - Estimated dynamic impacts of monitoring under Sub-option 2C at 75% coverage, aggregate fleet totals by vessel size class (2018$, mil).

Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
30'to<50'	14.5	1.6	3.5	9.4	65.0	-14.5
50'to<75'	24.3	1.6	6.0	16.6	68.5	-4.6
75'+	33.5	1.7	10.1	21.6	64.7	-5.7

Table 127 - Estimated dynamic impacts of monitoring under Sub-option 2C at 75% coverage, aggregate fleet totals by sector (2018$, mil).

Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
Sustainable Harvest Sector	25.7	1.3	7.0	17.4	67.6	-2.2
Northeast Fishery Sector II	14.3	0.9	3.6	9.8	68.4	-8.4
Northeast Fishery Sector VI	5.5	0.4	1.5	3.6	65.5	-10.0
Northeast Fishery Sector XIII	5.5	0.4	1.9	3.2	57.2	-8.6
Northeast Fishery Sector VIII	5.6	0.3	1.6	3.6	64.7	0.0
Georges Bank Cod Fixed Gear Sector	4.8	0.3	0.8	3.8	78.3	-5.0
Maine Coast Community Sector	2.6	0.2	0.7	1.6	63.2	-15.8
Northeast Fishery Sector XI	2.1	0.3	0.6	1.2	55.2	-20.0
Sustainable Harvest Sector - Inshore	1.9	0.2	0.7	1.0	53.5	-16.7
Northeast Fishery Sector V	1.8	0.3	0.4	1.1	65.0	-21.4
Northeast Fishery Sector XII	1.4	0.2	0.4	0.8	61.4	-20.0
Northeast Coastal Communities Sector	C	C	C	C	C	0.0
Northeast Fishery Sector III	0.4	0.0	0.1	0.3	59.7	0.0
Northeast Fishery Sector X	0.1	0.0	0.0	0.1	48.3	0.0
Northeast Fishery Sector VII	C	C	C	C	C	0.0

7.5.3.1.2.4 Sub-option 2D – 100 percent (*Preferred Alternative*)

Sector costs and fishery impacts

100% monitoring is estimated at 91% ASM coverage to account for SBRM-mandated NEFOP coverage, which has averaged ~9% over the past eight years. As previously stated, this analysis makes no attempt to estimate and account for sector's SBRM fleet composition (Table 128-Table 131).

Fishery impacts are estimated using the QCM. The dynamically-estimated ASM cost for sub-option 2D is $5.5 mil, slightly lower than the midpoint of the low and high static estimates ($5.72). Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $0.1 mil, but reducing aggregate operating profits by $-5.1 mil (Table 132 - Table 135).

Sub-option 2D is estimated to generate fleet-wide gross revenues of $71 mil, lower than those estimated at 22% coverage ($71.3 mil) and $0.1 mil higher than the Status Quo. Relative to the No Action at 13% coverage, revenues differ by $0.2 mil.

Revenues are not as important to fisherman as operating profits, and the higher gross revenues predicted under the 91% coverage sub-option are eroded by higher operating costs. Operating profits are estimated at $46.2 mil, lower than profits estimated for the Status Quo ($51.3 mil), the No Action at 13% coverage ($50.4 mil), and the No Action at 22% ASM ($50.2 mil); therefore, **negative** economic impacts from increased monitoring costs. Operating profits differ from sub-option 2A (25% coverage) by $-4 mil, and from sub-option 2B (50% coverage) by $-2 mil. If monitoring costs continue to be subsidized, as they have been in past years, negative economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

The following tables demonstrate that static costs and dynamic impacts are not uniformly distributed across the groundfish fleet signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be more negative on individual vessels, however, opportunities for cost-efficiencies may exist under 100% coverage (i.e., when the ASM serves as the DSM).

Compliance and Enforceability

Only 100% coverage rate obtains a '**high**' compliance score, since opportunity for illegal activity at sea is low. For the reasons described above, enforceability at 100% coverage is therefore '**high**'. Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

Table 128 - Estimated static costs of monitoring under Sub-option 2D at 100% coverage, by days absent category (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	41	44	1.69	1.84	0.45	0.49	0.50	0.54
>5, <=20	260	283	8.38	9.14	0.45	0.50	0.50	0.54
>20, <=50	1,057	1,157	22.98	25.15	0.54	0.59	0.50	0.54
>50, <=80	644	706	45.97	50.43	0.63	0.69	0.49	0.54
>80, <=160	1,867	2,067	49.13	54.41	1.23	1.36	0.49	0.53
>160	1,572	1,746	78.61	87.28	2.07	2.30	0.48	0.53
TOTAL	*5,440*	*6,004*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Table 129 - Estimated static costs of monitoring under Sub-option 2D at 100% coverage, by vessel home port (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
OTHER MA PORTS	432.1	476	20.58	22.66	0.77	0.85	0.49	0.54
BOSTON	1111.8	1232.5	48.34	53.59	1.76	1.95	0.48	0.53
CHATHAM	312	339.5	14.18	15.43	0.37	0.4	0.5	0.54
GLOUCESTER	1293.5	1426.9	38.04	41.97	0.87	0.96	0.49	0.54
NEW BEDFORD	779.5	865.9	59.96	66.61	2.46	2.73	0.48	0.53
OTHER ME PORTS	267.3	293.1	20.56	22.55	0.57	0.62	0.49	0.54
PORTLAND	342.7	380.7	38.07	42.3	2.35	2.61	0.47	0.53
NH PORTS	376	412.9	31.33	34.41	0.64	0.7	0.49	0.54
NY PORTS	80.7	87.5	16.13	17.51	0.42	0.46	0.5	0.54
OTHER RI PORTS	33.2	36.9	11.06	12.29	2.07	2.3	0.47	0.53
POINT JUDITH	321.6	351.6	18.92	20.68	0.51	0.56	0.5	0.54
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 130 - Estimated static costs of monitoring under Sub-option 2D at 100% coverage, by vessel size class (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one SD).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	1,792	1,961	19.69	21.55	0.51	0.56	0.49	0.54
50'to<75'	1,782	1,969	33.00	36.46	1.04	1.14	0.49	0.54
75'+	1,866	2,074	66.66	74.07	2.67	2.97	0.47	0.53

Table 131 - Estimated static costs of monitoring under Sub-option 2D at 100% coverage, by sector (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	1422	1579.6	59.25	65.82	2.46	2.74	0.48	0.53
Northeast Fishery Sector II	1045.6	1151.7	41.82	46.07	0.79	0.88	0.49	0.54
Northeast Fishery Sector XIII	453.7	503.3	30.25	33.55	1.84	2.04	0.48	0.53
Northeast Fishery Sector VI	399.5	443.9	57.07	63.41	2.79	3.1	0.47	0.53
Northeast Fishery Sector XI	368.4	404.6	33.49	36.78	0.65	0.71	0.49	0.54
Northeast Fishery Sector VIII	358.3	398.1	44.79	49.76	2.08	2.31	0.47	0.53
Georges Bank Cod Fixed Gear Sector	294	320	14.7	16	0.37	0.4	0.5	0.54
Northeast Fishery Sector V	290	315.4	19.33	21.03	0.42	0.46	0.5	0.54
Maine Coast Community Sector	254.4	280.7	16.96	18.71	0.75	0.83	0.49	0.53
Sustainable Harvest Sector - Inshore	192.1	211.6	24.01	26.45	0.73	0.8	0.49	0.54
Northeast Fishery Sector XII	182.4	198.9	26.05	28.41	0.47	0.51	0.5	0.54
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector III	68.4	74.5	8.55	9.31	0.41	0.45	0.5	0.54
Northeast Fishery Sector X	32.9	35.7	4.7	5.1	0.42	0.45	0.5	0.54
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 132 - Estimated dynamic impacts of monitoring under Sub-option 2D at 100% coverage, aggregate fleet totals by days absent category (91% coverage analyzed, 2018$, mil).

Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
<=5	0.2	0.0	0.0	0.1	55.5	0.0
>5, <=20	1.7	0.2	0.4	1.0	61.2	-23.1
>20, <=50	7.5	1.0	2.1	4.4	58.9	-21.4
>50, <=80	6.3	0.7	2.1	3.5	55.7	-14.6
>80, <=160	27.8	2.0	7.4	18.4	66.2	-9.4
>160	27.5	1.6	7.1	18.8	68.2	-5.5
TOTAL	*71.0*	*5.5*	*19.1*	*46.2*	*65.1*	*-9.4*

Table 133 - Estimated dynamic impacts of monitoring under Sub-option 2D at 100% coverage, aggregate fleet totals by vessel home port (91% coverage analyzed, 2018$, mil).

Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
CT PORTS	0.2	0.0	0.0	0.2	75.9	100.0
OTHER MA PORTS	5.2	0.4	1.7	3.1	60.0	-20.5
BOSTON	16.6	1.2	4.6	10.8	65.0	-8.5
CHATHAM	4.8	0.3	0.8	3.7	76.7	-7.5
GLOUCESTER	15.8	1.3	4.1	10.3	65.6	-14.2
NEW BEDFORD	12.3	0.8	3.7	7.8	62.9	-1.3
OTHER ME PORTS	2.1	0.3	0.7	1.1	54.9	-21.4
PORTLAND	5.3	0.4	1.5	3.5	65.2	-12.5
NH PORTS	2.1	0.4	0.6	1.1	52.5	-26.7
NY PORTS	0.5	0.1	0.1	0.4	75.5	-20.0
OTHER RI PORTS	0.3	0.0	0.1	0.2	57.0	-33.3
POINT JUDITH	2.2	0.3	0.6	1.3	60.1	-27.8
OTHER NORTHEAST	C.0	C.0	C.0	C.0	C.0	0.0

Table 134 - Estimated dynamic impacts of monitoring under Sub-option 2D at 100% coverage, aggregate fleet totals by vessel size class (91% coverage analyzed, 2018$, mil).

Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
30'to<50'	14.3	1.8	3.4	9.1	63.6	-17.3
50'to<75'	24.1	1.8	6.0	16.3	67.7	-6.3
75'+	32.5	2.0	9.8	20.8	63.9	-9.2

Table 135 - Estimated dynamic impacts of monitoring under Sub-option 2D at 100% coverage, aggregate fleet totals by sector (91% coverage analyzed, 2018$, mil).

Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
Sustainable Harvest Sector	25.2	1.5	6.8	16.9	67.0	-5.1
Northeast Fishery Sector II	13.9	1.0	3.5	9.3	67.2	-13.1
Northeast Fishery Sector VI	5.7	0.4	1.6	3.7	64.6	-7.5
Northeast Fishery Sector XIII	5.4	0.5	1.9	3.1	56.3	-11.4
Northeast Fishery Sector VIII	5.5	0.4	1.6	3.5	63.6	-2.8
Georges Bank Cod Fixed Gear Sector	4.8	0.3	0.8	3.7	77.5	-7.5
Maine Coast Community Sector	2.6	0.3	0.7	1.6	62.6	-15.8
Northeast Fishery Sector XI	2.1	0.4	0.6	1.1	52.8	-26.7
Sustainable Harvest Sector - Inshore	1.8	0.2	0.7	1.0	52.9	-16.7
Northeast Fishery Sector V	1.7	0.3	0.4	1.1	62.9	-21.4
Northeast Fishery Sector XII	1.3	0.2	0.3	0.8	59.5	-20.0
Northeast Coastal Communities Sector	C	C	C	C	C	0.0
Northeast Fishery Sector III	0.4	0.0	0.1	0.3	60.4	0.0
Northeast Fishery Sector X	0.1	0.0	0.0	0.0	49.0	-100.0
Northeast Fishery Sector VII	C	C	C	C	C	0.0

7.5.3.1.3 Sector Monitoring Standard Option 3: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Catch

Approach for Analysis

This option considers an alternative methodology to using the CV standard (precision standard) for determining coverage levels for human observers or at-sea monitors. Specifically, the Council would select an annual coverage level of total catch to be independently verified in all future fishing years. For whichever coverage level is chosen, sectors collectively would be required to meet the coverage level of total catch to be independently verified for each allocated groundfish stock, targeted at the total sector sub-ACL level. Independent verification could be achieved through a suite of monitoring tools. Sectors would describe in their monitoring plans how the selected target coverage level would be achieved for each allocated groundfish stock.

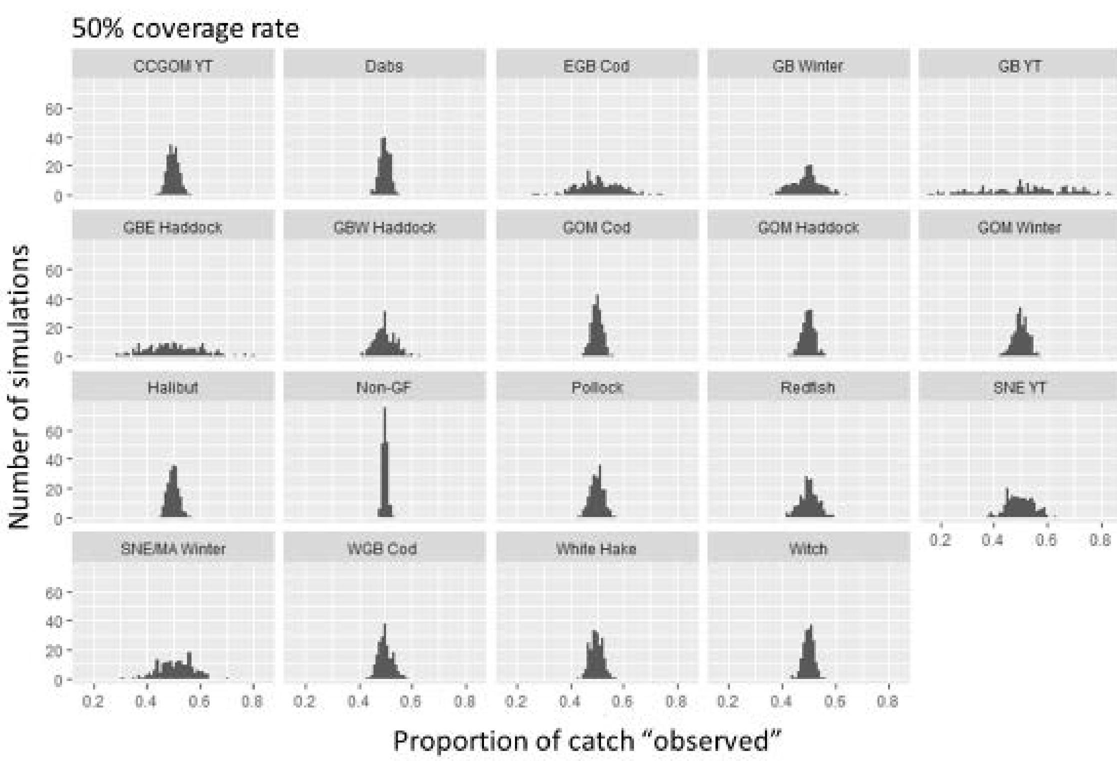
Simulations were performed in order to investigate what overall coverage levels would be necessary to achieve a given coverage rate of total catch for any given allocated stock. Each simulation was run to randomly assign all sector groundfish trips in FY2018[56] (GARFO DMIS database) as "observed" or

[56] Where a groundfish trip is defined as a trip where the vessel owner or operator declared, either through the vessel monitoring system (VMS) or through the interactive voice response system, that the vessel was making a groundfish trip. This includes trips on which groundfish DAS were used, including monkfish (Lophius americanus) trips that used groundfish DAS (Murphy et al 2018).

“unobserved”, from which, the total simulated “observed” catch was calculated as a proportion of total reported landings (GARFO dealer data) in that year. For example, assume the monitoring target was 50% of total catch, 200 simulations were run to estimate a distribution of potential “observed” ratios for every allocated stock, assuming trips are randomly selected.

The simulations suggest that the proportion of trips that need to be monitored to observe 50% of the total catch varies considerably between stocks (Figure 45). Non-groundfish (“other”) has very little variance so a 50% coverage rate would be very likely to observe 50% of the total catch. This is also fairly true for American plaice, GOM cod, and a few other stocks. However, for stocks with greater variability, a higher proportion of trips would need to be monitored to have a high probability of observing 50% of the total catch. In FY18 catches were low and sporadic for Georges Bank yellowtail flounder, and Eastern Georges Bank haddock, so achieving a high probability of ensuring at least 50% of the total catch of each stock was observed would require a higher observer coverage rate. Specifically, moving the coverage rate to 70% of trips results in at least a 90% chance that 50 % of the total catch of every stock will be observed, with many stocks having a 100% chance of meeting that catch target if effort and stock availability remained identical to 2018.

Figure 45 - Distribution of 200 random simulations estimating the total percentage of catch observed at a 50% coverage rate in FY2018.



The simulations show that 50% randomized observer coverage across all FY 2018 sector trips would result in a 90% probability that at least 25% percent of the total catch of every allocated stock (and halibut) was observed (Figure 45, Table 136). Increasing coverage rates to 70% of trips would confer roughly a 90% chance that 50% of total catch was observed for each stock (Figure 46, Table 136). Finally, increasing observer coverage to 90% would achieve the 75% of total catch per stock threshold with a similar level of confidence (Figure 47, Table 136). Similar results were obtained for FY 2017, with slightly higher probabilities of achieving target catch coverage rates (between 93-95%). In every simulation GB yellowtail was the stock that drives the recommended coverage rate to meet each catch target (Table 136), including simulations run in FY 2017. Should fishery characteristics or changes in ACLs occur for this stock, catch rates and therefore the level of observer coverage needed to capture a given proportion of landings for this stock, or any stock in the northeast multispecies complex, are likely to change. In future years, the stock with the lowest and most variable catch rate will drive the coverage rate needed to meet the catch proportion target while other stocks will likely far exceed that target, resulting in a total proportion of catch observed that is significantly higher than the target.

It is important to recognize that this analysis assumes that under random deployment there will be no observer effects (observed trips do not materially change from unobserved trips), and that on unobserved trips landings and calculated discards are representative of true catch (no illegal discarding), both which have been shown to be false assumptions under low levels of observer coverage in this fishery (Appendix V, Attachments #1a and #1b). Observer effects or possible illegal discarding may further reduce the confidence in which a catch target may be achieved using randomized deployment in any given year, especially at low to medium levels of observer coverage rates.

Figure 46 - Distribution of 200 random simulations estimating the total percentage of catch observed at a 70% coverage rate in FY2018.

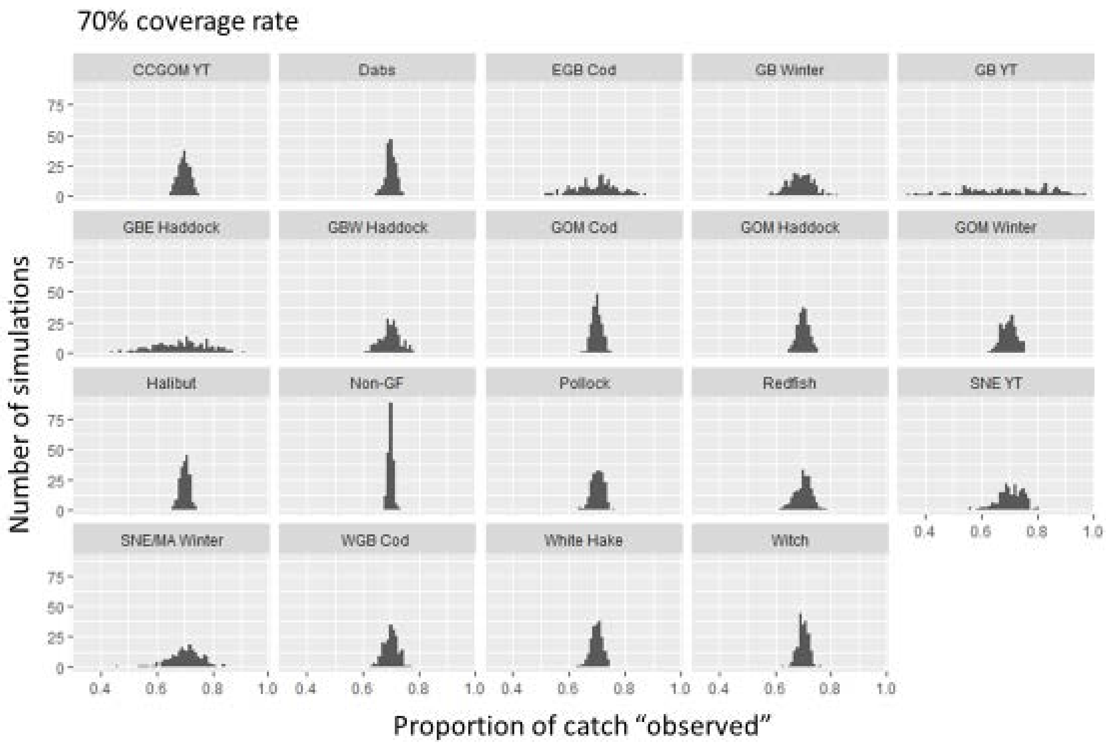


Figure 47 - Distribution of 200 random simulations estimating the total percentage of catch observed at a 90% coverage rate in FY2018.

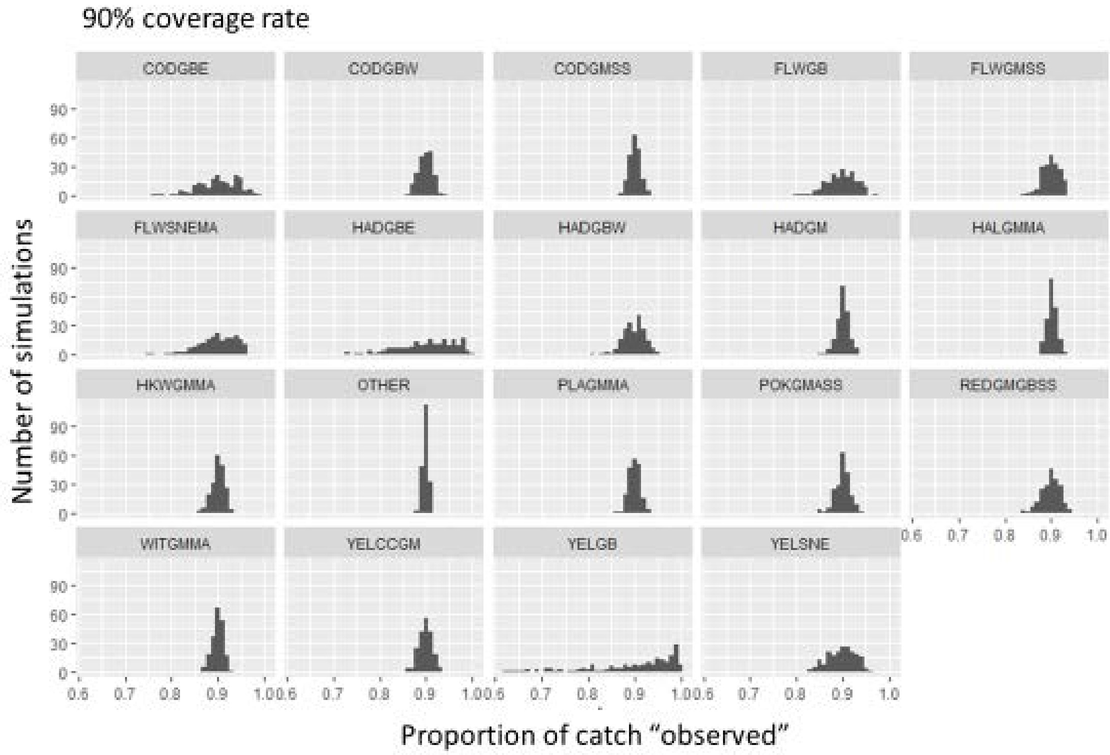


Table 136 - Results of FY 2018 simulations.

For each observer coverage rate, the likelihood of achieving a given catch target for GB Yellowtail (the most limiting stock in the analysis for FY 2018) is shown as the percentage of simulations at or above that catch proportion. For the 50% of catch target two levels are shown, since the probability of achieving the catch target (50%) is near 90%. Adding 5% more observer coverage increases the likelihood to 97%. Recommended observer coverage rates to achieve specified catch targets in this action are shown in bold.

Observer Rate	50% trips		70% trips		75% trips		90% trips	
Catch Target	**25% catch**	50% catch	**50% catch**	75% catch	50% catch	75% catch	**75% catch**	90% catch
Proportion of simulations meeting catch target	**0.93**	0.47	**0.89**	0.43	0.97	0.54	**0.92**	.65

Impacts Analysis

Compliance: The risk of non-compliance with ASM based on a fixed percentage of catch depends on the coverage rate selected. Because the compliance score depends on both the opportunity to be noncompliant and the economic incentives for noncompliance, there is less compliance risk for violations at sea when the coverage rate is higher. However, the risk for noncompliance at 50% observer coverage might be more similar to the risk of noncompliance at 25% observer coverage because of the incentive effect. That is, the incentive to misreport catch or landings may increase substantially if it means catch of certain stocks is more constraining some proportion of the time. For example, if 50% of the time catch limits are more binding since an observer is onboard, fishermen may fish differently, or pay higher prices to lease stocks that they may encounter, since they cannot as readily illegally discard. Therefore, if an observer is not onboard, the incentive to illegally discard, which includes the cost of quota, may be higher and just as, if not more catch may be discarded at this coverage rate as at the 25% coverage rate, when the incentive effect isn't as strong. At a 70% coverage level, a potentially strong incentive effect is counteracted by a lower opportunity. Now, only on a third of trips can quota costs be evaded, which limits the amount of potential illegal activity somewhat, but not entirely. Fishermen can strategically alter their pre-catch behavior depending on whether they have an observer onboard, to the extent that it is feasible, fishermen may choose to take longer trips or have more profitable trips when an observer is not onboard, however, it becomes much more difficult to maintain profitable business operations if it is dependent on illegal activity on a minority of trips. For these reasons, the compliance score is **'low' at 50% ASM coverage and medium at 70% coverage, which is conservative based on the assumption that illegal activity will be highly incentivized on the remainder of trips. Only between 90 to 100% coverage rate obtains a 'medium high' to 'high' compliance score**, since the opportunity is very low even though economic incentives are likely highest.

Relative to No Action, the impact of moving to any coverage rate to ensure at least a given of catch of all stocks is monitored coverage depends on the target CV coverage rate in any given year. Between FY 2010 and FY 2018, the ASM target coverage rate was between 8% and 30%, with the most recent five-year average being 13.2%, with combined NEFOP and ASM realized coverage rate being 22%. If future coverage rates are similar, slight to moderate increases in the percentage of at-sea monitoring coverage is expected to have a neutral effect on compliance, since the No Action, 25%, and 50% coverage levels all receive a 'low' compliance score. Major increases in at-sea coverage are expected to have positive impacts on compliance, as the risk for noncompliance decreases at 75% and is very low at 100% coverage, reflected in the compliance scores at these levels of coverage.

Enforceability: Enforceability is expected to scale somewhat linearly at different levels of at-sea observer coverage. NOAA OLE has recommended higher levels of at-sea observer coverage to improve compliance (Compliance Improvement Recommendations, Enforcement Committee Meeting July 2019) More information available to enforcement officials will support their ability to detect and prosecute violations. In addition, other types of information may also support their operations, for example, at more equal proportions of observer coverage differences in pre-catch behavior may be more readily identified, so that enforcement may better target their efforts on likely offenders**. The enforceability score at 50% is therefore 'low', 'medium' at 70%, 'medium-high' at 90%, and 'high' at 100% ASM coverage**.

Relative to No Action, the impact on enforceability of moving to a given coverage rate to achieve a percentage of catch standard depends on the target CV coverage rate in any given year. Between FY 2010 and FY 2018, the ASM target coverage rate was between 8% and 30%, with the most recent five-year average being 13.2%. If future coverage rates are similar, slight increases in the percentage of at-sea monitoring coverage is expected to have a neutral effect on enforceability, since the No Action and 25% coverage levels receive a ‘low’ compliance score. Increases in at-sea monitoring coverage are expected to have positive impacts on enforceability, as enforceability increases as the more monitoring reports and independently verified information is generated. At 50% coverage, there is expected to be a low positive impact on enforceability, a positive impact at 75%, and strongly positive impact at 100% coverage, reflected in the compliance scores at these levels of coverage.

7.5.3.1.3.1 Sub-option 3A – 25 percent

At a 50% target ASM coverage rate (25% catch target), fleet-wide ASM costs are estimated to be between $3.24 and $3.54 mil. Static costs under sub-option 2B are estimated to differ from the No Action at 22% coverage by $1.97 mil, and from the No Action at 13% coverage by $2.61 mil.

Fishery impacts are estimated using the QCM. The dynamically-estimated ASM cost for sub-option 3A is $3.3 mil, slightly lower than the midpoint of the low and high static estimates ($3.39). Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $0.2 mil, but reducing operating profits by $-3.1 mil.

Sub-option 3A is estimated to generate fleet-wide gross revenues of $71.1 mil, slightly lower than those estimated at 22% coverage ($71.3 mil) and $0.2 mil higher than the Status Quo. Relative to the No Action at 13% coverage, revenues differ by $0.3 mil.

Revenues are not as important to fisherman as operating profits, and the higher gross revenues predicted under the 50% coverage sub-option are eroded by higher operating costs. Operating profits are estimated at $48.2 mil, lower than profits estimated for the Status Quo ($51.3 mil), the No Action at 13% coverage ($50.4 mil), and the No Action at 22% ASM ($50.2 mil). Operating profits differ from sub-option 2A (25% coverage) by $-2 mil. If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

Static costs and dynamic impacts are not uniformly distributed across the groundfish fleet, signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be more negative on individual vessels, particularly since opportunities for cost-efficiencies may be limited under 25% coverage (i.e., ASM serve as the DSM).

Compliance: For the reasons described above, **the compliance score is ‘low’ at 25% of catch (50% ASM coverage).**

Enforceability: For the reasons described above, **the enforceability score at 25% of catch (50% ASM coverage) is therefore ‘low’.**

Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

7.5.3.1.3.2 Sub-option 3B – 50 percent

70% ASM coverage is estimated to be needed to meet a 50% catch target for the groundfish fishery under Sub-Option 3B. ASM costs are estimated to be between $4.3 million and $4.8 million per fishing year, based on 2018 effort. No Action at 13% ASM coverage is expected to cost $.9 million per year, therefore, costs under this option would increase by approximately $4.4 million dollars, when static fleetwide costs are estimated. Dynamically estimated costs and revenues may decrease net economic impacts when potential increases in revenue are considered. Under 75% coverage, an additional $1.4 million dollars in revenue is generated, offsetting increased costs, revenue generation may be similar under sub-option 3B. If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

Static costs and dynamic impacts are not uniformly distributed across the groundfish fleet, signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be slightly negative on individual vessels, but may be attenuated since opportunities for cost-efficiencies may exist 75% coverage (i.e., ASM serve as the DSM).

Compliance: For the reasons described above, **the compliance score is 'medium' at 50% of catch (70% ASM coverage).**

Enforceability: For the reasons described above, **the enforceability score at 50% of catch (70% ASM coverage) is 'medium'.**

Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

7.5.3.1.3.3 Sub-option 3C – 75 percent

90% ASM coverage is estimated to be needed to meet a 75% catch target is estimated to be very similar to costs estimated at 91% ASM coverage to account for SBRM-mandated NEFOP coverage, which has averaged ~9% over the past eight years. As previously stated, this analysis makes no attempt to estimate and account for sector's SBRM fleet composition.

Fishery impacts are estimated using the QCM. The dynamically-estimated ASM cost for sub-option 3D is $5.5 mil, slightly lower than the midpoint of the low and high static estimates ($5.72). Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $0.1 mil, but reducing aggregate operating profits by $-5.1 mil.

Sub-option 3D is estimated to generate fleet-wide gross revenues of $71 mil, lower than those estimated at 22% coverage ($71.3 mil) and $0.1 mil higher than the Status Quo. Relative to the No Action at 13% coverage, revenues differ by $0.2 mil.

Revenues are not as important to fisherman as operating profits, and the higher gross revenues predicted under the 91% coverage sub-option are eroded by higher operating costs. Operating profits are estimated at $46.2 mil, lower than profits estimated for the Status Quo ($51.3 mil), the No Action at 13% coverage ($50.4 mil), and the No Action at 22% ASM ($50.2 mil). Operating profits differ from sub-option 3A (25% coverage) by $-4 mil, and from sub-option 3B (50% coverage) by $-2 mil. If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

Static costs and dynamic impacts are not uniformly distributed across the groundfish fleet, signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be more negative on individual vessels, however, opportunities for cost-efficiencies may exist under 90% coverage (i.e., when the ASM serves as the DSM).

Compliance: For the reasons described above, **the compliance score is 'medium-high' at 75% of catch (90% ASM coverage).**

Enforceability: For the reasons described above, **the enforceability score at 75% of catch (90% ASM coverage) is 'medium-high'.**

Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

7.5.3.1.3.4 Sub-option 3D – 100 percent

Monitoring 100% catch is estimated to require 91% ASM coverage to account for SBRM-mandated NEFOP coverage, which has averaged ~9% over the past eight years. As previously stated, this analysis makes no attempt to estimate and account for sector's SBRM fleet composition.

Fishery impacts are estimated using the QCM. The dynamically-estimated ASM cost for sub-option 3D is $5.5 mil, slightly lower than the midpoint of the low and high static estimates ($5.72). Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $0.1 mil, but reducing aggregate operating profits by $-5.1 mil.

Sub-option 3D is estimated to generate fleet-wide gross revenues of $71 mil, lower than those estimated at 22% coverage ($71.3 mil) and $0.1 mil higher than the Status Quo. Relative to the No Action at 13% coverage, revenues differ by $0.2 mil.

Revenues are not as important to fisherman as operating profits, and the higher gross revenues predicted under the 91% coverage sub-option are eroded by higher operating costs. Operating profits are estimated at $46.2 mil, lower than profits estimated for the Status Quo ($51.3 mil), the No Action at 13% coverage ($50.4 mil), and the No Action at 22% ASM ($50.2 mil). Operating profits differ from sub-option 3A (25% coverage) by $-4 mil, and from sub-option 3B (50% coverage) by $-2 mil. If monitoring costs

continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

Static costs and dynamic impacts are not uniformly distributed across the groundfish fleet signifying that distributional impacts across vessels may vary widely. In addition, if partial, or comprehensive dockside monitoring is also implemented in this action (under 7.5.4.1), combined economic impacts may be more negative on individual vessels, however, opportunities for cost-efficiencies may exist under 100% coverage (i.e., when the ASM serves as the DSM), in addition, combining high ASM coverage and DSM coverage gets the highest possible compliance and enforceability benefits for both shoreside and dockside components.

Compliance: For the reasons described above, **the compliance score is 'high' at 100% of catch (100% ASM coverage).**

Enforceability: For the reasons described above, **the enforceability score at 100% of catch (100% ASM coverage) is 'high'.**

Compliance and enforceability scores are indicators of economic benefits resulting from different levels of monitoring coverage levels, either at-sea or shoreside. Compliance related benefits include increased catch accounting, which decreases the risk that ACL exceedances occur and the degradation of long-run fishing revenue as a result of overharvesting. In addition, increased catch accounting ensures that appropriate price signals are sent through the ACE lease market, which affects participation decisions and incentives targeting and other efficient fishing practices, as well as ensuring those who lease out their ACE are compensated for the true opportunity cost of their ACE.

7.5.3.2 Sector Monitoring Tools (Options for meeting monitoring standards)

Sectors may select one or more of the following monitoring tools options to address monitoring requirements. These options are to be used as a substitute monitoring tool for at-sea monitors. The intent is to create a suite of monitoring options that are equivalent in their ability to accurately monitor total catch, and the focus is on two specific versions of electronic monitoring (EM): the Audit Model, and the Maximized Retention (MaxRet) Model. The Audit Model employs EM as a backstop, generating kept catch and discards from vessel captain's Vessel Trip Reports (VTRs) and checking the captain's estimates against estimates generated by film review. The Maximized Retention Model requires retaining and landing all regulated groundfish species with allocated ACE, regardless of fish size. Discards of zero-retention groundfish and non-groundfish species would be generated based on human observers (NEFOP or ASM, as yet to be determined[57]), who would be employed at a reduced rate.

[57] Currently the MaxRet program requires ASM coverage for monitoring discards of species not landed. This may or may not persist. These anlyses are based on federal funding for human observers required to deploy on vessels enrolled in the MaxRet program. If the ASM program is used to monitor discards under the MaxRet program and those ASM's are industry-funded, costs associated with this program will be higher than those estimated here.

The cost of these options, as well as the equivalence of the monitoring they provide, depends on many details, most of which would be finalized during the implementation phase with individual sectors and NMFS. However, who will be responsible for which components of EM costs, and when those costs are experienced, is a critical driver of program participation. Overall cost for both programs are driven primarily by two factors: equipment and installation, and the costs of video review. The MaxRet program has a dockside monitoring component, another primary cost driver.

The following assumptions were used in generating cost and impacts analyses for the EM options considered in this action. It is recognized that these assumptions may not play out in reality and different values for program review for example may be used if electronic monitoring tools are implemented in this action. These assumptions were informed in part by recent NMFS guidance on adequate electronic monitoring standards:

- review rates will decline over three years of a vessel's program participation, from 50% to 30% to 15% for the Audit model and 50%, 50% and 25% for the MaxRet model;
- vessels enroll in a program in year 1 and remain in the same program for all three years;
- costs vary by year, where year 1 costs include the cost of equipment and installation, and year 2 and 3 costs include only operations and maintenance;
- for the MaxRet model, dockside monitoring costs (DSM) are included and are estimated to be slightly higher than those estimated for the stand-alone DSM options due to the inclusion of monitoring sub-legal catch offloads; and,
- costs do not vary across ASM sub-options and review rates apply to 100% of a vessel's days absent[58].

In recognition of the fact that some portion of EM costs may be subsidized, **a second set of models estimate costs without including equipment and installation ("Subsidy")**, under the assumption that industry would only be required to pay for the operational costs of the programs. NMFS has reported that Congress included $10.3 million for groundfish at-sea monitoring in NMFS' 2018, 2019, and 2020 appropriations to support at-sea monitoring in the commercial groundfish fishery (see Section 6.6.10.3), so the subsidy run was developed to provide some information to show the potential magnitude of impact if federal funds are used to offset some of the initial costs of monitoring.

7.5.3.2.1 Sector Monitoring Tools Option 1: Electronic Monitoring in place of At-Sea Monitors

Sector costs and fishery impacts

This option would incorporate the components of the currently authorized fishery exemption program, which allows EM equipment to be installed on vessels and turned on in place of human observers when a vessel is selected for coverage through the PTNS, into the groundfish FMP. The benefits of this option to fisherman stem from potentially reduced costs associated with video review relative to an alternative where the equipment was operating on 100% of trips (Option 2 and 3). Depending on the ASM coverage level selected (25% - 100%), this option may be more costly than human observers as year one equipment and installation costs are approximately $10k per vessel. That equates to approximately 15-20 observed sea days. Then there is the cost of video review on selected trips. Because these vessels do not participate in EM full-time, their catch handling practices are reported to be less efficient than vessels enrolled in

[58] Option 1, EM in place of ASM, is not analyzed quantitatively.

full-time EM exempted fisheries and they require relatively more video review time. Video review can be anywhere from $150 to $700 per day.

If video review for these vessels were to average $400 per day, the Council would need to select an ASM level that induces more than approximately 35 observed sea days for vessels opting EM in place of ASM in order for this option to reduce costs.

The benefits stemming from improved monitoring of the fishery are, at best, neutral relative to any selected coverage level. Implementation may render this option less effective than human monitors if, say, review rates are implemented on a per-trip rather than per-haul or per-day-at-sea margin. For example, implementing a 15% video review rate as applied to trips implies that, under a scenario where a vessel was selected for observation on 35 single-day trips, only five days would be monitored. The "effective monitoring rate" associated with this option is linearly related to the video review rate selected for implementation.

Compliance and Enforceability

Compliance: Compliance scores for this alternative **are similar** to the scores given for the at-sea monitoring alternatives depending on the coverage rate (**ranging from low for 25% to high for 100%)**. At status quo levels of monitoring, risk of non-compliance may still be high if cameras are only turned on 20-30% of the time. When cameras are on, fishermen are expected to be incentivized to follow rules and regulations similar to when an observer is onboard. Compliance may be somewhat higher than with human monitors to the extent that the coverage of onboard activities (sorting, discarding) is higher than with human monitors (no missed hauls) and if a video record is believed to be stronger evidence of noncompliance than a human-based record, and therefore perceived to increase the likelihood of sanction. Relative to No Action, this alternative is expected to have a neutral effect on compliance if the at-sea target coverage level is not increased to at least 50% under Option 2, as that is the point when the risk for noncompliance decreases. At a 50% target coverage level, the risk for noncompliance decreases so there is a low positive increase on the risk for noncompliance. At 75% and 100% coverage levels there is a positive and strongly positive impact on the risk for noncompliance, respectively.

Enforceability: Enforceability scores of this sub-option **are similar** to the enforceability scores for equivalent levels of ASM coverage (**ranging from low to high**). At low levels of observer coverage, 0-25%, enforceability is 'low'. NOAA OLE supports EM implementation as means to improve compliance (Compliance Improvement Recommendations, Enforcement Committee Meeting July 2019). As mentioned for compliance, video records may potentially be more useful to enforcement than observer statements if video footage can reliably identify illegal practices. Relative to No Action, this alternative is expected to have a neutral impact on enforceability if the at-sea target coverage level is not increased beyond 25% under Option 2, a low positive impact if the coverage level is increased to 50%, and positive to strongly positive impact on enforceability if the coverage rate is increased to 75% or 100%, respectively.

7.5.3.2.2 A blended analysis of sector monitoring tool options 2 and 3 – Audit and Maximized Retention Electronic Monitoring Models

Overview

Sector Monitoring Tool Options 2 and 3 are analyzed together in a quantitative model and the results will be summarized in this section. These analyses were completed to illustrate the potential combined impacts of adopting both Audit model and maximum retention electronic monitoring options under consideration. The sections that follow will address the specific stand-alone costs of Option 2 separate from Option 3 (7.5.3.2.3 and 7.5.3.2.4 respectively).

These two EM options are voluntary equivalent substitutes for human observers (ASM) and a sector or vessel's decision to opt in to one of them will be driven by a combination of cost and preference. Generally, EM is a lower cost alternative to human observers when a vessel fishes more than 20 days a year. Below this threshold, the cost of equipment, installation, maintenance and video review combine to make human observers the more cost-effective option. Preferences matter greatly, however, and many sectors and vessels will not opt into the option that has the lowest cost due to a preference for EM and/or human observers. These preferences may be driven by fishing practices such as high-volume fishing and long trips, or by vessel construction and equipment (i.e. an on deck conveyor for sorting catch). Even then, costs matter and a vessel paying for monitoring may develop new preferences if one option or the other can save tens of thousands of dollars.

Costs of the two EM options are estimated based on the Cost Efficiency model previously discussed. Three factors drive which vessels chose which programs: (1) EM costs for the Audit and MaxRet models; (2) individual preferences; and (3) the cost of the ASM alternative, which varies by the percent coverage option selected by the Council.

Individual preferences are not known, but vessel-level EM and ASM cost estimates are. Predictions of how many vessels may opt into each monitoring technology are based on cost, but because cost alone will not be the sole driver we analyze both the lowest possible cost and, using a different model, an "expected cost" estimate that is substantially higher than the lowest possible cost. This is intended as a proxy for unknowable individual preferences.

Because the EM costs vary by year, and are highest in the first year of the program[59], estimating which vessels are likely to opt into which programs based on cost requires an assumption about how costs that vary over time are likely to be experienced by fisherman. Table 137 summarizes the statically-determined total costs of each of the EM and ASM options, including the sub-options where EM equipment and installation costs are not borne by industry (subsidy scenario)[60].

Table 137 - Summary of all stand-alone aggregate static costs for each option under consideration (2018$, mil).

Option	Stand-alone Cost
ASM, 100%	5.72
ASM, 75%	4.89
ASM, 50%	3.39
ASM, 25%	1.72
Audit, Yr1	5.72
Audit, Yr1-Subsidy	2.68
Audit, Yr2	2.01
Audit, Yr3	1.23
MaxRet, Yr1	5.19
MaxRet, Yr1-Subsidy	2.15
MaxRet, Yr2	2.15
MaxRet, Yr3	1.82

[59] This is due to equipment purchases, installation and higher review rates in the first year.

[60] This is referred to as the "subsidy" option for both Audit and MaxRet.

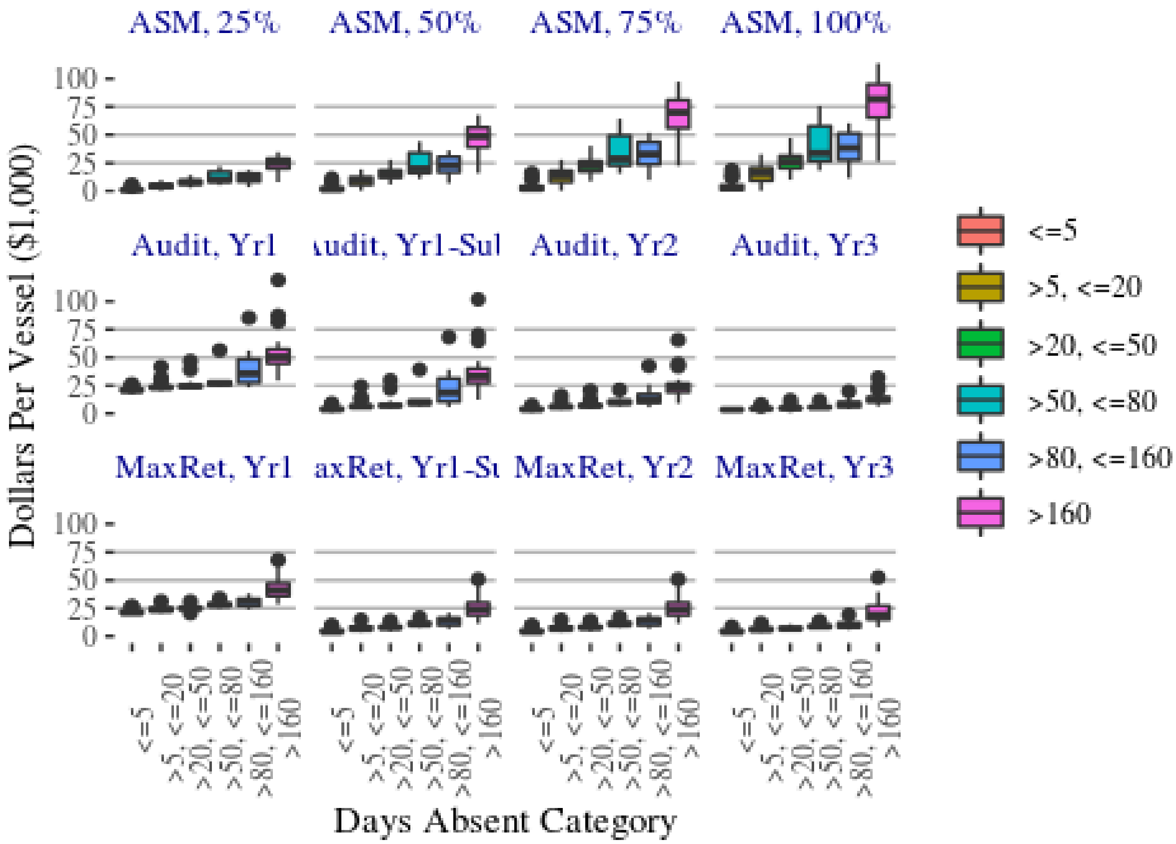
Equipment and installation costs in year 1 are roughly $2mil for both EM options. For the Audit model without subsidy, costs fall by $4.49mil over the three years. If sectors and owners are unable to smooth costs across these years and no subsidy emerges, under the 75% and 100% ASM options where human observer costs are roughly equivalent to EM costs, the number of vessels opting into an EM program may be substantially lower than it would be either under a subsidy scenario, or if financing is available to smooth costs over time. The ability to smooth costs, then, is a significant driver of EM program participation. Table 138 shows the aggregate static costs of the ASM options compared to those of the EM options, highlighting the difference between costs smoothed over three years and costs in year 1, as well as the influence of equipment and installation costs.

Table 138 - Comparison of stand-alone aggregate static costs for each option under consideration, based on either year 1 costs or 3-year average costs for EM the EM options (2018$, mil).

Cost Type	ASM Option	ASM Cost	Audit Cost	Audit Cost, Subsidy	MaxRet Cost	MaxRet Cost, Subsidy
Year 1	ASM, 100%	5.72	5.72	2.68	5.19	2.15
	ASM, 75%	4.89	5.72	2.68	5.19	2.15
	ASM, 50%	3.39	5.72	2.68	5.19	2.15
	ASM, 25%	1.72	5.72	2.68	5.19	2.15
3-Yr Avg	ASM, 100%	5.72	2.99	1.97	3.05	2.04
	ASM, 75%	4.89	2.99	1.97	3.05	2.04
	ASM, 50%	3.39	2.99	1.97	3.05	2.04
	ASM, 25%	1.72	2.99	1.97	3.05	2.04

Monitoring costs at the vessel level are primarily a function of groundfish fishing participation intensity, where the more days a vessel participates in the fishery, the higher their cost. The following figure summarizes vessel-level cost variability by days absent category and monitoring technology. This highlights the fact that vessels that do not fish much will have lower costs under human observers, while vessels that fish intensively will, for all coverage level options above 25%, experience lower costs under EM. Costs for MaxRet and Audit are roughly equal under most cases, however vessels that fish in high volumes may have higher MaxRet costs due to the mandated dockside monitoring, the costs of which scale linearly with landings.

Figure 48 - Annual cost of monitoring for the various options under consideration assuming 100% fleet-wide participation in each option, by days absent category (2018$, thousands).



Blended ASM and EM at the Low-Cost Frontier

One method for modeling vessel selection into one of the three monitoring technologies would simply estimate their annual cost for each technology and, assuming (a) complete vessel-level cost knowledge, and (b) no other preferences beyond cost, select each vessel into their lowest-cost technology. Such a model would represent the cost efficiency frontier, the lowest possible cost obtainable under each of the four ASM coverage options. This assumes the cost estimates are perfectly accurate, which is not likely. Keeping that in mind, a low-cost frontier model was developed using vessel level 3-year average costs for the two EM options relative to ASM costs across the four coverage level options. Table 139 summarizes the results of this model. Under this low-cost frontier model, the ability to choose from either of the two EM options reduces the cost of monitoring, with or without an EM subsidy, relative to ASM alone. At 50% coverage, an optimal selection of blended EM and ASM saves 36% over ASM alone without a subsidy, and 55% with equipment and installation subsidized. Total cost for comprehensive (100%) monitoring is $3.4 and $4.2 mil less expensive than ASM, without and with subsidy (a 59% and 73% reduction, respectively).

Table 139 - Comparison of blended ASM and EM costs at the cost-efficiency frontier (2018$, mil).

Subsidy	ASM	nVsls ASM	nVsls Aud	nVsls MaxR	Blend Cost	ASM Cost	$ Saved	% Saved	Yr1 Cost	Yr2 Cost	Yr3 Cost
0	ASM 25	156	17	6	1.67	1.72	0.05	3%	2.01	1.56	1.43
	ASM 50	86	63	30	2.19	3.39	1.21	36%	3.51	1.74	1.31
	ASM 75	62	81	36	2.30	4.89	2.59	53%	3.91	1.73	1.25
	ASM 100	54	87	38	2.33	5.72	3.39	59%	4.04	1.72	1.23
1	ASM 25	100	59	20	1.42	1.72	0.30	17%	1.64	1.49	1.14
	ASM 50	47	91	41	1.54	3.39	1.85	55%	1.83	1.64	1.14
	ASM 75	35	96	48	1.56	4.89	3.33	68%	1.85	1.66	1.16
	ASM 100	33	97	49	1.57	5.72	4.16	73%	1.86	1.67	1.17

Expected Value Model for Blended ASM and EM

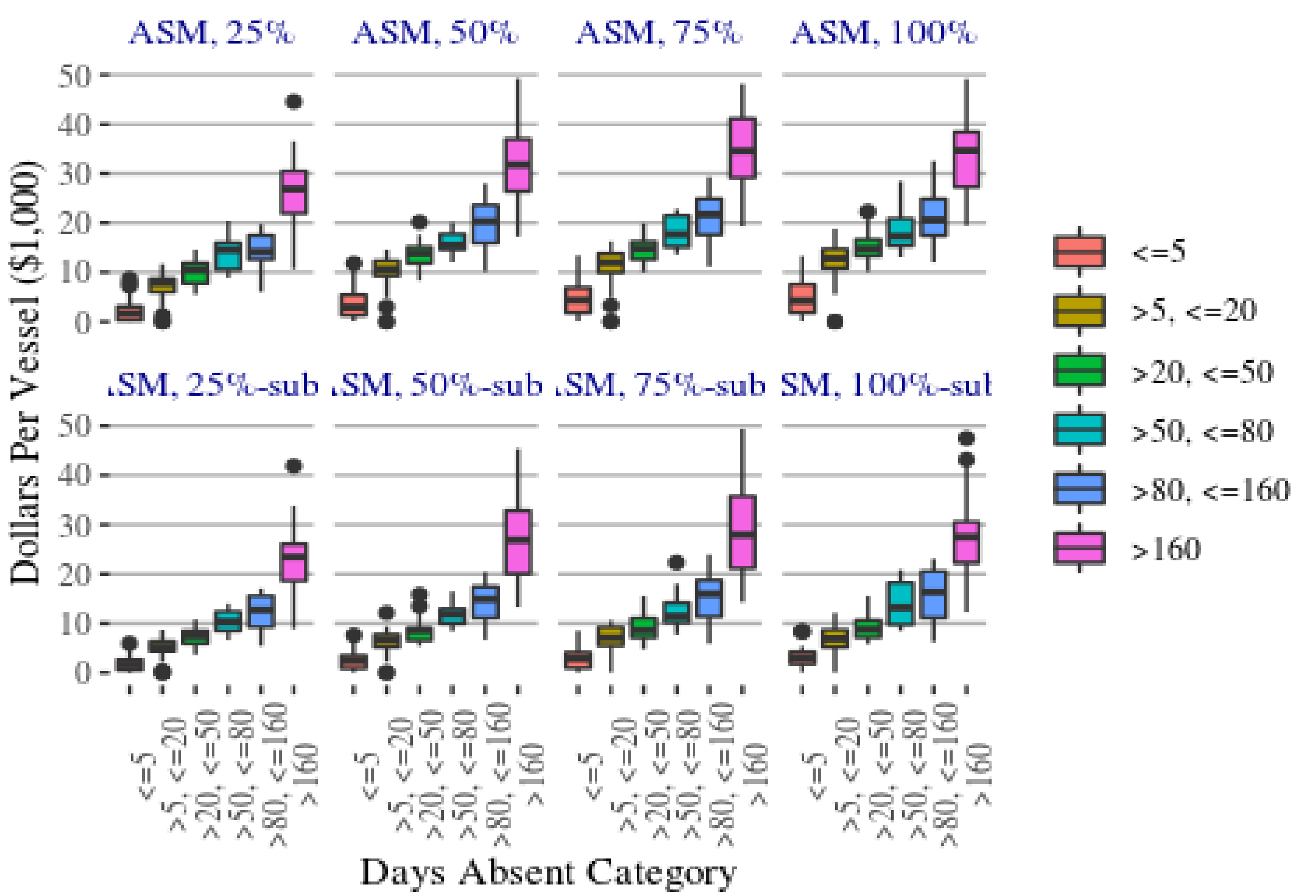
Selection into the different EM options will not be optimal because cost information is imperfect and preferences may over-ride cost considerations. To model a more realistic EM selection scenario we use weighted random sampling to estimate who may opt into which technology over the four different ASM coverage options. Sampling selection probability weights are a function of the vessel-level cost difference between the EM option and the relevant ASM coverage option. ASM weights are therefore always equal to one, while the EM weights may vary. For example, if ASM coverage is estimated to cost a vessel $10k annually, and the three year average Audit model cost is only $5k, the sampling weight for the Audit model would be (10 / 5) = 2, and the probability that this vessel would opt into the audit model is twice the probability that it would opt into ASM under these conditions. This same computation is made for MaxRet, and the sample is drawn from these three weights. This is replicated 10,000 times for each vessel, and estimates are presented based on replicate mean values. Table 140 reports expected values for blended ASM and EM costs. It is analogous to the preceding table (Table 139), but with weighted sampling to better represent preferences and imperfect information.

The expected values from this method are 0-13% higher than those at the low-cost frontier for an ASM coverage level of 25%, and anywhere from 30-50% higher at the higher coverage levels. If the 50% ASM coverage level is selected, blending EM will save between $0.81 and 1.45 mil fleet-wide relative to ASM alone (without and with subsidy, respectively). At comprehensive (100%) coverage, it will save between $2.55 and 3.32 mil. These savings are lower than those predicted by the low-cost efficiency frontier model, but they provide a more realistic estimate of likely costs. The expected value model provides the static costs reported here, and are the costs used in the QCM for estimating dynamic impacts.

Table 140 - Comparison of blended ASM and EM costs for the expected value model based on weighted sampling (2018$, mil).

Subsidy	ASM	nVsls ASM	nVsls Aud	nVsls MaxR	Blend Cost	ASM Cost	$ Saved	% Saved	Yr1 Cost	Yr2 Cost	Yr3 Cost
0	ASM 25	169	7	3	1.89	1.72	-0.17	-10%	1.94	1.73	1.67
	ASM 50	92	72	15	2.78	3.39	0.61	18%	4.34	2.17	1.58
	ASM 75	65	96	18	3.03	4.89	1.86	38%	5.00	2.19	1.50
	ASM 100	58	104	17	3.17	5.72	2.55	45%	5.27	2.23	1.51
1	ASM 25	117	49	13	1.51	1.72	0.21	12%	1.72	1.58	1.29
	ASM 50	54	105	20	2.10	3.39	1.29	38%	2.59	2.15	1.41
	ASM 75	36	120	23	2.28	4.89	2.61	53%	2.75	2.26	1.46
	ASM 100	33	125	21	2.31	5.72	3.42	60%	2.99	2.43	1.57

Figure 49 - Annual cost of monitoring under the blended expected value model, by days absent category (2018$, thousands).



Sector costs and fishery impacts

Table 141 - Table 172 summarize the static and dynamic results for the blended option, if both EM Audit and EM Max Ret are selected in this action and available to the fishery. The preceding tables give a sense of the assumed number of vessels that would opt into each program. These are based on imperfect information and the number of vessels that would actually opt into a particular program depends on many factors.

100% monitoring is estimated at 91% ASM coverage to account for SBRM-mandated NEFOP coverage, which has averaged ~9% over the past eight year. As previously stated, this analysis makes no attempt to estimate and account for sector's SBRM fleet composition and, further, does not include SBRM-mandated NEFOP coverage in the coverage rate target. These results, therefore, represent likely overestimates if NEFOP is to provide a portion of this coverage at no cost to industry.

<u>25% Coverage</u>

The dynamically-estimated monitoring cost when EM is a substitute for ASM under 25% coverage is $2 mil for the no-subsidy model, and with the subsidy $1.7 mil. Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $1.4 mil without subsidy and $1 mil with subsidy. Operating profits are reduced by $1 mil without subsidy, and $0.8 mil with subsidy, relative to the Status Quo.

<u>50% Coverage</u>

The dynamically-estimated monitoring cost when EM is a substitute for ASM under 50% coverage is $2.6 mil for the no-subsidy model, and with the subsidy $1.9 mil. Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $1.4 mil without subsidy and $0.9 mil with subsidy. Operating profits are reduced by $1.2 mil without subsidy, and $1.1 mil with subsidy, relative to the Status Quo.

<u>75% Coverage</u>

The dynamically-estimated monitoring cost when EM is a substitute for ASM under 75% coverage is $2.7 mil for the no-subsidy model, and with the subsidy $1.9 mil. Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $1.6 mil without subsidy and $0.1 mil with subsidy. Operating profits are reduced by $1.1 mil without subsidy, and $1.8 mil with subsidy, relative to the Status Quo.

<u>100% Coverage</u>

Noting that costs were estimated based on 91% ASM coverage, the dynamically-estimated monitoring cost when EM is a substitute for ASM under 100% coverage is $3.1 mil for the no-subsidy model, and with the subsidy $1.9 mil. Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $1.4 mil without subsidy and $0.1 mil with subsidy. Operating profits are reduced by $21.1 mil without subsidy, and $21.8 mil with subsidy, relative to the Status Quo.

Under the blended model, there is no cost difference between 50-percent and 75-percent coverage when there is no subsidy. With a subsidy, 50-, 75-, and 100-percent coverage have only minor cost and impact differences. This is because, as ASM costs rise with higher coverage targets, more vessels are likely to shift into lower-cost EM programs.

Table 141 - Expected static costs of monitoring under blended ASM and EM with 25% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	<=5	10	45	0.41	1.89	0.11	0.5	0.11	0.55
	>5, <=20	66	231	2.12	7.47	0.12	0.41	0.13	0.43
	>20, <=50	322	610	7	13.25	0.16	0.31	0.15	0.28
	>50, <=80	186	262	13.25	18.72	0.18	0.26	0.14	0.18
	>80,	562	883	14.79	23.24	0.37	0.58	0.14	0.24
	>160	476	642	23.79	32.09	0.63	0.85	0.14	0.21
-	*TOTAL*	*1,621*	*2,673*	-	-	-	-	-	-
1	<=5	8	41	0.34	1.72	0.09	0.45	0.11	0.51
	>5, <=20	79	148	2.55	4.76	0.14	0.26	0.15	0.26
	>20, <=50	263	389	5.71	8.46	0.13	0.2	0.12	0.17
	>50, <=80	144	204	10.29	14.57	0.14	0.2	0.09	0.15
	>80,	489	716	12.87	18.85	0.32	0.47	0.12	0.18
	>160	421	578	21.04	28.88	0.55	0.76	0.13	0.18
-	*TOTAL*	*1,404*	*2,076*	-	-	-	-	-	-

Table 142 - Expected static costs of monitoring under blended ASM and EM with 25% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	OTHER MA PORTS	126.4	250.1	6.02	11.91	0.23	0.45	0.14	0.3
	BOSTON	337.6	523.9	14.68	22.78	0.53	0.83	0.14	0.22
	CHATHAM	88.4	221.9	4.02	10.09	0.1	0.26	0.14	0.35
	GLOUCESTER	375.6	588.8	11.05	17.32	0.25	0.4	0.14	0.24
	NEW BEDFORD	240.9	313.9	18.53	24.15	0.76	0.99	0.14	0.2
	OTHER ME PORTS	77.9	136	5.99	10.46	0.17	0.29	0.14	0.24
	PORTLAND	112.8	164.6	12.54	18.29	0.77	1.13	0.16	0.25
	NH PORTS	111.3	189.6	9.28	15.8	0.19	0.32	0.15	0.24
	NY PORTS	25.6	53.6	5.11	10.72	0.13	0.28	0.16	0.33
	OTHER RI PORTS	8.9	30.8	2.98	10.27	0.56	1.93	0.11	0.41
	POINT JUDITH	93.2	160.1	5.48	9.42	0.15	0.25	0.14	0.24
	OTHER NORTHEAST	C	C	C	C	C	C	C	C
1	OTHER MA PORTS	112.4	165.9	5.35	7.9	0.2	0.3	0.12	0.19
	BOSTON	301.4	438.8	13.1	19.08	0.48	0.69	0.11	0.18
	CHATHAM	90.2	144	4.1	6.54	0.11	0.17	0.14	0.23
	GLOUCESTER	308.7	467.5	9.08	13.75	0.21	0.31	0.11	0.17
	NEW BEDFORD	205.8	288.3	15.83	22.18	0.65	0.91	0.12	0.18
	OTHER ME PORTS	68.4	96.8	5.26	7.45	0.14	0.21	0.12	0.17
	PORTLAND	102.4	125.9	11.38	13.99	0.7	0.86	0.14	0.19
	NH PORTS	86.8	138.2	7.24	11.52	0.15	0.24	0.11	0.17
	NY PORTS	22.2	31.8	4.43	6.37	0.12	0.17	0.14	0.2
	OTHER RI PORTS	9.6	22.9	3.2	7.64	0.6	1.43	0.13	0.48
	POINT JUDITH	74.2	113.9	4.36	6.7	0.12	0.18	0.11	0.17
	OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 143 - Expected static costs of monitoring under blended ASM and EM with 25% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	30'to<50'	522	1,002	5.73	11.01	0.15	0.29	0.14	0.28
	50'to<75'	526	877	9.73	16.24	0.31	0.51	0.14	0.24
	75'+	574	794	20.49	28.38	0.82	1.14	0.14	0.20
1	30'to<50'	438	680	4.82	7.48	0.13	0.19	0.12	0.19
	50'to<75'	449	690	8.32	12.78	0.26	0.40	0.11	0.18
	75'+	516	706	18.43	25.21	0.74	1.01	0.13	0.18

Table 144 - Expected static costs of monitoring under blended ASM and EM with 25% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	Sustainable Harvest Sector	433.4	611.5	18.06	25.48	0.75	1.06	0.14	0.22
	Northeast Fishery Sector II	301.6	465.3	12.06	18.61	0.23	0.35	0.14	0.22
	Northeast Fishery Sector XIII	137.9	221.1	9.19	14.74	0.56	0.9	0.14	0.26
	Georges Bank Cod Fixed Gear Sector	84.5	210.7	4.23	10.54	0.11	0.26	0.14	0.35
	Northeast Fishery Sector VI	125	208.4	17.86	29.78	0.87	1.46	0.15	0.24
	Northeast Fishery Sector XI	108.2	177.3	9.83	16.12	0.19	0.31	0.15	0.22
	Northeast Fishery Sector VIII	110	155.5	13.75	19.44	0.64	0.9	0.14	0.22
	Maine Coast Community Sector	77.5	150.9	5.17	10.06	0.23	0.45	0.14	0.32
	Northeast Fishery Sector V	85	146.5	5.67	9.77	0.12	0.21	0.15	0.25
	Sustainable Harvest Sector - Inshore	56.2	116.7	7.02	14.58	0.21	0.44	0.14	0.26
	Northeast Fishery Sector XII	51.9	73.5	7.41	10.5	0.13	0.19	0.14	0.2
	Northeast Fishery Sector III	19.5	63.8	2.44	7.97	0.12	0.38	0.14	0.46
	Northeast Fishery Sector X	6.2	37.8	0.89	5.4	0.08	0.48	0.09	0.57
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C
1	Sustainable Harvest Sector	392.5	543.3	16.36	22.64	0.68	0.94	0.13	0.19
	Northeast Fishery Sector II	244.3	373.8	9.77	14.95	0.19	0.28	0.11	0.16
	Northeast Fishery Sector XIII	120.2	182.9	8.02	12.19	0.49	0.74	0.12	0.21
	Northeast Fishery Sector VI	115.1	171.8	16.44	24.54	0.8	1.2	0.14	0.2
	Georges Bank Cod Fixed Gear Sector	85.4	137.8	4.27	6.89	0.11	0.17	0.14	0.23
	Northeast Fishery Sector XI	81.6	131.8	7.42	11.99	0.14	0.23	0.11	0.17
	Northeast Fishery Sector VIII	92.5	129.3	11.56	16.16	0.54	0.75	0.12	0.18
	Maine Coast Community Sector	76.6	99.4	5.11	6.62	0.23	0.29	0.14	0.2
	Northeast Fishery Sector V	65.6	97.9	4.37	6.52	0.1	0.14	0.11	0.17
	Sustainable Harvest Sector - Inshore	48.4	72.5	6.05	9.07	0.18	0.28	0.11	0.17
	Northeast Fishery Sector XII	34.3	51.1	4.9	7.3	0.09	0.13	0.09	0.14

Subsidy	Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
	Northeast Fishery Sector III	20.7	35.7	2.58	4.47	0.12	0.21	0.15	0.26
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
	Northeast Fishery Sector X	10.2	22	1.46	3.14	0.13	0.28	0.16	0.34
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 145 - Estimated dynamic impacts of monitoring under blended ASM and EM with 25% coverage, aggregate fleet totals by days absent category (2018$, mil, costs based on 3 year average for EM).

Subsidy	Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	<=5	0.2	0.0	0.1	0.1	54.8	0.0
	>5, <=20	1.8	0.1	0.5	1.1	65.3	-15.4
	>20, <=50	7.8	0.4	2.2	5.2	66.3	-7.1
	>50, <=80	6.4	0.2	2.2	4.0	62.2	-2.4
	>80, <=160	28.0	0.7	7.4	19.8	70.8	-2.5
	>160	28.1	0.6	7.3	20.1	71.8	1.0
	TOTAL	*72.3*	*2.0*	*19.7*	*50.3*	*69.6*	*-1.4*
1	<=5	0.2	0.0	0.1	0.1	62.9	0.0
	>5, <=20	1.8	0.1	0.5	1.2	67.4	-7.7
	>20, <=50	7.9	0.3	2.2	5.3	67.7	-5.4
	>50, <=80	6.6	0.2	2.3	4.2	63.0	2.4
	>80, <=160	28.2	0.6	7.5	20.1	71.1	-1.0
	>160	27.2	0.5	7.1	19.6	72.0	-1.5
	TOTAL	*71.9*	*1.7*	*19.7*	*50.5*	*70.2*	*-1.0*

Table 146 - Estimated dynamic impacts of monitoring under blended ASM and EM with 25% coverage, aggregate fleet totals by vessel home port (2018$, mil, costs based on 3 year average for EM).

Subsidy	Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	CT PORTS	0.2	0.0	0.0	0.1	75.4	0.0
	OTHER MA PORTS	5.6	0.2	1.8	3.6	64.4	-7.7
	BOSTON	16.9	0.4	4.7	11.7	69.4	-0.8
	CHATHAM	4.9	0.2	0.8	3.9	80.6	-2.5
	GLOUCESTER	16.6	0.5	4.4	11.8	70.8	-1.7
	NEW BEDFORD	12.1	0.3	3.7	8.1	67.1	2.5
	OTHER ME PORTS	2.1	0.1	0.7	1.3	62.4	-7.1
	PORTLAND	5.3	0.1	1.5	3.6	68.6	-10.0
	NH PORTS	2.1	0.1	0.7	1.3	62.3	-13.3
	NY PORTS	0.6	0.0	0.1	0.5	83.1	0.0
	OTHER RI PORTS	0.4	0.0	0.2	0.2	56.6	-33.3
	POINT JUDITH	2.3	0.1	0.6	1.6	68.8	-11.1
	OTHER NORTHEAST PORTS	C.0	C.0	C.0	C.0	C.0	0.0
1	CT PORTS	0.2	0.0	0.0	0.1	76.7	0.0
	OTHER MA PORTS	5.5	0.1	1.8	3.6	64.9	-7.7
	BOSTON	16.7	0.4	4.6	11.7	70.1	-0.8
	CHATHAM	4.8	0.1	0.8	3.9	80.9	-2.5
	GLOUCESTER	16.5	0.4	4.4	11.7	70.9	-2.5
	NEW BEDFORD	12.3	0.2	3.8	8.3	67.3	5.1
	OTHER ME PORTS	2.1	0.1	0.7	1.3	63.7	-7.1
	PORTLAND	5.3	0.1	1.5	3.7	69.5	-7.5
	NH PORTS	2.2	0.1	0.7	1.4	64.4	-6.7
	NY PORTS	0.6	0.0	0.1	0.5	84.9	0.0
	OTHER RI PORTS	0.4	0.0	0.2	0.2	57.7	-33.3
	POINT JUDITH	2.4	0.1	0.6	1.7	70.2	-5.6
	OTHER NORTHEAST PORTS	C.0	C.0	C.0	C.0	C.0	0.0

Table 147 - Estimated dynamic impacts of monitoring under blended ASM and EM with 25% coverage, aggregate fleet totals by vessel size class (2018$, mil, costs based on 3 year average for EM).

Subsidy	Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	30'to<50'	14.6	0.7	3.6	10.3	70.5	-6.4
	50'to<75'	24.1	0.7	6.0	17.4	72.1	0.0
	75'+	33.5	0.7	10.1	22.7	67.7	-0.9
1	30'to<50'	14.6	0.6	3.6	10.4	71.3	-5.5
	50'to<75'	24.0	0.6	6.0	17.4	72.6	0.0
	75'+	33.3	0.6	10.0	22.7	68.0	-0.9

Table 148 - Estimated dynamic impacts of monitoring under blended ASM and EM with 25% coverage, aggregate fleet totals by sector (2018$, mil, costs based on 3 year average for EM).

Subsidy	Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	Sustainable Harvest Sector	25.1	0.5	6.9	17.7	70.3	-0.6
	Northeast Fishery Sector II	14.9	0.4	3.8	10.7	71.9	0.0
	Northeast Fishery Sector VI	5.6	0.2	1.5	3.9	70.1	-2.5
	Northeast Fishery Sector XIII	5.6	0.2	2.0	3.5	61.4	0.0
	Northeast Fishery Sector VIII	5.2	0.1	1.5	3.5	68.2	-2.8
	Georges Bank Cod Fixed Gear	4.9	0.1	0.8	4.0	81.3	0.0
	Maine Coast Community Sector	2.5	0.1	0.7	1.7	67.6	-10.5
	Northeast Fishery Sector XI	2.1	0.1	0.6	1.3	62.7	-13.3
	Sustainable Harvest Sector - Inshore	2.0	0.1	0.7	1.1	57.7	-8.3
	Northeast Fishery Sector V	1.8	0.1	0.4	1.3	72.9	-7.1
	Northeast Fishery Sector XII	1.4	0.1	0.4	0.9	68.7	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.5	0.0	0.2	0.3	60.5	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.1	54.6	0.0
	Northeast Fishery Sector VII	C	C	C	C	C	0.0
1	Sustainable Harvest Sector	25.1	0.5	6.9	17.7	70.7	-0.6
	Northeast Fishery Sector II	14.6	0.3	3.8	10.5	72.0	-1.9
	Northeast Fishery Sector VI	5.2	0.1	1.4	3.7	70.1	-7.5
	Northeast Fishery Sector XIII	5.7	0.2	2.0	3.6	62.0	2.9
	Northeast Fishery Sector VIII	5.5	0.1	1.6	3.8	68.8	5.6
	Georges Bank Cod Fixed Gear	4.8	0.1	0.8	3.9	81.5	-2.5
	Maine Coast Community Sector	2.6	0.1	0.7	1.8	68.9	-5.3
	Northeast Fishery Sector XI	2.1	0.1	0.6	1.4	64.8	-6.7
	Sustainable Harvest Sector - Inshore	2.0	0.1	0.8	1.2	59.0	0.0
	Northeast Fishery Sector V	1.8	0.1	0.4	1.4	75.1	0.0
	Northeast Fishery Sector XII	1.3	0.0	0.4	0.9	70.0	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.5	0.0	0.2	0.3	62.4	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.1	57.7	0.0

Table 149 - Expected static costs of monitoring under blended ASM and EM with 50% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	<=5	15	85	0.61	3.53	0.16	0.93	0.18	1.01
	>5, <=20	150	287	4.83	9.26	0.26	0.5	0.29	0.53
	>20, <=50	474	677	10.31	14.72	0.24	0.35	0.23	0.31
	>50, <=80	197	323	14.06	23.07	0.19	0.31	0.12	0.23
	>80, <=160	666	1,037	17.52	27.29	0.44	0.68	0.18	0.29
	>160	463	789	23.17	39.46	0.61	1.04	0.15	0.24
-	*TOTAL*	*1,965*	*3,198*	-	-	-	-	-	-
1	<=5	21	62	0.86	2.59	0.23	0.68	0.26	0.74
	>5, <=20	110	167	3.54	5.38	0.19	0.29	0.2	0.3
	>20, <=50	218	490	4.75	10.65	0.11	0.25	0.1	0.21
	>50, <=80	106	238	7.54	17.04	0.1	0.23	0.06	0.17
	>80, <=160	426	887	11.2	23.34	0.28	0.58	0.11	0.22
	>160	371	794	18.57	39.68	0.49	1.05	0.11	0.24
-	*TOTAL*	*1,251*	*2,638*	-	-	-	-	-	-

Table 150 - Expected static costs of monitoring under blended ASM and EM with 50% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	OTHER MA PORTS	186.6	301.3	8.89	14.35	0.33	0.54	0.22	0.36
	BOSTON	371.1	633.5	16.14	27.54	0.59	1	0.15	0.28
	CHATHAM	178.9	251.7	8.13	11.44	0.21	0.3	0.28	0.4
	GLOUCESTER	425.7	698.6	12.52	20.55	0.29	0.47	0.17	0.3
	NEW BEDFORD	212.1	398.6	16.32	30.66	0.67	1.26	0.13	0.26
	OTHER ME PORTS	114.6	170.7	8.81	13.13	0.24	0.36	0.19	0.3
	PORTLAND	139	200.8	15.44	22.31	0.95	1.38	0.2	0.3
	NH PORTS	130.4	197.3	10.87	16.44	0.22	0.34	0.19	0.26
	NY PORTS	42.8	54.2	8.56	10.84	0.22	0.28	0.26	0.33
	OTHER RI PORTS	16	40.6	5.33	13.53	1	2.54	0.2	0.62
	POINT JUDITH	120.2	193.8	7.07	11.4	0.19	0.31	0.18	0.3
	OTHER NORTHEAST	C	C	C	C	C	C	C	C
1	OTHER MA PORTS	118.9	229.6	5.66	10.94	0.21	0.41	0.13	0.25
	BOSTON	288.3	588.1	12.54	25.57	0.46	0.93	0.1	0.23
	CHATHAM	106.2	173.7	4.83	7.89	0.12	0.2	0.17	0.28
	GLOUCESTER	231.3	550.3	6.8	16.19	0.16	0.37	0.09	0.2
	NEW BEDFORD	146.9	355.7	11.3	27.36	0.46	1.12	0.09	0.22
	OTHER ME PORTS	57.1	112.7	4.39	8.67	0.12	0.24	0.1	0.2
	PORTLAND	107.2	184.8	11.91	20.54	0.73	1.27	0.15	0.26
	NH PORTS	73.7	171.4	6.14	14.28	0.13	0.29	0.09	0.22
	NY PORTS	20.9	39.4	4.18	7.87	0.11	0.21	0.13	0.24
	OTHER RI PORTS	11.5	30.5	3.84	10.17	0.72	1.91	0.17	0.54
	POINT JUDITH	55.3	143.1	3.26	8.42	0.09	0.23	0.08	0.21
	OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 151 - Expected static costs of monitoring under blended ASM and EM with 50% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	30'to<50	748	1,182	8.22	12.98	0.21	0.34	0.21	0.34
	50'to<75	612	1,022	11.33	18.93	0.36	0.59	0.18	0.29
	75'+	604	994	21.59	35.49	0.86	1.42	0.15	0.25
1	30'to<50	420	804	4.61	8.84	0.12	0.23	0.12	0.22
	50'to<75	395	913	7.32	16.92	0.23	0.53	0.09	0.23
	75'+	436	920	15.57	32.86	0.62	1.32	0.11	0.24

Table 152 - Expected static costs of monitoring under blended ASM and EM with 50% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	Sustainable Harvest Sector	459.8	776.6	19.16	32.36	0.8	1.35	0.16	0.28
	Northeast Fishery Sector II	354.7	555.3	14.19	22.21	0.27	0.42	0.18	0.28
	Northeast Fishery Sector XIII	142.1	271.3	9.47	18.09	0.58	1.1	0.16	0.33
	Northeast Fishery Sector VI	160.9	244.5	22.99	34.93	1.13	1.71	0.19	0.28
	Georges Bank Cod Fixed Gear Sector	169	234.9	8.45	11.75	0.21	0.29	0.28	0.39
	Northeast Fishery Sector VIII	104.6	195.7	13.07	24.46	0.61	1.14	0.15	0.28
	Northeast Fishery Sector XI	116.3	186.7	10.57	16.97	0.2	0.33	0.16	0.25
	Maine Coast Community Sector	119.4	170.7	7.96	11.38	0.35	0.51	0.27	0.38
	Northeast Fishery Sector V	118	169.8	7.87	11.32	0.17	0.25	0.2	0.29
	Sustainable Harvest Sector - Inshore	81.1	128.5	10.14	16.06	0.31	0.49	0.17	0.3
	Northeast Fishery Sector XII	59.6	100.4	8.51	14.34	0.15	0.26	0.16	0.27
	Northeast Fishery Sector III	36.9	76.9	4.62	9.61	0.22	0.46	0.26	0.56
	Northeast Fishery Sector X	20.4	48	2.91	6.85	0.26	0.61	0.31	0.74
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C
1	Sustainable Harvest Sector	383.6	724	15.98	30.17	0.66	1.25	0.13	0.25
	Northeast Fishery Sector II	174.4	445.6	6.98	17.82	0.13	0.34	0.08	0.19
	Northeast Fishery Sector XIII	92.8	246.9	6.19	16.46	0.38	1	0.11	0.29
	Northeast Fishery Sector VI	118.2	238.4	16.88	34.06	0.83	1.67	0.14	0.28
	Georges Bank Cod Fixed Gear Sector	102.7	166.4	5.13	8.32	0.13	0.21	0.17	0.28
	Northeast Fishery Sector XI	63.7	165.9	5.79	15.08	0.11	0.29	0.07	0.21
	Northeast Fishery Sector VIII	63.8	161.8	7.97	20.22	0.37	0.94	0.09	0.22
	Northeast Fishery Sector V	51.2	118	3.42	7.86	0.07	0.17	0.09	0.2
	Maine Coast Community Sector	70.8	116.2	4.72	7.74	0.21	0.34	0.15	0.23
	Sustainable Harvest Sector - Inshore	48.1	97.5	6.01	12.19	0.18	0.37	0.1	0.24
	Northeast Fishery Sector XII	21.8	62.1	3.12	8.87	0.06	0.16	0.06	0.17
	Northeast Fishery Sector III	25.7	37.7	3.21	4.71	0.15	0.23	0.19	0.28
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C

Subsidy	Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
	Northeast Fishery Sector X	17.4	25.4	2.48	3.63	0.22	0.32	0.26	0.38
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 153 - Estimated dynamic impacts of monitoring under blended ASM and EM with 50% coverage, aggregate fleet totals by days absent category (2018$, mil, costs based on 3 year average for EM).

Subsidy	Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	<=5	0.2	0.0	0.1	0.1	50.8	0.0
	>5, <=20	1.7	0.2	0.4	1.1	63.8	-15.4
	>20, <=50	7.6	0.5	2.1	4.9	64.7	-12.5
	>50, <=80	6.3	0.3	2.2	3.8	61.4	-7.3
	>80, <=160	27.9	0.9	7.5	19.6	70.1	-3.4
	>160	28.6	0.7	7.4	20.6	71.9	3.5
	TOTAL	*72.3*	*2.6*	*19.7*	*50.1*	*69.3*	*-1.8*
1	<=5	0.2	0.0	0.0	0.1	54.8	0.0
	>5, <=20	1.8	0.1	0.5	1.2	67.0	-7.7
	>20, <=50	7.8	0.4	2.2	5.2	66.8	-7.1
	>50, <=80	6.4	0.2	2.2	4.0	62.8	-2.4
	>80, <=160	27.7	0.7	7.4	19.6	70.8	-3.4
	>160	27.9	0.5	7.3	20.1	71.9	1.0
	TOTAL	*71.8*	*1.9*	*19.6*	*50.2*	*69.9*	*-1.6*

Table 154 - Estimated dynamic impacts of monitoring under blended ASM and EM with 50% coverage, aggregate fleet totals by vessel home port (2018$, mil, costs based on 3 year average for EM).

Subsidy	Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	CT PORTS	0.2	0.0	0.0	0.1	75.5	0.0
	OTHER MA PORTS	5.6	0.2	1.8	3.6	64.3	-7.7
	BOSTON	16.8	0.5	4.6	11.7	69.5	-0.8
	CHATHAM	4.8	0.2	0.8	3.8	79.0	-5.0
	GLOUCESTER	16.3	0.5	4.3	11.4	70.0	-5.0
	NEW BEDFORD	12.4	0.3	3.8	8.4	67.2	6.3
	OTHER ME PORTS	2.1	0.1	0.7	1.3	60.7	-7.1
	PORTLAND	5.5	0.2	1.6	3.7	68.2	-7.5
	NH PORTS	2.2	0.2	0.7	1.4	61.3	-6.7
	NY PORTS	0.5	0.0	0.1	0.4	81.3	-20.0
	OTHER RI PORTS	0.3	0.0	0.1	0.2	58.6	-33.3
	POINT JUDITH	2.3	0.2	0.6	1.5	67.0	-16.7
	OTHER NORTHEAST PORTS	C	C	C	C	C	0.0
1	CT PORTS	0.2	0.0	0.0	0.1	75.0	0.0
	OTHER MA PORTS	5.8	0.2	1.8	3.7	65.0	-5.1
	BOSTON	16.8	0.4	4.7	11.7	69.6	-0.8
	CHATHAM	4.7	0.1	0.8	3.8	80.5	-5.0
	GLOUCESTER	15.9	0.4	4.2	11.3	71.0	-5.8
	NEW BEDFORD	12.6	0.3	3.8	8.4	67.3	6.3
	OTHER ME PORTS	2.0	0.1	0.7	1.3	63.8	-7.1
	PORTLAND	5.3	0.1	1.5	3.6	68.6	-10.0
	NH PORTS	2.1	0.1	0.7	1.3	62.7	-13.3
	NY PORTS	0.5	0.0	0.1	0.5	83.6	0.0
	OTHER RI PORTS	0.4	0.0	0.1	0.2	59.6	-33.3
	POINT JUDITH	2.3	0.1	0.6	1.6	70.2	-11.1
	OTHER NORTHEAST PORTS	C	C	C	C	C	0.0

Table 155 - Estimated dynamic impacts of monitoring under blended ASM and EM with 50% coverage, aggregate fleet totals by vessel size class (2018$, mil, costs based on 3 year average for EM).

Subsidy	Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	30'to<50'	14.6	0.9	3.6	10.1	69.2	-8.2
	50'to<75'	24.1	0.8	6.1	17.2	71.4	-1.1
	75'+	33.7	0.8	10.0	22.8	67.8	-0.4
1	30'to<50'	14.4	0.6	3.6	10.2	71.0	-7.3
	50'to<75'	23.8	0.6	6.0	17.2	72.4	-1.1
	75'+	33.6	0.7	10.1	22.7	67.8	-0.9

Table 156 - Estimated dynamic impacts of monitoring under blended ASM and EM with 50% coverage, aggregate fleet totals by sector (2018$, mil, costs based on 3 year average for EM).

Subsidy	Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	Sustainable Harvest Sector	25.5	0.6	6.9	18.0	70.5	1.1
	Northeast Fishery Sector II	14.4	0.4	3.7	10.3	71.1	-3.7
	Northeast Fishery Sector VI	5.6	0.2	1.5	3.9	69.3	-2.5
	Northeast Fishery Sector XIII	5.5	0.2	1.9	3.4	61.0	-2.9
	Northeast Fishery Sector VIII	5.6	0.1	1.6	3.8	68.1	5.6
	Georges Bank Cod Fixed Gear Sector	4.9	0.2	0.8	3.9	79.7	-2.5
	Maine Coast Community Sector	2.6	0.1	0.7	1.7	67.1	-10.5
	Northeast Fishery Sector XI	2.2	0.2	0.7	1.4	62.0	-6.7
	Sustainable Harvest Sector -	1.8	0.1	0.7	1.0	56.0	-16.7
	Northeast Fishery Sector V	1.8	0.1	0.4	1.3	71.1	-7.1
	Northeast Fishery Sector XII	1.3	0.1	0.4	0.9	67.4	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.4	0.0	0.1	0.3	60.9	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.0	48.0	-100.0
	Northeast Fishery Sector VII	C	C	C	C	C	0.0
1	Sustainable Harvest Sector	25.5	0.5	7.0	18.0	70.5	1.1
	Northeast Fishery Sector II	14.1	0.3	3.6	10.2	72.1	-4.7
	Northeast Fishery Sector VI	5.4	0.2	1.5	3.8	69.3	-5.0
	Northeast Fishery Sector XIII	5.7	0.2	2.0	3.5	61.7	0.0
	Northeast Fishery Sector VIII	5.5	0.1	1.6	3.7	68.3	2.8
	Georges Bank Cod Fixed Gear Sector	4.8	0.1	0.8	3.9	81.0	-2.5
	Maine Coast Community Sector	2.6	0.1	0.7	1.8	69.1	-5.3
	Northeast Fishery Sector XI	2.1	0.1	0.7	1.4	63.5	-6.7
	Sustainable Harvest Sector -	2.0	0.1	0.7	1.1	58.4	-8.3
	Northeast Fishery Sector V	1.8	0.1	0.4	1.3	74.3	-7.1
	Northeast Fishery Sector XII	1.3	0.1	0.4	0.9	69.7	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.5	0.0	0.2	0.3	61.4	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.1	52.6	0.0

Table 157 - Expected static costs of monitoring under blended ASM and EM with 75% coverage, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	<=5	20	117	0.84	4.88	0.22	1.29	0.26	1.4
	>5, <=20	193	305	6.21	9.84	0.34	0.53	0.36	0.56
	>20, <=50	448	765	9.73	16.62	0.23	0.39	0.21	0.35
	>50, <=80	151	402	10.76	28.71	0.15	0.39	0.09	0.29
	>80,	536	1,246	14.11	32.78	0.35	0.82	0.16	0.32
	>160	358	940	17.91	47	0.47	1.24	0.13	0.3
-	*TOTAL*	*1,706*	*3,774*	-	-	-	-	-	-
1	<=5	29	69	1.22	2.89	0.32	0.76	0.35	0.82
	>5, <=20	104	179	3.34	5.78	0.18	0.31	0.19	0.32
	>20, <=50	192	567	4.18	12.33	0.1	0.29	0.08	0.26
	>50, <=80	68	336	4.82	24.02	0.07	0.33	0.03	0.23
	>80,	312	1,010	8.22	26.57	0.21	0.66	0.08	0.26
	>160	251	939	12.55	46.95	0.33	1.24	0.07	0.29
-	*TOTAL*	*956*	*3,100*	-	-	-	-	-	-

Table 158 - Expected static costs of monitoring under blended ASM and EM with 75% coverage, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	OTHER MA PORTS	187.6	320.4	8.93	15.26	0.34	0.57	0.22	0.39
	BOSTON	302.5	750.3	13.15	32.62	0.48	1.19	0.12	0.32
	CHATHAM	194.5	265.5	8.84	12.07	0.23	0.31	0.31	0.42
	GLOUCESTER	358.4	822.8	10.54	24.2	0.24	0.55	0.15	0.34
	NEW BEDFORD	154.4	518.9	11.88	39.91	0.49	1.64	0.1	0.34
	OTHER ME PORTS	107.9	189.9	8.3	14.61	0.23	0.4	0.18	0.34
	PORTLAND	108	242.4	12	26.93	0.74	1.66	0.16	0.37
	NH PORTS	99.3	253.6	8.27	21.13	0.17	0.43	0.16	0.34
	NY PORTS	42	64.8	8.41	12.96	0.22	0.34	0.26	0.4
	OTHER RI PORTS	19.3	47.2	6.43	15.73	1.21	2.95	0.26	0.84
	POINT JUDITH	110.6	253.6	6.5	14.92	0.18	0.4	0.16	0.37
	OTHER NORTHEAST	C	C	C	C	C	C	C	C
1	OTHER MA PORTS	96.9	253.7	4.61	12.08	0.17	0.45	0.12	0.28
	BOSTON	213.3	645.4	9.27	28.06	0.34	1.02	0.07	0.26
	CHATHAM	91	215.3	4.13	9.79	0.11	0.25	0.15	0.34
	GLOUCESTER	162.2	642.5	4.77	18.9	0.11	0.43	0.06	0.24
	NEW BEDFORD	119	439.2	9.16	33.78	0.38	1.39	0.07	0.27
	OTHER ME PORTS	44.2	147.2	3.4	11.33	0.09	0.31	0.08	0.26
	PORTLAND	73.1	208.5	8.13	23.17	0.5	1.43	0.11	0.31
	NH PORTS	52.3	209.7	4.36	17.48	0.09	0.36	0.07	0.26
	NY PORTS	20.5	40.4	4.1	8.08	0.11	0.21	0.13	0.25
	OTHER RI PORTS	13.9	32.8	4.64	10.93	0.87	2.05	0.26	0.58
	POINT JUDITH	41.9	196.5	2.46	11.56	0.07	0.31	0.06	0.29
	OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 159 - Expected static costs of monitoring under blended ASM and EM with 75% coverage, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	30'to<50	700	1,326	7.69	14.58	0.20	0.38	0.21	0.38
	50'to<75	527	1,221	9.77	22.61	0.31	0.71	0.15	0.35
	75'+	478	1,227	17.08	43.83	0.68	1.76	0.12	0.32
1	30'to<50	327	992	3.59	10.90	0.09	0.28	0.09	0.27
	50'to<75	306	1,030	5.66	19.07	0.18	0.60	0.07	0.28
	75'+	323	1,079	11.55	38.54	0.46	1.54	0.08	0.28

Table 160 - Expected static costs of monitoring under blended ASM and EM with 75% coverage, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	Sustainable Harvest Sector	368.7	898.1	15.36	37.42	0.64	1.56	0.14	0.31
	Northeast Fishery Sector II	289.1	646.5	11.56	25.86	0.22	0.49	0.14	0.32
	Northeast Fishery Sector XIII	128.3	368.4	8.55	24.56	0.52	1.49	0.15	0.44
	Northeast Fishery Sector VI	135.2	295.6	19.31	42.22	0.95	2.07	0.16	0.35
	Georges Bank Cod Fixed Gear Sector	187	249.9	9.35	12.49	0.23	0.31	0.31	0.42
	Northeast Fishery Sector VIII	81.1	239.8	10.14	29.98	0.47	1.39	0.12	0.33
	Northeast Fishery Sector XI	89.4	237	8.13	21.55	0.16	0.42	0.14	0.32
	Northeast Fishery Sector V	105.9	208.8	7.06	13.92	0.15	0.3	0.18	0.35
	Maine Coast Community Sector	112.6	191.2	7.51	12.75	0.33	0.57	0.27	0.41
	Sustainable Harvest Sector - Inshore	80	145.6	10	18.19	0.3	0.55	0.17	0.34
	Northeast Fishery Sector XII	41.6	108.5	5.95	15.5	0.11	0.28	0.11	0.29
	Northeast Fishery Sector III	48.8	80.9	6.09	10.12	0.29	0.48	0.34	0.59
	Northeast Fishery Sector X	24.2	51	3.45	7.29	0.31	0.65	0.36	0.8
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C
1	Sustainable Harvest Sector	273.2	826.9	11.38	34.45	0.47	1.43	0.09	0.28
	Northeast Fishery Sector II	121.2	519.1	4.85	20.77	0.09	0.39	0.05	0.24
	Northeast Fishery Sector XIII	77.6	318.2	5.17	21.22	0.31	1.29	0.1	0.36
	Northeast Fishery Sector VI	93.4	240.9	13.34	34.42	0.65	1.68	0.11	0.28
	Northeast Fishery Sector XI	42.5	207.1	3.86	18.83	0.07	0.36	0.05	0.27
	Georges Bank Cod Fixed Gear Sector	89.2	203.4	4.46	10.17	0.11	0.25	0.15	0.34
	Northeast Fishery Sector VIII	58.7	168.4	7.34	21.05	0.34	0.98	0.08	0.24
	Maine Coast Community Sector	53.4	161.7	3.56	10.78	0.16	0.48	0.11	0.32
	Northeast Fishery Sector V	39.8	152.8	2.65	10.18	0.06	0.22	0.07	0.26
	Sustainable Harvest Sector - Inshore	40.4	124.3	5.04	15.53	0.15	0.47	0.09	0.29

Subsidy	Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
	Northeast Fishery Sector XII	13.1	81.8	1.87	11.69	0.03	0.21	0.03	0.22
	Northeast Fishery Sector III	23.7	36.6	2.96	4.57	0.14	0.22	0.17	0.26
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
	Northeast Fishery Sector X	16.8	26.9	2.4	3.84	0.21	0.34	0.25	0.41
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 161 - Estimated dynamic impacts of monitoring under blended ASM and EM with 75% coverage, aggregate fleet totals by days absent category (2018$, mil, costs based on 3 year average for EM).

Subsidy	Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	<=5	0.2	0.0	0.0	0.1	49.9	0.0
	>5, <=20	1.7	0.2	0.4	1.1	62.4	-15.4
	>20, <=50	7.5	0.6	2.1	4.9	64.7	-12.5
	>50, <=80	6.4	0.3	2.2	3.9	61.4	-4.9
	>80, <=160	27.7	0.9	7.4	19.4	70.1	-4.4
	>160	29.0	0.7	7.5	20.8	71.8	4.5
	TOTAL	*72.5*	*2.7*	*19.6*	*50.2*	*69.2*	*-1.6*
1	<=5	0.2	0.0	0.1	0.1	52.1	0.0
	>5, <=20	1.8	0.1	0.5	1.2	66.4	-7.7
	>20, <=50	8.0	0.4	2.3	5.3	66.8	-5.4
	>50, <=80	6.6	0.2	2.3	4.2	62.6	2.4
	>80, <=160	27.8	0.7	7.5	19.6	70.7	-3.4
	>160	26.6	0.5	6.9	19.1	71.9	-4.0
	TOTAL	*71.0*	*1.9*	*19.6*	*49.5*	*69.7*	*-2.9*

Table 162 - Estimated dynamic impacts of monitoring under blended ASM and EM with 75% coverage, aggregate fleet totals by vessel home port (2018$, mil, costs based on 3 year average for EM).

Subsidy	Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	CT PORTS	0.2	0.0	0.0	0.2	75.9	100.0
	OTHER MA PORTS	5.8	0.3	1.8	3.7	64.1	-5.1
	BOSTON	17.0	0.6	4.7	11.7	69.1	-0.8
	CHATHAM	4.8	0.2	0.8	3.7	78.7	-7.5
	GLOUCESTER	16.1	0.5	4.3	11.3	70.0	-5.8
	NEW BEDFORD	12.3	0.3	3.7	8.3	67.5	5.1
	OTHER ME PORTS	2.1	0.1	0.7	1.3	61.0	-7.1
	PORTLAND	5.5	0.2	1.6	3.8	68.2	-5.0
	NH PORTS	2.2	0.2	0.7	1.3	61.2	-13.3
	NY PORTS	0.5	0.0	0.1	0.4	80.1	-20.0
	OTHER RI PORTS	0.2	0.0	0.1	0.1	56.0	-66.7
	POINT JUDITH	2.3	0.2	0.6	1.6	67.2	-11.1
	OTHER NORTHEAST	C.0	C.0	C.0	C.0	C.0	0.0
1	CT PORTS	0.2	0.0	0.1	0.2	75.9	100.0
	OTHER MA PORTS	5.7	0.2	1.8	3.7	64.7	-5.1
	BOSTON	16.6	0.4	4.6	11.6	69.8	-1.7
	CHATHAM	4.8	0.2	0.8	3.9	80.5	-2.5
	GLOUCESTER	16.2	0.4	4.4	11.5	70.5	-4.2
	NEW BEDFORD	11.9	0.3	3.7	8.0	67.0	1.3
	OTHER ME PORTS	2.1	0.1	0.7	1.3	63.7	-7.1
	PORTLAND	5.3	0.1	1.5	3.6	68.6	-10.0
	NH PORTS	2.2	0.1	0.7	1.4	63.5	-6.7
	NY PORTS	0.6	0.0	0.1	0.5	83.9	0.0
	OTHER RI PORTS	0.5	0.0	0.2	0.3	58.2	0.0
	POINT JUDITH	2.2	0.1	0.6	1.6	69.7	-11.1
	OTHER NORTHEAST	C.0	C.0	C.0	C.0	C.0	0.0

Table 163 - Estimated dynamic impacts of monitoring under blended ASM and EM with 75% coverage, aggregate fleet totals by vessel size class (2018$, mil, costs based on 3 year average for EM).

Subsidy	Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	30'to<50'	14.4	1.0	3.5	9.9	68.7	-10.0
	50'to<75'	24.1	0.9	6.0	17.2	71.5	-1.1
	75'+	33.9	0.8	10.1	23.0	67.8	0.4
1	30'to<50'	14.8	0.7	3.7	10.5	70.9	-4.5
	50'to<75'	23.2	0.6	5.9	16.7	72.1	-4.0
	75'+	33.0	0.7	9.9	22.3	67.7	-2.6

Table 164 - Estimated dynamic impacts of monitoring under blended ASM and EM with 75% coverage, aggregate fleet totals by sector (2018$, mil, costs based on 3 year average for EM).

Subsidy	Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	Sustainable Harvest Sector	26.5	0.7	7.2	18.6	70.4	4.5
	Northeast Fishery Sector II	14.3	0.4	3.7	10.2	71.1	-4.7
	Northeast Fishery Sector VI	5.6	0.2	1.5	3.9	69.0	-2.5
	Northeast Fishery Sector XIII	5.2	0.2	1.8	3.2	61.0	-8.6
	Northeast Fishery Sector VIII	5.3	0.2	1.6	3.6	68.0	0.0
	Georges Bank Cod Fixed Gear Sector	4.8	0.2	0.8	3.8	79.3	-5.0
	Maine Coast Community Sector	2.6	0.2	0.7	1.7	66.9	-10.5
	Northeast Fishery Sector XI	2.2	0.2	0.7	1.4	61.9	-6.7
	Sustainable Harvest Sector - Inshore	1.9	0.1	0.7	1.0	56.0	-16.7
	Northeast Fishery Sector V	1.8	0.1	0.4	1.3	70.7	-7.1
	Northeast Fishery Sector XII	1.3	0.1	0.3	0.9	67.8	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.4	0.0	0.1	0.3	61.0	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.0	45.0	-100.0
1	Sustainable Harvest Sector	24.5	0.5	6.7	17.3	70.4	-2.8
	Northeast Fishery Sector II	14.3	0.3	3.7	10.3	71.7	-3.7
	Northeast Fishery Sector VI	5.4	0.2	1.5	3.8	69.3	-5.0
	Northeast Fishery Sector XIII	5.5	0.2	2.0	3.4	61.4	-2.9
	Northeast Fishery Sector VIII	5.3	0.1	1.5	3.6	68.2	0.0
	Georges Bank Cod Fixed Gear Sector	4.9	0.1	0.8	3.9	81.1	-2.5
	Maine Coast Community Sector	2.7	0.1	0.7	1.9	69.3	0.0
	Northeast Fishery Sector XI	2.2	0.1	0.7	1.4	64.0	-6.7
	Sustainable Harvest Sector - Inshore	2.0	0.1	0.8	1.1	58.3	-8.3
	Northeast Fishery Sector V	1.8	0.1	0.4	1.3	74.1	-7.1
	Northeast Fishery Sector XII	1.4	0.1	0.4	0.9	69.3	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.5	0.0	0.2	0.3	62.7	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.1	53.8	0.0
	Northeast Fishery Sector VII	C	C	C	C	C	0.0

Table 165 - Expected static costs of monitoring under blended ASM and EM with 100% coverage, by days absent category (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	<=5	38	140	1.59	5.82	0.42	1.53	0.47	1.68
	>5, <=20	220	344	7.11	11.11	0.39	0.6	0.41	0.64
	>20, <=50	503	866	10.94	18.82	0.26	0.44	0.23	0.4
	>50, <=80	172	435	12.3	31.1	0.17	0.42	0.11	0.31
	>80,	652	1,443	17.16	37.98	0.43	0.95	0.19	0.39
	>160	442	1,091	22.11	54.56	0.58	1.44	0.15	0.34
-	*TOTAL*	*2,029*	*4,320*	-	-	-	-	-	-
1	<=5	38	78	1.6	3.23	0.42	0.85	0.46	0.92
	>5, <=20	110	214	3.55	6.91	0.19	0.37	0.2	0.39
	>20, <=50	238	674	5.17	14.66	0.12	0.34	0.11	0.31
	>50, <=80	129	325	9.22	23.24	0.13	0.32	0.07	0.21
	>80,	458	1,156	12.06	30.42	0.3	0.76	0.12	0.29
	>160	335	1,047	16.77	52.33	0.44	1.38	0.11	0.31
-	*TOTAL*	*1,309*	*3,494*	-	-	-	-	-	-

Table 166 - Expected static costs of monitoring under blended ASM and EM with 100% coverage, by vessel home port (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	OTHER MA PORTS	198	404.4	9.43	19.26	0.35	0.72	0.25	0.48
	BOSTON	396.7	849.9	17.25	36.95	0.63	1.34	0.16	0.41
	CHATHAM	208.5	302.2	9.48	13.74	0.24	0.35	0.33	0.48
	GLOUCESTER	409.4	985.6	12.04	28.99	0.28	0.66	0.17	0.39
	NEW BEDFORD	220.7	521.5	16.98	40.12	0.7	1.65	0.14	0.33
	OTHER ME PORTS	120.3	209.5	9.25	16.11	0.25	0.44	0.21	0.36
	PORTLAND	116.6	271.8	12.96	30.2	0.8	1.86	0.18	0.41
	NH PORTS	131.7	275.8	10.97	22.98	0.22	0.47	0.18	0.4
	NY PORTS	48.3	69.8	9.65	13.96	0.25	0.37	0.3	0.43
	OTHER RI PORTS	23.2	52.2	7.73	17.41	1.45	3.26	0.33	0.93
	POINT JUDITH	125.3	286.2	7.37	16.84	0.2	0.46	0.19	0.41
	OTHER	C	C	C	C	C	C	C	C
1	OTHER MA PORTS	108.5	286	5.17	13.62	0.19	0.51	0.12	0.33
	BOSTON	248.8	822	10.82	35.74	0.39	1.3	0.12	0.29
	CHATHAM	111	242.2	5.04	11.01	0.13	0.28	0.18	0.39
	GLOUCESTER	267.8	675.8	7.88	19.88	0.18	0.45	0.11	0.25
	NEW BEDFORD	222	416.9	17.08	32.07	0.7	1.32	0.14	0.26
	OTHER ME PORTS	52.3	173.4	4.02	13.34	0.11	0.37	0.08	0.31
	PORTLAND	75.1	278.7	8.34	30.96	0.51	1.91	0.11	0.4
	NH PORTS	80.8	243.6	6.73	20.3	0.14	0.41	0.11	0.31
	NY PORTS	21.7	62.6	4.34	12.51	0.11	0.33	0.13	0.39
	OTHER RI PORTS	15	38.3	5	12.77	0.94	2.39	0.27	0.68
	POINT JUDITH	79.2	170.2	4.66	10.01	0.13	0.27	0.1	0.26
	OTHER	C	C	C	C	C	C	C	C

Table 167 - Expected static costs of monitoring under blended ASM and EM with 100% coverage, by vessel size class (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
0	30'to<50	815	1.509	8.95	16.58	0.23	0.43	0.24	0.44
	50'to<75	665	1,427	12.32	26.42	0.39	0.83	0.18	0.40
	75'+	549	1,384	19.59	49.42	0.78	1.98	0.14	0.36
1	30'to<50	446	1,110	4.91	12.19	0.13	0.32	0.13	0.31
	50'to<75	395	1,211	7.31	22.43	0.23	0.70	0.10	0.31
	75'+	468	1,173	16.70	41.90	0.67	1.68	0.12	0.30

Table 168 - Expected static costs of monitoring under blended ASM and EM with 100% coverage, by sector (91% coverage analyzed, 2018$, thousands. Low and high estimates are mean +/- one standard deviation, costs based on 3 year average for EM).

Subsidy	Sector	Fleet	Fleet	Vessel	Vessel	Trip	Trip	Day	Day
0	Sustainable Harvest Sector	449.1	1041.5	18.71	43.39	0.78	1.8	0.16	0.37
	Northeast Fishery Sector II	310.9	800.3	12.44	32.01	0.24	0.61	0.16	0.38
	Northeast Fishery Sector XIII	168	387	11.2	25.8	0.68	1.57	0.19	0.48
	Northeast Fishery Sector VI	157.9	357	22.56	51	1.1	2.5	0.19	0.42
	Georges Bank Cod Fixed Gear Sector	200.4	285.8	10.02	14.29	0.25	0.36	0.34	0.48
	Northeast Fishery Sector XI	118.3	255.1	10.75	23.19	0.21	0.45	0.16	0.37
	Northeast Fishery Sector VIII	104.9	243.8	13.11	30.48	0.61	1.42	0.15	0.34
	Northeast Fishery Sector V	123.9	228.2	8.26	15.21	0.18	0.33	0.21	0.38
	Maine Coast Community Sector	135.9	203.4	9.06	13.56	0.4	0.6	0.29	0.46
	Sustainable Harvest Sector - Inshore	89.6	165.7	11.2	20.71	0.34	0.63	0.19	0.39
	Northeast Fishery Sector XII	53.6	159.5	7.65	22.79	0.14	0.41	0.14	0.44
	Northeast Fishery Sector III	57.2	89	7.15	11.12	0.34	0.53	0.41	0.65
	Northeast Fishery Sector X	33	56.8	4.72	8.12	0.42	0.72	0.5	0.88
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C
1	Sustainable Harvest Sector	314.3	985.8	13.1	41.07	0.54	1.71	0.11	0.33
	Northeast Fishery Sector II	216.2	553.8	8.65	22.15	0.16	0.42	0.1	0.26
	Northeast Fishery Sector VI	94.1	318.5	13.44	45.5	0.66	2.23	0.11	0.38
	Northeast Fishery Sector XIII	163.9	276.5	10.93	18.43	0.66	1.12	0.17	0.33
	Georges Bank Cod Fixed Gear Sector	105.9	226.4	5.29	11.32	0.13	0.28	0.18	0.38
	Northeast Fishery Sector XI	73.8	216.8	6.71	19.71	0.13	0.38	0.1	0.27
	Northeast Fishery Sector VIII	82.8	207.7	10.35	25.96	0.48	1.21	0.11	0.29
	Maine Coast Community Sector	60.9	204.3	4.06	13.62	0.18	0.6	0.13	0.39
	Northeast Fishery Sector V	61.8	160.5	4.12	10.7	0.09	0.23	0.1	0.28
	Sustainable Harvest Sector - Inshore	41.1	137.8	5.14	17.23	0.16	0.52	0.09	0.32
	Northeast Fishery Sector XII	39.2	77	5.6	11	0.1	0.2	0.11	0.21
	Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
	Northeast Fishery Sector III	27.9	44.7	3.49	5.59	0.17	0.27	0.2	0.33
	Northeast Fishery Sector X	18.9	31.6	2.69	4.51	0.24	0.4	0.28	0.49
	Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 169 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage, aggregate fleet totals by days absent category (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	<=5	0.2	0.0	0.0	0.1	47.7	0.0
	>5, <=20	1.7	0.2	0.4	1.1	62.3	-15.4
	>20, <=50	7.7	0.7	2.1	4.9	63.6	-12.5
	>50, <=80	6.1	0.3	2.1	3.7	60.0	-9.8
	>80, <=160	28.1	1.1	7.5	19.6	69.6	-3.4
	>160	28.5	0.8	7.3	20.4	71.5	2.5
	TOTAL	*72.3*	*3.1*	*19.4*	*49.8*	*68.9*	*-2.4*
1	<=5	0.2	0.0	0.0	0.1	53.3	0.0
	>5, <=20	1.7	0.1	0.4	1.1	65.3	-15.4
	>20, <=50	7.8	0.4	2.2	5.1	65.9	-8.9
	>50, <=80	6.4	0.2	2.2	4.0	62.6	-2.4
	>80, <=160	27.8	0.9	7.4	19.5	70.1	-3.9
	>160	27.1	0.6	7.2	19.3	71.3	-3.0
	TOTAL	*71.0*	*2.2*	*19.4*	*49.1*	*69.2*	*-3.7*

Table 170 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage, aggregate fleet totals by vessel home port (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
	CT PORTS	0.2	0.0	0.0	0.1	76.6	0.0
	OTHER MA PORTS	5.7	0.3	1.8	3.7	63.7	-5.1
	BOSTON	17.1	0.6	4.7	11.8	68.9	0.0
	CHATHAM	4.9	0.3	0.8	3.8	78.0	-5.0
	GLOUCESTER	16.2	0.6	4.3	11.3	69.7	-5.8
	NEW BEDFORD	12.1	0.4	3.6	8.0	66.8	1.3
0	OTHER ME PORTS	2.1	0.2	0.7	1.2	59.8	-14.3
	PORTLAND	5.5	0.2	1.6	3.7	67.4	-7.5
	NH PORTS	2.2	0.2	0.7	1.3	59.9	-13.3
	NY PORTS	0.6	0.1	0.1	0.5	79.1	0.0
	OTHER RI PORTS	0.2	0.0	0.1	0.1	51.6	-66.7
	POINT JUDITH	2.3	0.2	0.6	1.5	65.0	-16.7
	OTHER NORTHEAST PORTS	C	C	C	C	C	0.0
	CT PORTS	0.2	0.0	0.0	0.2	76.5	100.0
	OTHER MA PORTS	5.7	0.2	1.8	3.6	64.3	-7.7
	BOSTON	16.3	0.5	4.5	11.2	69.0	-5.1
	CHATHAM	4.8	0.2	0.8	3.8	79.7	-5.0
	GLOUCESTER	16.1	0.5	4.3	11.3	70.2	-5.8
	NEW BEDFORD	12.0	0.3	3.7	8.0	66.4	1.3
1	OTHER ME PORTS	2.1	0.1	0.7	1.3	62.5	-7.1
	PORTLAND	5.5	0.2	1.6	3.8	68.4	-5.0
	NH PORTS	2.1	0.1	0.6	1.3	62.5	-13.3
	NY PORTS	0.6	0.0	0.1	0.5	83.1	0.0
	OTHER RI PORTS	0.3	0.0	0.1	0.2	56.1	-33.3
	POINT JUDITH	2.3	0.1	0.6	1.6	69.2	-11.1
	OTHER NORTHEAST PORTS	C	C	C	C	C	0.0

Table 171 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage, aggregate fleet totals by vessel size class (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
	30'to<50'	14.5	1.1	3.5	9.9	68.0	-10.0
0	50'to<75'	24.4	1.0	6.1	17.3	70.8	-0.6
	75'+	33.3	1.0	9.9	22.5	67.4	-1.7
	30'to<50'	14.5	0.8	3.6	10.2	70.1	-7.3
1	50'to<75'	23.3	0.7	5.9	16.7	71.7	-4.0
	75'+	33.1	0.9	10.0	22.2	67.2	-3.1

Table 172 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage, aggregate fleet totals by sector (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
0	Sustainable Harvest Sector	25.8	0.8	7.0	18.1	70.1	1.7
	Northeast Fishery Sector II	14.4	0.5	3.6	10.2	71.0	-4.7
	Northeast Fishery Sector VI	5.7	0.2	1.6	3.9	68.1	-2.5
	Northeast Fishery Sector XIII	5.3	0.3	1.9	3.1	59.7	-11.4
	Northeast Fishery Sector VIII	5.3	0.2	1.6	3.6	67.2	0.0
	Georges Bank Cod Fixed Gear Sector	4.9	0.3	0.8	3.9	78.9	-2.5
	Maine Coast Community Sector	2.7	0.2	0.7	1.7	65.9	-10.5
	Northeast Fishery Sector XI	2.2	0.2	0.7	1.3	60.4	-13.3
	Sustainable Harvest Sector - Inshore	1.9	0.1	0.7	1.0	55.2	-16.7
	Northeast Fishery Sector V	1.8	0.2	0.4	1.2	68.9	-14.3
	Northeast Fishery Sector XII	1.4	0.1	0.4	0.9	66.5	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.4	0.0	0.1	0.3	61.2	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.0	45.6	-100.0
1	Sustainable Harvest Sector	24.7	0.6	6.8	17.3	69.8	-2.8
	Northeast Fishery Sector II	14.3	0.4	3.7	10.2	71.4	-4.7
	Northeast Fishery Sector VI	5.5	0.2	1.5	3.8	69.1	-5.0
	Northeast Fishery Sector XIII	5.4	0.2	1.9	3.3	60.5	-5.7
	Northeast Fishery Sector VIII	5.4	0.2	1.6	3.7	67.8	2.8
	Georges Bank Cod Fixed Gear Sector	4.8	0.2	0.8	3.9	80.3	-2.5
	Maine Coast Community Sector	2.6	0.1	0.7	1.8	68.2	-5.3
	Northeast Fishery Sector XI	2.1	0.1	0.6	1.3	63.5	-13.3
	Sustainable Harvest Sector - Inshore	1.8	0.1	0.7	1.1	57.4	-8.3
	Northeast Fishery Sector V	1.8	0.1	0.4	1.3	73.5	-7.1
	Northeast Fishery Sector XII	1.3	0.1	0.3	0.9	68.3	-10.0
	Northeast Coastal Communities Sector	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.5	0.0	0.2	0.3	62.1	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.1	51.7	0.0

Compliance and Enforceability

Compliance: Because this sub-option would require video cameras to be on 100% of the time, with a subset of video footage reviewed, it is expected that risk of non-compliance is very low. This primarily stems from the fact that unlike when an observer is onboard, vessel operators do not know what portions of a trip will be reviewed, so deterrence is constant across trips. For these reasons, this sub-option has a

'high' compliance score. However, it should be noted that non-compliance is still possible, particularly if the review rate is low enough and operators perceive the probability of detection as low, as well as if video systems are focused on estimating discards, rather than landings, without dockside monitoring or another form of independent verification of landings, noncompliance dockside is still possible, and may have higher incentives for illegal activity under high levels ASM or under EM. Relative to No Action, this alternative would have a strongly positive impact on compliance if low to medium levels of coverage (25%-50%) are selected under Option 2, and a low positive impact if 75% is selected. If 100% coverage is selected under Option 1 or Option 2, this alternative would have a neutral impact on compliance, since even at fairly low review rates (10-15%), there is a constant deterrence since cameras are on 100% of the time, which results in a similar probability of detection as when an observer is onboard.

<u>Enforceability</u>: If cameras are situated as to provide full coverage of operations, video footage collected through the **audit model** could provide a great deal of information useful for enforcement about the frequency and quantity of illegal activity since more footage could be reviewed as a result of a report of suspected illegal behavior. NOAA OLE supports EM implementation as means to improve compliance (Compliance Improvement Recommendations, Enforcement Committee Meeting July 2019). For these reasons, this sub-option receives a **'high'** enforceability score. Relative to No Action, this sub-option would have a strongly positive impact on enforceability if low levels of coverage are selected under either Option 1 or Option 2, since it would greatly increase the quantity of information available for inquiry and investigation over status quo. If 100% ASM is selected under Option 1, then enforceability impacts may be relatively neutral, with some positive impacts if EM footage is stored longer, or generally is more useful for enforcement, than human-based observations. Relative to No Action, this alternative would have a strongly positive impact on enforceability if low levels of monitoring coverage are selected under Option 2 (25%), positive impact if medium levels of coverage are selected (50%), low positive impacts if medium-high levels of coverage are selected (75%), and neutral impacts if 100% coverage is selected.

For the **maximized retention model**, if cameras are situated and video recorded at sufficiently high resolution as to provide full coverage of operations, video footage could provide a great deal of information useful for enforcement about the frequency and quantity of illegal activity since more footage could be reviewed as a result of a report of suspected illegal behavior. NOAA OLE supports EM implementation as means to improve compliance (Compliance Improvement Recommendations, Enforcement Committee Meeting July 2019). For these reasons, this sub-option receives a **'high'** enforceability score. Relative to No Action, this alternative would have a strongly positive impact on enforceability if low levels of monitoring coverage are selected under Option 2 (25%), positive impact if medium levels of coverage are selected (50%), low positive impacts if medium-high levels of coverage are selected (75%), and neutral impacts if 100% coverage is selected.

7.5.3.2.3 Sector Monitoring Tools Option 2: Audit Model Electronic Monitoring Option (*Preferred Alternative*)

Sector costs and fishery impacts (Stand-alone Static costs)

This option would allow the Audit Model as an EM alternative to ASM. Vessels or sectors will opt in to the audit model based on its cost and their individual preference for EM in place of ASM. Costs are estimated as if every vessel were to opt into the Audit Model program. This is not a realistic assumption since vessels participating lightly in the groundfish fishery will likely opt to employ human observers at substantially lower cost. These cost estimates are presented for context alone.

EM under this option will cost between $4.9 and $6.5 million across the groundfish fleet during the first year if equipment and installation costs are not subsidized. Assuming subsidized equipment and installation costs results in a decline in year 1 EM costs to between $2.2 million and $3.1 million. EM costs are estimated to be between $1.5 to $2.5 million each year for the 2nd and 3rd year. Costs are lower in the 2nd and 3rd year as it is assumed that all equipment and installation costs are either paid by vessels or subsidized in year 1. If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy. Table 173 - Table 188 summarize the estimated static costs for the Audit EM option, first for year 1, followed by year 2, and finally year 3. Results are presented assuming some level of subsidy for monitoring costs, as well as no subsidy.

Annual vessel costs increase as groundfish participation increases, but costs per day absent are considerably higher for vessels that participate lightly. For example, vessel costs in the first year for those that fish between 80 and 160 days are estimated to be about 1 ½ times more than those that fish between 20 and 50 days, relative to ASM. Yet, vessel costs per day absent for vessels that fish between 20 and 50 days are almost 3 times higher than for those that fish between 80 and 160 days in the first year. Vessel costs per day absent decline significantly across all vessels in the 2nd and 3rd year as equipment and installation costs are assumed to be paid during year 1.

Total EM costs are highest for vessels with home ports in Gloucester and Boston and lowest for vessels with home ports in Connecticut and New York ports. EM costs by vessel, however, are highest in New Bedford and Boston ports and lowest in Point Judith and NY ports.

The Sustainable Harvest Sector and Northeast Fishery Sector II have the highest total EM costs while Northeast Fishery Sector X and Northeast Fishery Sector XII have the lowest total EM costs. The highest costs per vessel are from Northeast Fishery Sector VI and the lowest belong to Northeast Fishery Sector X. In terms of costs per day absent, Northeast Fishery Sector X is the highest and Northeast Fishery Sector VI is the lowest.

Table 173 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	424	560	17.69	23.31	8.9	11.73	9.12	12.02
>5. <=20	623	822	19.48	25.67	1.98	2.62	1.68	2.21
>20.	1.167	1.539	23.82	31.4	1.14	1.5	0.79	1.04
>50.	409	539	27.27	35.94	0.89	1.17	0.54	0.71
>80.	1.312	1.729	34.53	45.51	1.27	1.68	0.27	0.35
>160	C	1.317	47.57	62.7	1.4	1.85	0.22	0.29
TOTAL	*4.935*	*6.505*	-	-	-	-	-	-

Table 174 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
CT PORTS	46.9	62.1	23.46	31.07	0.94	1.25	4.24	5.62
OTHER MA PORTS	528.2	699.7	24.01	31.81	2.66	3.53	3.91	5.18
BOSTON	895.6	1186.4	38.94	51.58	3.25	4.31	1.42	1.88
CHATHAM	505.6	669.7	20.22	26.79	1.27	1.68	1.94	2.57
GLOUCESTER	899	1190.8	26.44	35.02	0.95	1.25	0.61	0.81
NEW BEDFORD	533.3	706.5	41.02	54.34	3.51	4.64	0.88	1.16
OTHER ME PORTS	271.2	359.3	20.86	27.64	2.21	2.93	1.3	1.72
PORTLAND	282.3	373.9	31.37	41.55	4.4	5.83	2.47	3.27
NH PORTS	356.4	472	29.7	39.34	1.35	1.78	1.17	1.55
NY PORTS	104.3	138.2	20.86	27.63	3.85	5.1	5.1	6.76
OTHER RI PORTS	101.8	134.9	33.95	44.97	6.94	9.2	2.24	2.97
POINT JUDITH	354.5	469.6	20.85	27.62	3.08	4.09	2.36	3.13
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 175 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	2,115	2,797	21.81	28.83	1.90	2.51	2.29	3.02
50'to<75'	1,588	2,100	29.41	38.89	3.09	4.08	1.83	2.42
75'+	1,223	1,617	43.67	57.74	2.60	3.43	0.47	0.63
TOTAL	4,927	6,513	NA	NA	NA	NA	NA	NA

Table 176 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest	885	1368.4	36.87	57.02	2.32	3.59	0.72	1.12
Northeast Fishery Sector II	608.4	940.7	24.34	37.63	0.75	1.17	0.43	0.66
Georges Bank Cod Fixed Gear Sector	450.1	696	18.76	29	0.83	1.28	1.9	2.94
Northeast Fishery Sector XIII	436.9	675.6	29.13	45.04	4.37	6.76	1.55	2.39
Northeast Fishery Sector VI	329.4	509.2	47.05	72.75	3.04	4.71	0.22	0.35
Northeast Fishery Sector XI	296.9	459.1	26.99	41.74	1.29	2	1.11	1.71
Maine Coast Community	287.9	445.2	19.19	29.68	3.07	4.74	1.99	3.08
Northeast Fishery Sector V	277.7	429.4	18.52	28.63	2.88	4.46	3	4.63
Northeast Fishery Sector VIII	228.6	353.5	28.58	44.19	1.23	1.91	0.52	0.8
Sustainable Harvest Sector -	196.6	304	24.58	38	2	3.09	1.4	2.17
Northeast Fishery Sector III	176.7	273.3	17.67	27.33	0.99	1.53	1.78	2.75
Northeast Fishery Sector XII	132.7	205.1	18.95	29.31	2.57	3.97	3.73	5.77
Northeast Fishery Sector X	118	182.4	16.85	26.05	4.37	6.76	7.63	11.8
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 177 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model and assuming subsidized equipment and installation costs, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	70	99	2.92	4.11	1.37	1.93	1.4	1.97
>5, <=20	152	214	4.76	6.7	0.5	0.7	0.4	0.57
>20, <=50	433	610	8.84	12.44	0.57	0.8	0.23	0.33
>50, <=80	181	255	12.06	16.98	0.42	0.59	0.22	0.3
>80, <=160	724	1,019	19.04	26.81	0.75	1.05	0.12	0.17
>160	663	933	31.56	44.43	0.95	1.34	0.11	0.16
TOTAL	*2,222*	*3,129*	-	-	-	-	-	-

Table 178 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model and assuming subsidized equipment and installation costs, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet	Fleet	Vessel	Vessel	Trip	Trip	Day	Day
CT PORTS	15.7	25.1	7.84	12.57	0.32	0.52	1.39	2.23
OTHER MA PORTS	184.8	296.4	8.4	13.47	0.6	0.96	0.65	1.05
BOSTON	497	797	21.61	34.65	1.47	2.36	0.29	0.46
CHATHAM	130.1	208.6	5.2	8.35	0.21	0.34	0.39	0.63
GLOUCESTER	358.8	575.4	10.55	16.92	0.35	0.56	0.14	0.22
NEW BEDFORD	304.2	487.9	23.4	37.53	1.16	1.86	0.21	0.33
OTHER ME PORTS	73.8	118.3	5.68	9.1	0.42	0.68	0.26	0.42
PORTLAND	133.9	214.8	14.88	23.87	1.16	1.86	0.39	0.63
NH PORTS	161.7	259.3	13.47	21.61	0.42	0.68	0.26	0.42
NY PORTS	27.4	43.9	5.48	8.79	0.57	0.92	0.75	1.2
OTHER RI PORTS	51.1	82	17.05	27.35	2.7	4.34	0.73	1.17
POINT JUDITH	92.5	148.4	5.44	8.73	0.52	0.83	0.37	0.59
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 179 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model and assuming subsidized equipment and installation costs, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	655	989	6.75	10.20	0.38	0.58	0.44	0.67
50'to<75'	731	1,104	13.54	20.45	0.90	1.35	0.33	0.50
75'+	746	1,126	26.63	40.23	1.44	2.17	0.16	0.25

Table 180 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of an Audit model and assuming subsidized equipment and installation costs, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet	Fleet	Vessel	Vessel	Trip	Trip	Day	Day
Sustainable Harvest Sector	614.4	814.4	25.6	33.93	1.2	1.59	0.19	0.25
Northeast Fishery Sector II	299.2	396.6	11.97	15.86	0.36	0.48	0.13	0.17
Northeast Fishery Sector VI	257.2	340.9	36.74	48.7	2.44	3.23	0.18	0.24
Northeast Fishery Sector XIII	256.3	339.7	17.09	22.65	1.81	2.4	0.43	0.57
Northeast Fishery Sector XI	164.7	218.3	14.97	19.85	0.49	0.65	0.29	0.38
Georges Bank Cod Fixed Gear Sector	146.4	194.1	6.1	8.09	0.2	0.27	0.49	0.65
Northeast Fishery Sector VIII	132.1	175.1	16.51	21.88	0.66	0.87	0.21	0.27
Maine Coast Community Sector	99.1	131.3	6.61	8.76	0.65	0.86	0.41	0.54
Sustainable Harvest Sector - Inshore	98.5	130.6	12.31	16.32	0.71	0.94	0.36	0.48
Northeast Fishery Sector V	83	110.1	5.53	7.34	0.53	0.7	0.55	0.73
Northeast Fishery Sector III	49.4	65.5	4.94	6.55	0.26	0.34	0.54	0.71
Northeast Fishery Sector XII	42.8	56.8	6.12	8.11	0.48	0.63	0.74	0.98
Northeast Fishery Sector X	27.6	36.6	3.94	5.22	0.81	1.08	1.36	1.8
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 181 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of an Audit model, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	62	102	2.57	4.27	1.21	2.01	1.24	2.06
>5, <=20	120	200	3.76	6.24	0.38	0.63	0.31	0.52
>20, <=50	316	525	6.45	10.72	0.36	0.6	0.19	0.32
>50, <=80	133	221	8.86	14.72	0.28	0.47	0.14	0.24
>80, <=160	478	794	12.58	20.9	0.47	0.77	0.09	0.14
>160	403	670	19.19	31.89	0.57	0.95	0.08	0.13
TOTAL	*1,512*	*2,512*	-	-	-	-	-	-

Table 182 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of an Audit model, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
CT PORTS	12.7	16.9	6.33	8.42	0.25	0.34	1.14	1.52
OTHER MA PORTS	152.5	203	6.93	9.23	0.54	0.72	0.67	0.89
BOSTON	379.9	505.6	16.52	21.98	1.14	1.52	0.28	0.37
CHATHAM	141.6	188.5	5.66	7.54	0.23	0.31	0.43	0.57
GLOUCESTER	313.2	416.8	9.21	12.26	0.3	0.4	0.14	0.19
NEW BEDFORD	243.7	324.2	18.74	24.94	0.99	1.32	0.19	0.25
OTHER ME PORTS	75.8	100.9	5.83	7.76	0.44	0.58	0.26	0.35
PORTLAND	106.3	141.4	11.81	15.72	1.02	1.35	0.42	0.56
NH PORTS	125.4	166.9	10.45	13.91	0.35	0.46	0.24	0.32
NY PORTS	25.5	34	5.1	6.79	0.61	0.81	0.8	1.07
OTHER RI PORTS	38.7	51.5	12.9	17.17	2.15	2.86	0.59	0.79
POINT JUDITH	92.6	123.2	5.45	7.25	0.55	0.74	0.41	0.54
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 183 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of an Audit model, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	595	806	6.13	8.31	0.36	0.49	0.44	0.59
50'to<75'	568	770	10.52	14.26	0.75	1.01	0.33	0.44
75'+	545	739	19.47	26.38	1.04	1.41	0.13	0.17

Table 184 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of an Audit model, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	389.3	563.9	16.22	23.49	0.79	1.15	0.15	0.21
Northeast Fishery Sector II	227.2	329.1	9.09	13.17	0.27	0.39	0.11	0.16
Northeast Fishery Sector XIII	169.3	245.2	11.29	16.35	1.28	1.85	0.34	0.49
Northeast Fishery Sector VI	160.6	232.6	22.94	33.23	1.5	2.17	0.11	0.16
Georges Bank Cod Fixed Gear	132.8	192.4	5.53	8.02	0.17	0.25	0.44	0.64
Northeast Fishery Sector XI	111.6	161.6	10.15	14.69	0.34	0.5	0.24	0.34
Northeast Fishery Sector VIII	103.7	150.1	12.96	18.76	0.51	0.73	0.16	0.23
Maine Coast Community Sector	84	121.7	5.6	8.11	0.59	0.86	0.37	0.54
Northeast Fishery Sector V	72.9	105.5	4.86	7.04	0.49	0.71	0.51	0.73
Sustainable Harvest Sector -	66.7	96.6	8.34	12.08	0.51	0.74	0.3	0.43
Northeast Fishery Sector III	41.7	60.4	4.17	6.04	0.22	0.32	0.43	0.62
Northeast Fishery Sector XII	39.6	57.4	5.66	8.2	0.44	0.64	0.69	1
Northeast Fishery Sector X	23.2	33.6	3.31	4.8	0.73	1.06	1.24	1.8
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 185 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of an Audit model, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	62	102	2.57	4.27	1.21	2.01	1.24	2.06
>5, <=20	120	200	3.76	6.24	0.38	0.63	0.31	0.52
>20, <=50	316	525	6.45	10.72	0.36	0.6	0.19	0.32
>50, <=80	133	221	8.86	14.72	0.28	0.47	0.14	0.24
>80, <=160	478	794	12.58	20.9	0.47	0.77	0.09	0.14
>160	403	670	19.19	31.89	0.57	0.95	0.08	0.13
TOTAL	*1,512*	*2,512*	-	-	-	-	-	-

Table 186 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of an Audit model, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
CT PORTS	8	11.8	4.02	5.91	0.16	0.24	0.73	1.07
OTHER MA PORTS	99.3	146.1	4.52	6.64	0.42	0.61	0.57	0.84
BOSTON	194.9	286.6	8.47	12.46	0.64	0.94	0.23	0.33
CHATHAM	89.7	132	3.59	5.28	0.2	0.29	0.32	0.46
GLOUCESTER	192.2	282.7	5.65	8.31	0.2	0.29	0.11	0.16
NEW BEDFORD	122.9	180.8	9.46	13.91	0.64	0.94	0.14	0.21
OTHER ME PORTS	51.8	76.1	3.98	5.85	0.37	0.54	0.22	0.32
PORTLAND	60.2	88.6	6.69	9.84	0.74	1.09	0.37	0.55
NH PORTS	71.9	105.8	6	8.82	0.23	0.34	0.18	0.27
NY PORTS	17.2	25.4	3.45	5.07	0.55	0.8	0.72	1.06
OTHER RI PORTS	20.4	30	6.8	10	1.27	1.86	0.38	0.55
POINT JUDITH	61.3	90.2	3.61	5.31	0.48	0.7	0.36	0.52
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 187 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of an Audit model, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	386	583	3.98	6.01	0.30	0.45	0.35	0.53
50'to<75'	314	474	5.82	8.78	0.51	0.78	0.27	0.41
75'+	284	428	10.13	15.30	0.55	0.83	0.08	0.12

Table 188 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of an Audit model, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	207.8	338.5	8.66	14.11	0.47	0.76	0.12	0.19
Northeast Fishery Sector II	134.6	219.2	5.38	8.77	0.17	0.27	0.08	0.13
Northeast Fishery Sector XIII	92	149.9	6.14	10	0.82	1.34	0.26	0.43
Georges Bank Cod Fixed Gear Sector	82.3	134	3.43	5.58	0.13	0.21	0.31	0.51
Northeast Fishery Sector VI	76.3	124.4	10.91	17.77	0.7	1.13	0.05	0.08
Northeast Fishery Sector XI	62.7	102.2	5.7	9.29	0.23	0.37	0.18	0.29
Maine Coast Community Sector	57.4	93.5	3.83	6.24	0.51	0.83	0.33	0.53
Northeast Fishery Sector VIII	53.7	87.4	6.71	10.93	0.27	0.45	0.11	0.18
Northeast Fishery Sector V	47.8	77.8	3.19	5.19	0.43	0.7	0.44	0.72
Sustainable Harvest Sector - Inshore	37.3	60.8	4.67	7.6	0.34	0.56	0.23	0.37
Northeast Fishery Sector III	31.3	51	3.13	5.1	0.18	0.29	0.32	0.52
Northeast Fishery Sector XII	23.9	39	3.42	5.57	0.38	0.62	0.57	0.93
Northeast Fishery Sector X	19.9	32.5	2.85	4.64	0.66	1.07	1.13	1.84
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Compliance and Enforceability

Compliance: Because this sub-option would require video cameras to be on 100% of the time, with a subset of video footage reviewed, it is expected that risk of non-compliance is very low. This primarily stems from the fact that unlike when an observer is onboard, vessel operators do not know what portions of a trip will be reviewed, so deterrence is constant across trips. For these reasons, this sub-option has a **'high'** compliance score. However, it should be noted that non-compliance is still possible, particularly if the review rate is low enough and operators perceive the probability of detection as low, as well as if video systems are focused on estimating discards, rather than landings, without dockside monitoring or another form of independent verification of landings, noncompliance dockside is still possible, and may have higher incentives for illegal activity under high levels ASM or under EM.

Relative to No Action, this alternative would have a strongly positive impact on compliance if low to medium levels of coverage (25%-50%) are selected under Option 2, and a low positive impact if 75% is selected. If 100% coverage is selected under Option 1 or Option 2, this alternative would have a neutral impact on compliance, since even at fairly low review rates (10-15%), there is a constant deterrence since cameras are on 100% of the time, which results in a similar probability of detection as when an observer is onboard.

Enforceability: If cameras are situated and high resolution as to provide full coverage of operations, video footage collected through the audit model could provide a great deal of information useful for enforcement about the frequency and quantity of illegal activity since more footage could be reviewed as a result of a report of suspected illegal behavior. NOAA OLE supports EM implementation as means to improve compliance (Compliance Improvement Recommendations, Enforcement Committee Meeting July 2019). For these reasons, this sub-option receives a **'high'** enforceability score. Relative to No Action, this sub-option would have a strongly positive impact on enforceability if low levels of coverage are selected under either Option 1 or Option 2, since it would greatly increase the quantity of information available for inquiry and investigation over status quo. If 100% ASM is selected under Option 1, then enforceability impacts may be relatively neutral, with some positive impacts if EM footage is stored longer, or generally is more useful for enforcement, than human-based observations.

Relative to No Action, this alternative would have a strongly positive impact on enforceability if low levels of monitoring coverage are selected under Option 2 (25%), positive impact if medium levels of coverage are selected (50%), low positive impacts if medium-high levels of coverage are selected (75%), and neutral impacts if 100% coverage is selected.

7.5.3.2.4 Sector Monitoring Tools Option 3: Maximized Retention Electronic Monitoring Option (*Preferred Alternative*)

Sector costs and fishery impacts (Stand-alone static costs)

This option would allow the Maximized Retention model as an EM alternative to ASM. Vessels or sectors will opt in to the MaxRet program based on its cost and their individual preference for EM in place of ASM. Costs are estimated as if every vessel were to opt into the MaxRet program. This is will not happen; vessels participating lightly in the groundfish fishery will likely opt to employ human observers at substantially lower cost. These cost estimates are presented for context alone.

EM under this option will cost between $3.9 and $6.5 million across the groundfish fleet during the first year if equipment and installation costs are not subsidized. Assuming subsidized equipment and installation costs results in a decline in year 1 EM costs to between $2.2 million and $3.1 million. EM costs are estimated to be between $1.7 to $2.6 million each year for the 2nd and 3rd year. Costs are lower in the 2nd and 3rd year as it is assumed that all equipment and installation costs are either paid by vessels or subsidized in year 1. If additional monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy. Table 189 - Table 204 summarize the estimated static costs for the Audit EM option, first for year 1, followed by year 2, and finally year 3. Results are presented assuming some level of subsidy for monitoring costs, as well as no subsidy.

Annual vessel costs increase as groundfish participation increases, but costs per day absent are considerably higher for vessels that participate lightly. For example, vessel costs in the first year for those that fish between 80 and 160 days are estimated to be about 3 1/2 times more than those that fish between 5 and 20 days. Yet, vessel costs per day absent for vessels that fish between 5 and 20 days are over 3 times higher than for those that fish between 80 and 160 days in the first year. Vessel costs per day absent decline significantly across all vessels in the 2nd and 3rd year as equipment and installation costs are assumed to be paid during year 1.

Total EM costs are highest for vessels with home ports in Gloucester and Boston and lowest for vessels with home ports in Connecticut and Rhode Island ports other than Point Judith. EM costs by vessel, however, are highest in New Bedford and Boston ports and lowest in Connecticut and Point Judith ports.

The Sustainable Harvest Sector and Northeast Fishery Sector II have the highest total EM costs while Northeast Fishery Sector X and Northeast Fishery Sector XII have the lowest total EM costs. The highest costs per vessel are from the Sustainable Harvest Sector and the lowest belong to Northeast Fishery Sector X. In terms of costs per day absent, Northeast Fishery Sector X is the highest and Northeast Fishery Sector VI is the lowest.

Table 189 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	386	632	16.1	26.35	8.33	13.63	8.55	14
>5, <=20	532	871	16.63	27.22	1.65	2.7	1.42	2.32
>20, <=50	930	1,522	18.98	31.06	0.72	1.17	0.69	1.13
>50, <=80	356	583	23.75	38.88	0.75	1.22	0.42	0.69
>80,	1,036	1,696	27.27	44.64	0.93	1.52	0.22	0.35
>160	699	1,144	33.27	54.46	0.96	1.58	0.18	0.29
TOTAL	*3,940*	*6,449*	-	-	-	-	-	-

Table 190 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
CT PORTS	44.5	51.2	22.24	25.61	0.88	1.02	4.07	4.68
OTHER MA PORTS	527.8	607.9	23.99	27.63	2.93	3.37	4.5	5.18
BOSTON	759.5	874.8	33.02	38.04	2.81	3.24	1.59	1.83
CHATHAM	582.3	670.7	23.29	26.83	1.38	1.6	2.16	2.49
GLOUCESTER	965.1	1111.6	28.39	32.69	0.98	1.13	0.66	0.76
NEW BEDFORD	450.4	518.8	34.65	39.91	3.53	4.07	0.93	1.08
OTHER ME PORTS	292.9	337.4	22.53	25.95	2.37	2.72	1.39	1.6
PORTLAND	279.2	321.6	31.02	35.73	5.13	5.91	3.05	3.52
NH PORTS	298.7	344	24.89	28.67	1.32	1.52	1.26	1.45
NY PORTS	113.1	130.2	22.62	26.05	4.29	4.94	5.69	6.55
OTHER RI PORTS	69	79.4	22.99	26.48	5.62	6.47	1.97	2.27
POINT JUDITH	382.3	440.3	22.49	25.9	3.33	3.83	2.58	2.97
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 191 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	1,866	2,927	19.24	30.17	1.77	2.78	2.16	3.39
50'to<75'	1,250	1,960	23.14	36.30	2.59	4.07	1.68	2.64
75'+	929	1,457	33.18	52.04	1.85	2.90	0.37	0.58

Table 192 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	740.3	1200.4	30.85	50.02	2.21	3.58	0.81	1.31
Northeast Fishery Sector II	615.3	997.7	24.61	39.91	0.73	1.19	0.42	0.68
Georges Bank Cod Fixed Gear Sector	466.2	756	19.43	31.5	0.84	1.36	1.94	3.14
Northeast Fishery Sector XIII	321	520.4	21.4	34.7	3.51	5.68	1.4	2.27
Northeast Fishery Sector V	276.4	448.2	18.43	29.88	2.86	4.64	2.98	4.83
Maine Coast Community Sector	270.2	438.1	18.01	29.2	2.95	4.79	1.92	3.12
Northeast Fishery Sector XI	229.2	371.6	20.84	33.79	1.15	1.86	1.09	1.77
Northeast Fishery Sector VI	210.1	340.7	30.01	48.67	1.73	2.8	0.13	0.2
Northeast Fishery Sector VIII	202.2	327.9	25.28	40.99	1.07	1.74	0.49	0.79
Northeast Fishery Sector III	163.6	265.3	16.36	26.53	0.93	1.51	1.62	2.63
Sustainable Harvest Sector - Inshore	158.6	257.2	19.83	32.15	1.73	2.81	1.31	2.13
Northeast Fishery Sector XII	137.6	223.1	19.66	31.88	2.75	4.46	3.91	6.34
Northeast Fishery Sector X	114.4	185.4	16.34	26.49	4.56	7.4	8.07	13.08
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 193 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring and assuming subsidized equipment and installation costs, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	81	123	3.36	5.12	1.83	2.79	1.89	2.88
>5, <=20	129	196	4.02	6.13	0.37	0.57	0.32	0.49
>20, <=50	313	476	6.38	9.72	0.24	0.37	0.22	0.33
>50, <=80	169	258	11.28	17.19	0.37	0.56	0.16	0.24
>80, <=160	568	866	14.94	22.78	0.51	0.78	0.1	0.15
>160	445	678	21.17	32.27	0.63	0.96	0.09	0.14
TOTAL	*1,704*	*2,597*	-	-	-	-	-	-

Table 194 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring and assuming subsidized equipment and installation costs, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
CT PORTS	11.8	15.6	5.92	7.8	0.24	0.31	1.08	1.42
OTHER MA PORTS	167.7	221.1	7.62	10.05	0.72	0.95	0.99	1.3
BOSTON	365	481.3	15.87	20.93	1.01	1.33	0.38	0.5
CHATHAM	179.7	236.8	7.19	9.47	0.25	0.33	0.5	0.67
GLOUCESTER	397.3	523.8	11.69	15.41	0.36	0.47	0.15	0.2
NEW BEDFORD	225	296.6	17.31	22.82	1.07	1.41	0.22	0.29
OTHER ME PORTS	82.8	109.1	6.37	8.39	0.45	0.59	0.27	0.36
PORTLAND	126.5	166.8	14.05	18.53	1.65	2.18	0.8	1.05
NH PORTS	101.5	133.8	8.45	11.15	0.35	0.46	0.29	0.38
NY PORTS	31.1	41	6.23	8.21	0.76	1.01	1	1.32
OTHER RI PORTS	19.3	25.5	6.44	8.49	1.29	1.7	0.4	0.53
POINT JUDITH	103.3	136.2	6.08	8.01	0.58	0.76	0.44	0.58
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 195 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring and assuming subsidized equipment and installation costs, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	646	880	6.65	9.07	0.47	0.64	0.57	0.78
50'to<75'	574	782	10.63	14.49	0.74	1.01	0.38	0.52
75'+	600	818	21.45	29.22	0.98	1.34	0.11	0.15

Table 196 - Estimated static costs of monitoring in Year 1 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring and assuming subsidized equipment and installation costs, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
Sustainable Harvest Sector	467.3	648.8	19.47	27.03	1.12	1.55	0.3	0.41
Northeast Fishery Sector II	318	441.5	12.72	17.66	0.35	0.49	0.13	0.18
Georges Bank Cod Fixed Gear	174.5	242.2	7.27	10.09	0.23	0.32	0.58	0.8
Northeast Fishery Sector XIII	136	188.8	9.07	12.59	0.95	1.32	0.31	0.43
Northeast Fishery Sector VI	129.9	180.3	18.56	25.76	1.03	1.42	0.07	0.1
Northeast Fishery Sector VIII	106.8	148.3	13.35	18.54	0.5	0.69	0.19	0.26
Northeast Fishery Sector XI	95.4	132.4	8.67	12.04	0.36	0.49	0.3	0.41
Northeast Fishery Sector V	88.1	122.3	5.88	8.16	0.58	0.8	0.61	0.85
Maine Coast Community Sector	86.1	119.5	5.74	7.97	0.6	0.84	0.39	0.54
Sustainable Harvest Sector - Inshore	60.4	83.9	7.55	10.48	0.46	0.64	0.3	0.41
Northeast Fishery Sector XII	51.3	71.2	7.33	10.18	0.74	1.03	1.04	1.44
Northeast Fishery Sector III	39.3	54.5	3.93	5.45	0.21	0.29	0.41	0.56
Northeast Fishery Sector X	26.6	37	3.81	5.28	1.14	1.59	2.04	2.83
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 197 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	77	127	3.21	5.27	1.75	2.87	1.81	2.97
>5, <=20	123	202	3.84	6.32	0.36	0.59	0.31	0.51
>20, <=50	298	490	6.09	10.01	0.23	0.38	0.21	0.34
>50, <=80	162	266	10.77	17.7	0.35	0.57	0.15	0.24
>80, <=160	542	891	14.27	23.45	0.49	0.8	0.09	0.15
>160	425	698	20.22	33.22	0.6	0.99	0.09	0.15
TOTAL	*1,627*	*2,673*	-	-	-	-	-	-

Table 198 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
CT PORTS	11.7	15.8	5.82	7.9	0.23	0.32	1.06	1.44
OTHER MA PORTS	165	223.8	7.5	10.18	0.71	0.96	0.97	1.32
BOSTON	359.1	487.2	15.61	21.18	0.99	1.34	0.37	0.5
CHATHAM	176.7	239.8	7.07	9.59	0.25	0.34	0.5	0.67
GLOUCESTER	390.9	530.3	11.5	15.6	0.35	0.47	0.15	0.2
NEW BEDFORD	221.3	300.3	17.03	23.1	1.05	1.43	0.22	0.29
OTHER ME PORTS	81.4	110.5	6.26	8.5	0.44	0.6	0.27	0.37
PORTLAND	124.4	168.8	13.83	18.76	1.63	2.21	0.78	1.06
NH PORTS	99.8	135.4	8.32	11.28	0.34	0.46	0.29	0.39
NY PORTS	30.6	41.5	6.13	8.31	0.75	1.02	0.99	1.34
OTHER RI PORTS	19	25.8	6.34	8.6	1.27	1.72	0.39	0.54
POINT JUDITH	101.6	137.9	5.98	8.11	0.57	0.77	0.43	0.59
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 199 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	622	903	6.41	9.31	0.45	0.66	0.55	0.80
50'to<75'	553	804	10.24	14.88	0.71	1.04	0.37	0.54
75'+	578	840	20.66	30.01	0.95	1.38	0.11	0.16

Table 200 - Estimated static costs of monitoring in Year 2 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet	Fleet	Vessel	Vessel	Trip	Trip	Day	Day
Sustainable Harvest Sector	503.9	612.2	21	25.51	1.2	1.46	0.32	0.39
Northeast Fishery Sector II	342.9	416.6	13.72	16.66	0.38	0.46	0.14	0.17
Georges Bank Cod Fixed Gear Sector	188.1	228.5	7.84	9.52	0.25	0.31	0.62	0.76
Northeast Fishery Sector XIII	146.7	178.2	9.78	11.88	1.02	1.24	0.33	0.4
Northeast Fishery Sector VI	140.1	170.2	20.01	24.31	1.11	1.34	0.08	0.1
Northeast Fishery Sector VIII	115.2	139.9	14.4	17.49	0.54	0.65	0.2	0.24
Northeast Fishery Sector XI	102.8	124.9	9.35	11.36	0.38	0.47	0.32	0.39
Northeast Fishery Sector V	95	115.5	6.34	7.7	0.62	0.76	0.66	0.8
Maine Coast Community Sector	92.8	112.7	6.19	7.52	0.65	0.79	0.42	0.51
Sustainable Harvest Sector - Inshore	65.2	79.1	8.14	9.89	0.5	0.6	0.32	0.39
Northeast Fishery Sector XII	55.3	67.2	7.9	9.6	0.8	0.97	1.12	1.36
Northeast Fishery Sector III	42.4	51.4	4.23	5.14	0.23	0.28	0.44	0.53
Northeast Fishery Sector X	28.7	34.9	4.1	4.98	1.23	1.5	2.2	2.67
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Table 201 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by days absent category (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Cat	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
<=5	83	118	3.45	4.91	1.89	2.69	1.96	2.78
>5, <=20	122	174	3.82	5.43	0.36	0.51	0.31	0.43
>20, <=50	272	387	5.55	7.89	0.2	0.29	0.19	0.27
>50, <=80	144	205	9.62	13.67	0.32	0.46	0.13	0.19
>80,	488	693	12.84	18.25	0.44	0.62	0.08	0.12
>160	394	559	18.74	26.63	0.56	0.8	0.08	0.11
TOTAL	*1,503*	*2,136*	-	-	-	-	-	-

Table 202 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by vessel home port (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Home Port	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
CT PORTS	9.6	13.1	4.81	6.57	0.19	0.26	0.87	1.19
OTHER MA PORTS	145.1	198.3	6.6	9.01	0.67	0.91	0.94	1.28
BOSTON	296.4	404.9	12.88	17.61	0.84	1.15	0.35	0.48
CHATHAM	147.5	201.6	5.9	8.06	0.23	0.31	0.43	0.59
GLOUCESTER	332.5	454.3	9.78	13.36	0.3	0.41	0.13	0.18
NEW BEDFORD	182.2	249	14.02	19.16	0.94	1.29	0.21	0.28
OTHER ME PORTS	69	94.3	5.31	7.25	0.41	0.56	0.25	0.34
PORTLAND	105.1	143.7	11.68	15.96	1.51	2.06	0.76	1.04
NH PORTS	75.5	103.1	6.29	8.59	0.29	0.39	0.27	0.36
NY PORTS	28	38.3	5.6	7.65	0.74	1.01	0.97	1.33
OTHER RI PORTS	15.6	21.3	5.19	7.09	1.1	1.5	0.34	0.47
POINT JUDITH	87	118.8	5.12	6.99	0.54	0.74	0.41	0.56
OTHER NORTHEAST	C	C	C	C	C	C	C	C

Table 203 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by vessel size class (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Size Class	Fleet Low	Fleet High	Vessel Low	Vessel High	Trip Low	Trip High	Day Low	Day High
30'to<50'	546	728	5.63	7.50	0.45	0.60	0.55	0.73
50'to<75'	491	655	9.10	12.13	0.68	0.91	0.37	0.50
75'+	522	697	18.66	24.88	0.85	1.14	0.10	0.13

Table 204 - Estimated static costs of monitoring in Year 3 at 100% fleet-wide adoption of a Max Retention model including dockside monitoring, by sector (2018$, thousands. Low and high estimates are mean +/- one standard deviation).

Sector	Fleet	Fleet	Vessel	Vessel	Trip	Trip	Day	Day
Sustainable Harvest Sector	397.9	567.3	16.58	23.64	0.99	1.41	0.28	0.4
Northeast Fishery Sector II	271.7	387.4	10.87	15.5	0.3	0.43	0.11	0.16
Georges Bank Cod Fixed Gear Sector	144.6	206.2	6.03	8.59	0.21	0.3	0.51	0.72
Northeast Fishery Sector XIII	109.4	156	7.29	10.4	0.83	1.18	0.28	0.4
Northeast Fishery Sector VI	99.4	141.8	14.21	20.25	0.76	1.08	0.05	0.08
Northeast Fishery Sector VIII	90.4	128.9	11.3	16.11	0.43	0.62	0.16	0.23
Northeast Fishery Sector V	75.9	108.2	5.06	7.21	0.55	0.79	0.58	0.83
Maine Coast Community Sector	74.3	105.9	4.95	7.06	0.56	0.8	0.36	0.52
Northeast Fishery Sector XI	69.1	98.6	6.29	8.96	0.3	0.42	0.27	0.39
Sustainable Harvest Sector - Inshore	46.9	66.9	5.87	8.37	0.39	0.55	0.26	0.38
Northeast Fishery Sector XII	41.8	59.6	5.98	8.52	0.71	1.02	0.96	1.37
Northeast Fishery Sector III	34.4	49.1	3.44	4.91	0.19	0.27	0.35	0.5
Northeast Fishery Sector X	25.5	36.4	3.64	5.19	1.12	1.59	2	2.85
Northeast Coastal Communities Sector	C	C	C	C	C	C	C	C
Northeast Fishery Sector VII	C	C	C	C	C	C	C	C

Compliance and Enforceability

Compliance: Compliance scores for the maximized retention sub-option **are similar** to the compliance scores for the audit-model sub-option. Specifically, the risk of non-compliance when cameras are on 100% of the time is expected to be low as long as cameras are positioned correctly and collect reliable information, this includes all fishing activities and verification of retained, sub-legal discards, dockside after the trip has concluded. Therefore, the compliance score for this alternative is **'high'**. Relative to No Action, this alternative would have a strongly positive impact on compliance if low to medium levels of coverage (25%-50%) are selected under Option 2, and a low positive impact if 75% is selected. If 100% coverage is selected under Option 2, this alternative would have a neutral impact on compliance, since even at fairly low review rates (10-15%), there is a constant deterrence since cameras are on 100% of the time, which results in a similar probability of detection as when an observer is onboard.

Enforceability: If cameras are situated and high resolution as to provide full coverage of operations, video footage collected through the maximized retention model could provide a great deal of information useful for enforcement about the frequency and quantity of illegal activity since more footage could be reviewed as a result of a report of suspected illegal behavior. NOAA OLE supports EM implementation as means to improve compliance (Compliance Improvement Recommendations, Enforcement Committee Meeting July 2019). For these reasons, this sub-option receives a '**high'** enforceability score. Relative to No Action, this alternative would have a strongly positive impact on enforceability if low levels of monitoring coverage are selected under Option 2 (25%), positive impact if medium levels of coverage are selected (50%), low positive impacts if medium-high levels of coverage are selected (75%), and neutral impacts if 100% coverage is selected.

7.5.3.3 Combined impacts of enhanced monitoring standards and dockside monitoring

Since this action is considering alternatives to enhance monitoring standards, up to 100% at-sea monitoring coverage levels for sector vessels as well as implementing a mandatory dockside monitoring program for the entire commercial groundfish fishery, the potential combined economic impacts of those measures is described in this section. The previous sections evaluate the static and dynamic costs of at-sea monitoring standards for 25% to 100%. The static estimates range from about $1 million under No Action to over $5 million under 100% coverage levels; so negative economic impacts are expected under higher coverage levels from reduced profits (caused by increased monitoring costs), noting that impacts may be more negative for vessels in some homeports, vessel size classes, or who participate less in the fishery.

However, the higher coverage level alternatives have positive impacts on compliance and enforceability, which could offset some of the direct negative economic impacts: if the opportunity for illegal activity at sea is low than the fishery may experience positive economic impacts from improved compliance and enforceability with at-sea reporting requirements. Benefits stemming from improved compliance and enforceability include accurate accounting of true catch and proper allocation of fishing opportunities. Full catch accounting in the form of comprehensive at-sea and dockside monitoring is expected to increase the functionality of the ACE lease market by ensuring that prices are reflective of true opportunity costs. A functioning ACE lease market not only benefits skilled, active fishermen who can avoid bycatch and maximize the value of their catch relative to ACE costs, but also benefits fishermen who join sectors and choose to lease their ACE. However, it is important to note that benefits associated with accurate catch accounting may be reduced, or nullified, if monitoring levels are not sufficiently high at-sea as well as shoreside: Increased monitoring at-sea alone s may have the adverse effect of increasing incentives to misreport, non-report, or otherwise be non-compliant with dockside reporting requirements.

A comprehensive dockside monitoring program would discourage non-compliant behavior shoreside, in a similar way that at-sea monitoring does when fishing. If the dockside monitoring program is adopted in this action it is predicted to have an overall cost of approximately $1 million dollars for the entire fishery (sectors and common pool), or $3,500-$4,200 per vessel. The sector component of the fishery represents the majority of landings and effort, and therefore majority of cost, around $800,000 per year. There are several measures in this action that could reduce these costs if some vessels are exempt from higher at-sea coverage and/or 100% dockside monitoring. At the extreme, total costs may be reduced by 39% to nearly $600,000. However, a comprehensive at-sea and dockside monitoring program would ensure a more complete catch accounting system, by discouraging shoreside noncompliance, and impacts stemming from improved compliance and enforceability are expected to neutralize some of those costs.

Additionally, if both enhanced at-sea monitoring and mandatory dockside monitoring are adopted in this action the incremental costs of a dockside monitoring program might be much lower than the estimated standalone cost. For example, if 100% ASM coverage is selected and human at-sea monitors are the primary monitoring tool, then the ASM may be able to serve as the DSM on the same trip, reducing travel costs, or additional time coordinating and/or waiting for a vessel to arrive, which in turn could reduce estimated DSM costs considerably (travel costs alone were estimated to be approximately one third of total costs). The maximized retention model also requires DSM presence to account for sub-legal landings, which is already factored into the cost of that EM alternative, thus another DSM would not need to be present on those trips. The blended analysis suggests that between 15 and 23 vessels potentially might adopt maximized retention under higher levels of monitoring coverage, further reducing additional DSM costs. The extent of these cost-efficiencies might be limited depending on both the ultimate coverage rate chosen, the types of EM tools available, and other alternatives in the document, such as funding responsibility.

7.5.3.4 Total Monitoring Coverage Level Timing

7.5.3.4.1 Coverage Level Timing Option 1: No Action

Currently, NMFS publishes the total monitoring coverage level once the necessary analysis is completed, which has varied year to year (See Table 64 in Section 6.6.10.2). There have been several years since FY 2010 when sector rosters were due before total monitoring coverage rates were announced (FY 2019, FY 2016, and FY2015), and one year when they were announced the day before (FY 2017). Option 1/No Action would continue the current process of making the total monitoring coverage level available once the necessary analyses are completed, which may result in **low negative** economic impacts to the extent it affects the ability for businesses to anticipate their annual operating costs and make participation decisions as a result. It is unclear what economic impact resulted in the years when the coverage rate was announced after the sector roster deadline. Table 15 in Section 6.6 shows that the number of vessels with LA permits joining sectors has decreased since FY 2010 but fluctuates some between years. Participation decisions may be affected by many other economic factors including market shifts, changes in ACLs and expected revenue in other fisheries, and other changes in costs such as fuel prices or repair and equipment costs. In addition, sectors have been partially to fully reimbursed for their monitoring costs in all years since 2012 (full funding by NMFS occurred in FY 2012-2014 and for most of FY 2015, partial reimbursement occurred from July 2016 to April 2018), so it is further unclear how much sectors anticipate to pay in monitoring costs in any given year, regardless of coverage rate.

7.5.3.4.2 Coverage Level Timing Option 2: Knowing Total Monitoring Coverage Level at a Time Certain

This alternative only applies if No Action or Option 3 is selected in Section 4.1.1: Sector Monitoring Standards. This measure would consider a time certain for knowing the total monitoring coverage level as a target date of three weeks prior to the annual sector enrollment deadline set by NMFS. This measure would be expected to result in **indirect, positive** economic impacts relative to No Action to the extent that it permits advance financial planning sufficient to make participation decisions. If this option improves the ability for individuals to forecast their monitoring costs and compare costs across providers, businesses can adopt cost-minimizing strategies. However, as mentioned under Option 1, it is unclear what, if any, economic impacts resulted in past years when the coverage rate was announced after the sector roster deadline, in part due to the many other economic factors which affect participation and uncertainty surrounding federal reimbursement for monitoring costs in any given year.

7.5.3.5 Review process for Sector Monitoring Coverage

7.5.3.5.1 Coverage Review Process Option 1: No Action

Under Option 1/No Action, the efficacy of sector monitoring coverage rates would not be reviewed on a prescribed basis. The groundfish monitoring program would continue to be reviewed as part of the goals and objectives of the groundfish sector monitoring program through Goal 6: Perform periodic review of monitoring program for effectiveness (see Section 3.3.2 for the complete list of goals and objectives of the groundfish monitoring program). Therefore, **no direct economic impacts** are anticipated under Option 1/No Action.

7.5.3.5.2 Coverage Review Process Option 2: Establish a Review Process for Monitoring Coverage Rates (*Preferred Alternative*)

This measure would establish a review process to evaluate the efficacy of sector monitoring coverage rates, to occur once two full fishing years of data is available. The review process would include establishing metrics and indicators of how well the monitoring program improved accuracy while maximizing value and minimizing costs. Therefore if review occurs more frequently than under Option 1/No Action, **some positive economic impacts** may result if issues with monitoring coverage levels or other components of the monitoring program are detected and determined to be suboptimal to achieve the goals of the program, such as if illegal behavior persists affecting ex-vessel markets, the ACE lease market, and reduced competitiveness among rule-followers and rule-breakers.

7.5.3.6 Addition to List of Framework Items (*Preferred Alternative*)

Compared to No Action, this measure is expected to have **neutral economic impacts**. There is no expectation that the establishment of this administrative measure will have any discernibly positive or negative economic impact except for that it may confer more flexibility to the agency to consider additional monitoring tools in the future, which may permit operations to identify and adopt more cost-effective technologies more quickly than under No Action.

This option would also add vessel coverage levels to the list of framework items. Initial discussion and analysis on possible impacts of vessel coverage levels can be found in "Memo from Groundfish PDT to Groundfish Committee re vessel specific coverage level option"[61], as well as in a letter from the NEFSC to the Council[62] in response to a request for information on observer deployment data at the vessel level for groundfish trips.

7.5.4 Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool)

7.5.4.1 Dockside Monitoring Program (Sectors and Common Pool)

7.5.4.1.1 Analytical Approach

[61] "Memo from Groundfish PDT to Groundfish Committee re vessel specific coverage level option", dated November 19, 2019; https://s3.amazonaws.com/nefmc.org/191119-GF-PDT-memo-to-GF-Committee-re-vessel-specific-coverage-level-option-with-attachments.pdf

[62] Letter from NEFSC to NEFMC, dated November 22, 2019; https://s3.amazonaws.com/nefmc.org/191122_Letter_NEFSC-to-NEFMC_vessel-observer-coverage-rates.pdf

For several alternatives in this document, a common analytical approach is used to estimate costs and direct economic impacts resulting from an industry-funded dockside monitoring program, the methodology is briefly described here.

Dockside monitoring (DSM) costs are calculated by applying an estimate of an hourly DSM cost from recent sector ASM contract costs (FY 2016-2018) and applying this to the estimated time to offload at port, including some time for coordination, and travel expenses for vessels landings outside major ports (here, Gloucester, Boston, New Bedford, Portland, Chatham, Point Judith, Seabrook, Rye, and Portsmouth[63]). ASM costs and travel costs are calculated by adapting methods and results from Ardini et al. 2019 and Henry et al. 2019. Ardini et al. (2019, Appendix VII) found that average sector at-sea ASM costs varied between $683 and $711 per observed day absent between FY 2016 and FY 2018[64]. This analysis specifies the hourly cost as a normally distributed random variable, using the mean cost per day absent ($698), as the mean hourly cost for DSMs— $29.08 per hour (SD=2). DSM hourly costs do not directly correspond to the wage that a DSM might receive since the ASM sector contracts are variable across providers and have different structures for including other costs into their seaday rate, such as at-sea training[65], which may not be able to be linearly disaggregated into an hourly wage (See Ardini et al., Appendix VII, page 7 for more details). To account for these additional, miscellaneous costs, we add 5% to each total cost estimate, a typical figure used in accounting.

Here, the DSMs hourly cost applies to several cost components: 1) the time it takes for a trip to fully offload its catch at port, 2) time spent communicating or coordinating with the vessel prior to offloading, and 3) any travel time to/from the offload. The time needed to offload will vary but is assumed to be affected by several factors. First, it is assumed that larger catch volumes will take longer to offload. NMFS port agents estimate that approximately between 8,000 and 10,000 pounds are offloaded per hour, but some variance might be expected depending on the dealer and target species[66]. For this reason, we apply the mean of 9,000 lbs/hour, but also generate high and low estimates using 7,000 lbs/hour and 11,000 lbs/hour, as a sensitivity. For offload volumes less than 9,000 lbs. (or 7,000 lbs./11,000 lbs.), the time to observe the offload is assumed to equal 1 hour. For all offloads greater than one hour, we round up to the nearest half hour, in order to represent lumpiness in labor costs.[67]

In the base scenario, offload rates are assumed to vary between 1 lb/hour and 9,000 lbs/hour depending on the volume of the offload, (i.e., smallest recorded offloads are 1 lb), with an average, effective offload rate across all deliveries of 3,870 pounds offloaded per hour, which likely overestimates the amount of time it takes to observe both small and large offloads. The analysis also assumes that an additional hour of

[63] The Groundfish Committee added Chatham, Point Judith, and “NH” ports (identified as in the top 7 ports by landings volume) to the list of ‘major’ ports analyzed in section 7.4.3.2.3, Option for Lower Coverage Levels, at their meeting in October 2019. “NH” ports included Seabrook, Rye, and Portsmouth and are all included here.

[64]In 2018 dollars. Original estimates from Ardini et al. (2019) have been inflation-adjusted.

[65] Shoreside training costs are covered by NMFS.

[66] Personal communication with C. Gilbert and G. Power, November 2019

[67] ‘lumpy’ costs are those that do not increase smoothly with increases in service, also represented by a step function.

DSM time is required to coordinate with the vessel, including time that a DSM spends at the dock waiting for the vessel to arrive.[68]

Travel costs were unable to be estimated based on ASM sector contracts; instead the method used by Henry et al. (2019) was adapted. Per Henry et al. (2019), monitors are assumed to be deployed from the nearest major port, thus travel costs are only incurred for offloads at minor ports. 2019 Federal (GSA) standards for reimbursement were applied when possible, including a mileage reimbursement of $.58/mile traveled, and lodging reimbursement at the annual average rate for the offload port location when travel time to the offload port exceeds 8 hours to calculate lodging costs.[69] Predicting travel costs is challenging, in part because observer providers have different travel policies, but also because for ASMs lodging is authorized on a case-by-case basis, such as if the vessel departs or returns very late or very early, or the total time the ASM was working. Since lodging is only calculated when it would be necessary because of the total travel time, lodging costs are likely underestimated, however, the total travel cost calculation may be conservative in other ways. Observer providers may choose their own mileage reimbursement rate, the federal rate may be a ceiling and a threshold for a minimum travel distance may also constrain total travel costs (e.g., 50 miles).[70]

Some ports are on islands, or the most cost-effective driving routes may include a ferry. In these cases, ferry costs were also estimated and included for these trips as well as the time spent on the ferry. Some potential costs, such as tolls, parking costs, or other incidentals, were not estimated, so on an individual trip basis travel costs may be underestimated, however, it is also assumed that a different monitor must be paid to be sent out for each individual offload from the nearest major port, which may overestimate costs if multiple offloads occur in the same area in a similar time span and could be covered by the same monitor (roving trips), as well as on trips that offload at multiple ports. Additionally, costs may be overestimated for trips ending far south, such as in Virginia or North Carolina, since flights may be more cost effective than driving.

The analysis does not cover trips that offload at a single port but deliver to dealers in different ports, suggesting a truck may be involved. Trucking may extend the time that the DSM must work by requiring them to follow the truck to the dealer and verify dealer-reported landings there, or require another DSM to be present at the dealer port. Alternatively, it may add no time if verification of landings at the offload port is deemed sufficient. In FY 2018, approximately 11% of sector groundfish trips and 29% of vessels report offloading at a different port than where the dealer is located, covering approximately 13% of sector total reported revenue (Table 205).

The analysis assumes that the sector ASM contract costs are representative of likely DSM contracts and furthermore that costs directly relate to an hourly cost. This is an important assumption and different results are possible if the imputed cost is drastically different than actual cost, such as if other costs (such as training costs) would increase the cost of DSMs beyond what is included from the ASM rate used here. Several alternatives in this document may affect the ultimate cost structure of DSM contracts. Therefore, costs estimated here might be assumed to be a ballpark estimate.

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[68] In the maximized retention EFP the DSM must arrive at least a half hour before the vessel is expected to arrive (Rob Johnston, pers. Communication).

[69] These assumptions appear reasonable based on discussions with ASM providers in the NE region.

[70] Pers. Comm. with an observer provider, 12/13/2019

Table 205 - Number of groundfish (sector and common pool) vessels and trips delivering to dealers outside the VTR reported port for fishing years (FY) 2016-2018. Landed pounds, live pounds and total revenue shown for all groundfish and non-groundfish catch (2018$).

FY	Group	# dealers outside VTR port	Vessels	Trips	Landed pounds	Live pounds	Revenue ($)
2016	common pool	0	51	599	1,844,642	2,169,127	1,233,080
2016	common pool	1	27	200	960,353	1,065,608	573,533
2016	common pool	2	3	17	75,343	84,828	73,797
2016	sector	0	196	5584	47,689,160	62,285,598	64,329,464
2016	sector	1	91	910	6,850,138	9,493,256	9,890,239
2016	sector	2	9	13	86,454	131,389	203,884
2017	common pool	0	43	409	1,081,495	1,295,659	754,495
2017	common pool	1	22	161	742,843	847,887	362,781
2017	common pool	2	4	24	324,414	332,014	87,129
2017	sector	0	186	5844	53,160,553	69,678,943	59,156,426
2017	sector	1	73	877	5,892,397	8,927,074	8,578,324
2017	sector	2	7	26	58,195	135,088	156,244
2017	sector	3	2	10	c	c	c
2018	common pool	0	45	440	1,343,362	1,648,578	819,634
2018	common pool	1	17	110	633,528	673,635	266,113
2018	common pool	2	2	8	c	c	c
2018	sector	0	165	6336	58,115,540	75,363,343	60,624,570
2018	sector	1	71	729	6,333,038	8,697,303	9,006,526
2018	sector	2	9	58	239,952	314,607	340,975
2018	sector	3	1	12	c	c	c

Source: DMIS data, accessed 1/7/2019.

7.5.4.1.1 Dockside Monitoring Option 1: No Action (*Preferred Alternative*)

Under No Action there would not be any organized dockside monitoring (DSM) program for the sector and common pool components of the commercial groundfish fishery, since the DSM program implemented in Amendment 16 was removed in FY 2012. Certain components of the original dockside monitoring program would remain, namely start and end trip hails. Therefore, No Action has no direct economic impacts to the fishing industry since DSM costs will be similar to recent fishing years ($0).

Compliance: NOAA OLE has noted that while it conducts some groundfish dockside inspections (approximately 300 in 2017), it does not believe this level of activity is sufficient to ensure accurate reporting of landings since capacity limits efforts to investigate only the most egregious of violations (Attachment 6, PDT memo, May 3rd 2018). Incentives for misreporting catch dockside are similar to incentives for illegally discarding at sea, as they stem from both the probability that the illegal activity will be detected and benefits derived (avoided quota costs, increased access to stocks). Dockside, such illegal activities may include misreported or unreported landings (e.g., species substitutions or black fish). Under the status quo, there have been instances of misreported catch in the groundfish fishery, and without dockside monitoring the risk of noncompliance shoreside is likely to be high, therefore the compliance score for this alternative is **'low' to 'medium'**, due to the limited number and nature of dockside inspections, and somewhat lower incentives to misreport in the common pool fishery due to the absence of quota costs.

Enforceability: Enforceability is defined here as the ability for enforcement officials (NOAA OLE or Coast Guard) to detect and prosecute violations. NOAA OLE has noted that current levels of capacity makes detection of reporting violations dockside difficult (Attachment 6, PDT memo, May 3rd, 2018). Dockside monitors are not enforcement agents but their records, which include observations of potential illegal activities, can be used by enforcement to identify and prosecute violations. At current levels of dockside monitoring coverage there is little to no information confirming landings dockside so the enforceability score for this option is **'low'**.

Impact Summary: No Action would not implement a dedicated dockside monitoring program for the groundfish fishery. Therefore, No Action has no direct economic impacts to the fishing industry since dockside monitoring costs will be zero. However, No Action may have other, indirect negative economic impacts on the fishing fleet with respect to compliance and enforceability of reporting requirements. Reduced quota accountability decreases the functionality of the quota market to send appropriate price signals when quota is limiting and reduces the benefits of efficient harvesting strategies, such as decreased catch of non-target stocks. Additionally, overharvesting degrades long-term fishing revenue.

7.5.4.1.2 Dockside Monitoring Option 2: Mandatory Dockside Monitoring Program for the Commercial Groundfish Fishery

The analysis (described in Section 7.5.4.1.1) estimates potential dockside monitoring costs under a comprehensive program (100% of offloads for both sector and common pool vessels). Costs are estimated based on realized fishing effort in fishing years 2016 through 2018, giving a range of total dockside monitoring costs from approximately $941,000 in FY 2017 to $964,000 in FY 2018, or approximately $125- $129 per trip, or between $3,550 and $4,150 per vessel annually (Table 206).

Based on information on the total cost billed to sectors under the 2010 sector monitoring program, this cost estimate seems reasonable; under the 2010 program, the average cost was $110 per trip.71 The total cost for monitoring approximately 10,200 trips in 2010 was $1.2 million. The total estimated cost would be approximately 1.4% of all fishery revenue in FY 2018.

Results are sensitive to the selected offload rate. An offload rate of 11,000 pounds per hour decreases total estimated costs by $26-$32,000, or between 2.7% and 3.3%, while decreasing the offload rate to 7,000 pounds per hour increases costs by 4.7-5.5% or between $45,500 and $54,000, providing a range of costs with respect to offload rate ranging from a minimum of approximately $913,000 and a maximum of $1,017,000 (Table 207).

In addition, results are also sensitive to the choice of base hourly rate, based off of the observed ASM seaday rate. Economic theory suggests that ASM rates might be higher than DSM rates, particularly if the programs are contracted and operated separately, principally because ASMs might receive a wage premium due to the increased risk of their duties. At-sea, ASMs must accept higher levels of risk than their dockside counterparts, due to possible accidents at sea, vessel incidents, or the generally hazardous nature of working onboard fishing vessels. As a sensitivity, we reduce the base hourly DSM cost by 5%

[71] in 2018 dollars. The mean nominal cost under the 2010 program was $95.73 per trip.

and 10%[72], generating a range of possible total DSM costs that are between $867,000 and $908,000, on average over three years (Table 208).

Combining the two sensitivity analyses, the mean DSM cost is minimized at $841,184 over the three years and provides a bookend to the high cost scenario at $1,000,300— or between 11.5% lower or 5% higher than the mean total cost estimate in the base scenario.

Table 206 - Total estimated DSM costs across all sector and common pool trips FY 16-18 under full coverage (base scenario). Revenue includes all revenue (groundfish and non-groundfish) landed on all groundfish trips (2018$).

FY	Travel Costs ($)	Offloading Costs ($)	Misc. costs ($)	Total Costs ($)	Total Revenue ($)	Total Pounds	Trips	Vessels
2016	352,777	548,112	45,044	945,933	76,303,998	57,506,089	7,323	268
2017	332,963	562,872	44,792	940,627	69,216,748	61,303,166	7,351	252
2018	317,716	599,993	45,885	963,595	71,133,178	66,786,881	7,693	233
Average	334,485	570,326	45,241	950,052	*72,217,975*	*61,86,379*	*7,456*	*251*

Table 207 - Sensitivity Analysis. changes in offload and total costs based on different offload rates. Low= 11,000 lbs/hour, base=9,000 lbs/hour, high= 7,000 lbs/hour (2018$).

FY	Offloading costs			Total costs		
	low	**base**	high	low	**base**	high
2016	523,758	**548,112**	591,224	920,361	**945,933**	991,201
2017	536,122	**562,872**	612,024	912,539	**940,627**	992,236
2018	569,368	**599,993**	651,295	931,438	**963,595**	1,017,462
Average	*543,082*	**570,326**	*618,181*	921,446	**950,052**	1,000,300

Table 208 - Risk Premiums. The effect of possible risk premiums in the base ASM rate is shown by 5% and 10% reductions in the hourly DSM cost estimate (base) on the total estimated DSM costs (2018$).

FY	5% risk premium (total cost $)	10% risk premium (total cost $)
2016	908,382	865,335
2017	898,869	858,560
2018	917,170	876,526
Average	908,140	866,807

There is considerable variability in the distribution of predicted dockside monitoring costs for sectors and the common pool under the base scenario. A the trip level, the common pool is predicted to be more

[72] While no specific studies have quantified the wage differential in fisheries or fisheries observers studies looking at other dangerous jobs found that nonfatal risk premiums range from 7.3% to 9.9%, while fatal risk premiums range from 3.7% to 3.8%, but may be variable across race and gender (see Olson 1981, Leeth and Ruser 2003).

expensive to monitor than the sector component of the fleet; average predicted costs for common pool trips range from $211 per trip in FY16 to $240 per trip in FY18, whereas sector trips range between $116 and $118, driven largely by differences in estimated travel costs. Travel costs compromise around 62-67% of total DSM costs for common pool trips, but only 28-32% of sector DSM costs (Table 209).

This corresponds with the proportion of trips that land in minor ports. In FY2018, 49% of common pool offloads were in minor ports whereas only 17% of sector offloads occurred in minor ports in the same year. In addition, the time needed to observe small offloads is large relative to the volume-- the average common pool trip is 60% smaller than the average sector trip, which means that they are proportionally more expensive for a DSM to observe, resulting in total predicted offloading costs that are over four times as much per pound for common pool trips (approximately $.013 per pound on sector trips and $.065 per pound on common pool trips.)

At the vessel-level, the proportion of predicted monitoring costs ranges broadly, from less than 0.5% of total revenue to five times the landed value. Predicted DSM costs are high relative to landed value when large travel costs are incurred. In any given year, offloads from groundfish trips may occur as far south as North Carolina. Travel costs predictions assume there are no exclusions from the dockside monitoring program and that DSMs are deployed from the nearest major port which means that an observer must be sent from Point Judith, RI to Beaufort, NC, a distance of over 700 miles. Mileage reimbursement alone is estimated to be over $800 for such trips[73]. Therefore, in these states, a high proportion of total estimated costs are assumed to be travel costs, in contrast to Rhode Island where travel costs are predicted to be minimal.

Vessel-level DSM costs vary across vessel-length categories (Figure 52. Vessels less than 30 feet in length are expected to pay a much larger proportion of revenue for dockside monitoring than vessels in larger size classes. In FY 2018, costs as a proportion of revenue ranged between 26% and 53% of revenue for the smallest vessels (middle 50% of vessels, shown by the interquartile range, Figure 52)—a margin that likely will make these vessels' groundfish activities unprofitable[74]. For vessels landing few fish or landing in distant ports, the cost of dockside monitoring may even exceed reported revenue on groundfish trips, though instances of this are limited to 7 or fewer vessels in each year, and are generally a combination of very low total landings and/or landings in very distant ports. However, most vessels, particularly sector vessels and vessels in larger size classes are more likely to pay much smaller proportions of their revenue for DSM. The median vessel between 30 and 50 feet in length is projected to pay between 3.3% and 4.4% of their revenue. The median vessel between 50 and 75 feet in length is expected to pay between 1.6% and 2.8%. Vessels greater than 75 feet in length are projected to pay half a percent or less, with little variability. Most vessels are in the 30-50 foot length category (55%) and the fewest are in the smallest length category (4%). Overall, vessels of any size delivering to major ports will incur lower DSM costs, due to the absence of travel costs.

When considering the combined impacts across alternatives in this document, incremental direct impacts of a DSM program may be reduced depending on the ASM coverage rate and ultimate combination of tools selected. Using the base estimate, nearly $300,000 is estimated for travel costs alone from an independent DSM program. If the ASM may also act as the DSM on a given trip, travel costs, coordination costs, or other costs may be reduced or eliminated on those trips—For 100% coverage, the total cost of a comprehensive program may be less than $615,000, similar to the lower-coverage options, but without any tradeoffs for compliance and enforceability. Furthermore, as ASM coverage rate

[73] Flights for these trips would likely be more cost-effective and could reduce costs, but reconfiguring the model for including airfare and time related to flying was not attempted, so this represents an upper bound.

[74] All vessels in this size class are common pool vessels.

increases and incentives for non-compliance at sea are diminished, incentives for non-compliance shoreside remain, and may increase as ASM coverage increases— meaning compliance-related benefits from at-sea monitoring coverage may be reduced if a dockside monitoring program is not also implemented.

Table 209 - Total estimated DSM costs by fleet FY 16- 18 under full DSM coverage. Revenue includes all revenue (groundfish and non-groundfish) on all groundfish trips (2018$).

FY	Fleet	Travel Costs ($)	Offloading Costs ($)	Misc. Costs ($)	Total Costs ($)	Total Revenue ($)	Total Pounds	Trips	Vessels
2016	common pool	107,179	56,698	8,194	172,071	1,880,410	2,880,337	816	59
2016	sector	245,598	491,414	36,851	773,863	74,423,588	54,625,752	6,507	209
2017	common pool	91,354	42,678	6,702	140,733	1,204,406	2,148,752	594	54
2017	sector	241,609	520,195	38,090	799,894	68,012,343	59,154,414	6,757	198
2018	common pool	89,549	38,253	6,390	134,192	1,115,513	2,064,185	558	54
2018	sector	228,167	561,741	39,495	829,403	70,017,665	64,722,697	7,135	179

Table 210 - Sensitivity results. Changes in costs based on different offload rates for common pool and sector trips. Low= 11,000 lbs/hour, base=9,000 lbs/hour, high= 7,000 lbs/hour (2018$).

FY	Fleet	Offloading costs			Total costs		
		Low	*base*	High	Low	*base*	High
2016	common pool	55,514	*56,698*	58,610	170,827	*172,071*	174,078
2016	sector	468,244	*491,414*	532,614	749,534	*773,863*	817,122
2017	common pool	41,818	*42,678*	44,244	139,830	*140,733*	142,378
2017	sector	494,304	*520,195*	567,779	772,709	*799,894*	849,858
2018	common pool	37,635	*38,253*	39,578	133,543	*134,192*	135,583
2018	sector	531,733	*561,741*	611,717	797,895	*829,403*	881,878

Figure 50 - Proportion of estimated DSM costs by dealer state and fishing year under full coverage. Offloading costs (off_cost) are shown in dark gray while travel costs (TC) are shown in light gray.

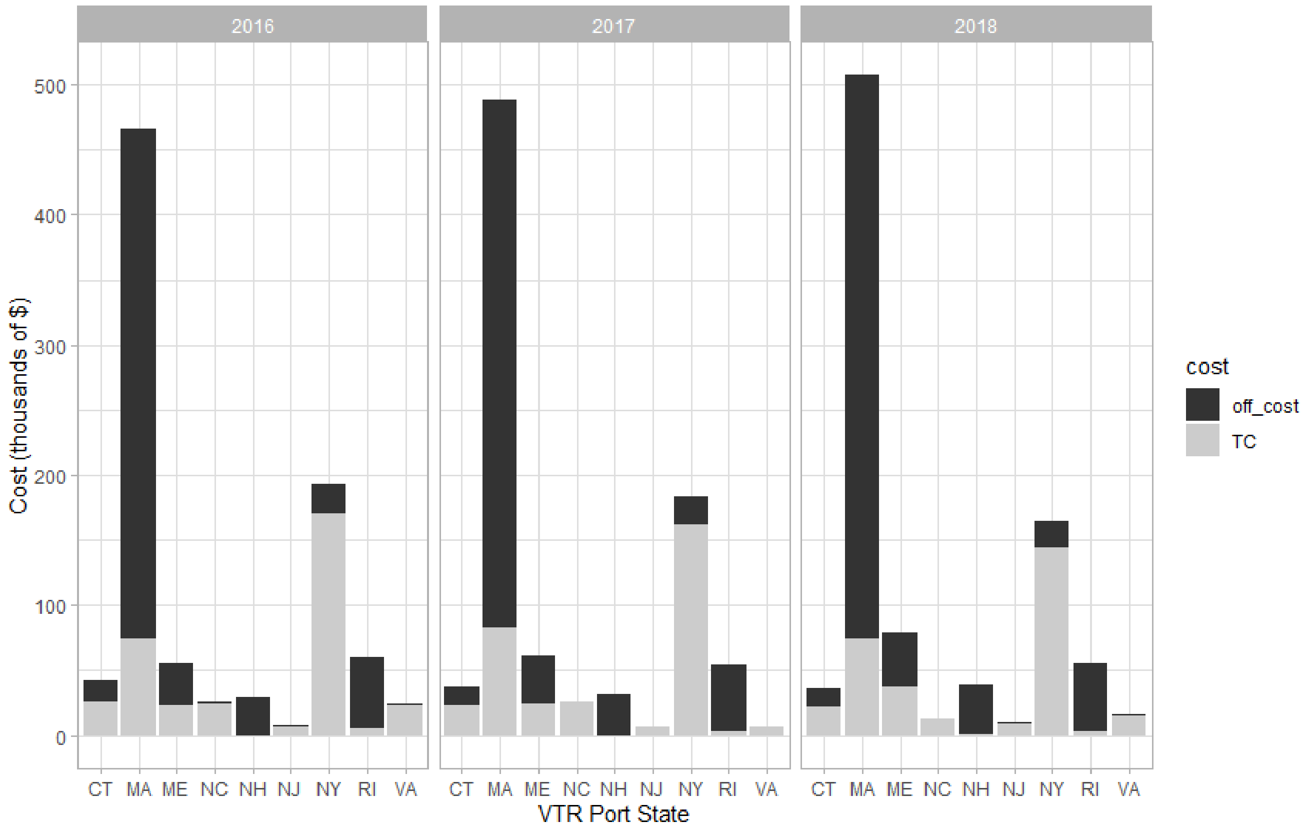


Figure 51 - Proportion of estimated DSM costs by port category (major or minor) and fishing year under full coverage. Offloading costs (off_cost) are shown in dark gray while travel costs (TC) are shown in light gray.

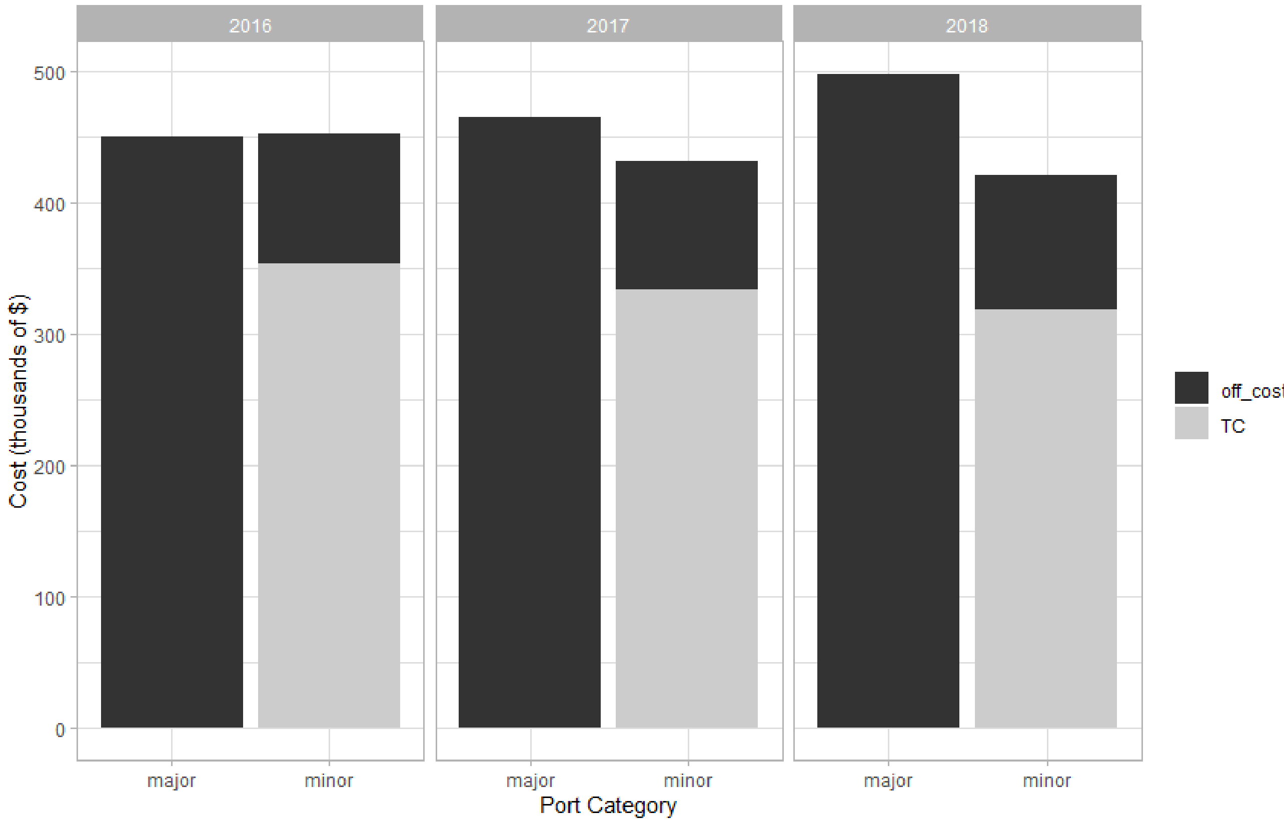
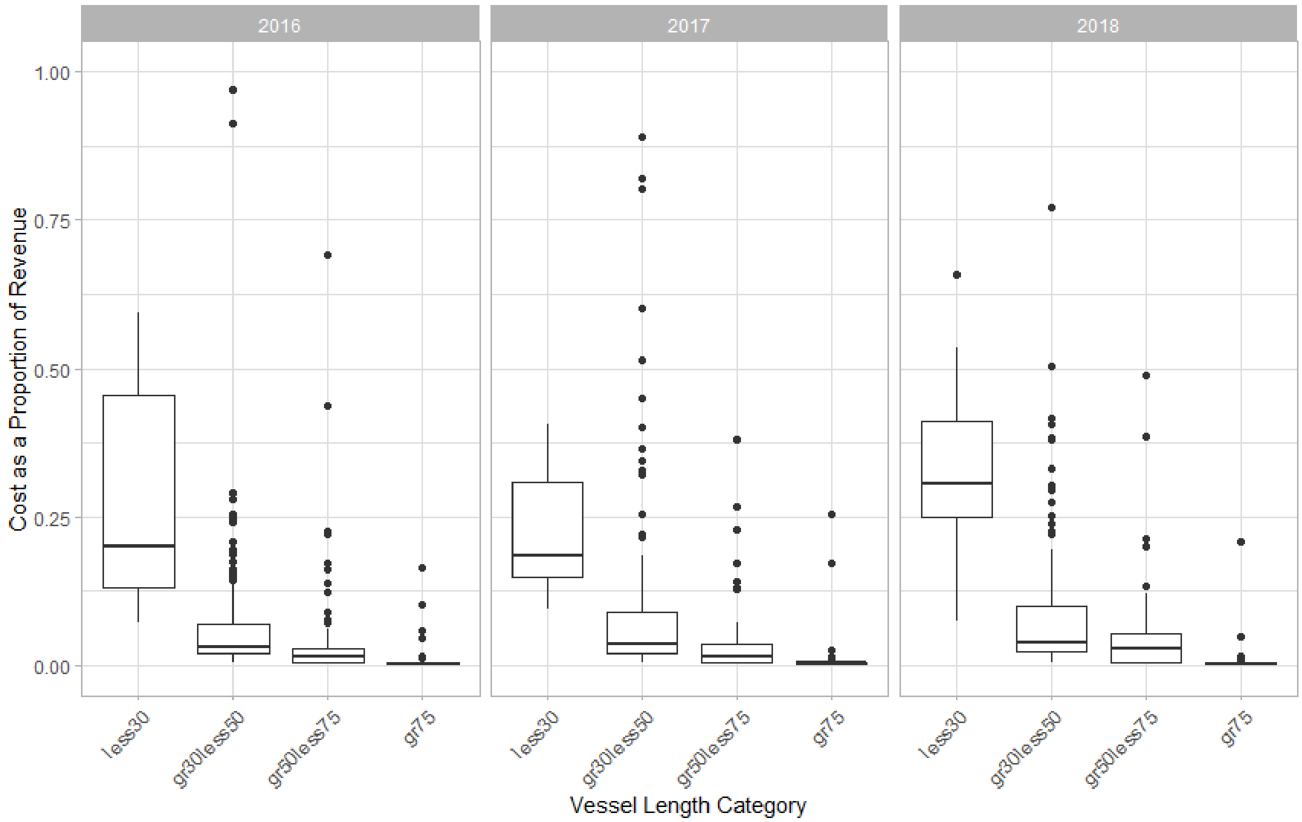


Figure 52 - Vessel-level costs as a percent of revenue by vessel length category and fishing year under full coverage. Some outliers are not shown, for clarity, but fewer than 7 vessels in any year had DSM costs that exceeded reported revenue on groundfish trips.



Compliance: A comprehensive dockside monitoring program covering all sector and common pool trips is likely to decrease the risk of noncompliance significantly from the status quo since the probability of detecting reporting violations would increase. The compliance score for this option is 'high', but it is noted that this would only ensure compliance with dockside reporting requirements, and without commensurate increases in at-sea coverage, this option alone may not ensure overall compliance since increasing dockside monitoring may increase the incentive to illegally discard at sea, among other forms of at-sea noncompliance.

Relative to No Action, this measure is expected to have a positive impact on compliance with dockside reporting requirements in the groundfish fishery but may only have a low positive impact on compliance overall if not coupled with additional at-sea monitoring coverage, through humans or EM, under Sector Monitoring Standards and Tools Options 2 or 3.

Enforceability: Dockside monitors are not enforcement agents but their records, which include observations of potential illegal activities and independent records of catch, can be used by enforcement to identify and prosecute violations, therefore full coverage of landings by monitors would greatly increase the amount of information available for enforcement and gets a 'high' enforceability score. Relative to No Action, this measure is expected to have high positive impacts on shoreside capabilities for enforcement, but if not coupled with increased levels of at-sea monitoring may have low positive to positive impacts on enforceability overall.

Impact summary: Relative to No Action, 100% dockside monitoring for both the common pool and sector components of the commercial groundfish fishery is expected to have low negative direct impacts on the groundfish fishery since it could increase fleetwide operating costs by around one million dollars per fishing year, if effort is similar to previous fishing years. Operating costs could be higher or lower depending on the structure of the program, such as the ability for at-sea monitors to act as dockside monitors on the same trip, which would reduce travel costs in minor ports. Further, total costs could be lower to the extent that at-sea monitors receive a risk premium compared to dockside monitors If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

Direct economic impacts are more negative for the common pool component of the fishery, vessels delivering to minor ports, and for vessels less than 35 feet in length, potentially leading to reduced participation. Over the long term, increased monitoring costs in minor ports may work to reduce effort in these areas, consolidating effort into major ports and further reducing total monitoring costs. Increased compliance and enforceability may lead to some indirect positive economic impacts relative to No Action, particularly with respect to dockside reporting requirements. Indirect benefits stem from increased quota accountability, which supports functional quota markets and efficient harvesting practices, in turn supporting long term economic viability.

7.5.4.2 Dockside Monitoring Program Structure and Design

7.5.4.2.1 Dockside Monitoring Program Funding Responsibility

7.5.4.2.1.1 Dockside Monitoring Program Funding Responsibility Option A – Dealer Responsibility

Under this option dealers would be responsible for covering the cost of groundfish monitoring. Since each individual dealer would be responsible for covering the costs of having their transactions observed, the funding of the program would be straightforward. Dealers would likely be invoiced on regular (e.g. monthly) intervals and directly pay for the cost of monitoring.

The difference in total costs for the program between this option and Option B is uncertain. Under both option there will be many buyers of dockside monitoring services. The number of dockside monitoring providers that will be approved by NMFS is not certain. Dealers will work to identify dockside monitoring providers that can cover their transactions at the lowest possible cost. Dealers will work to have dockside monitors close to their primary ports, and would ideally have wide windows for landing, without added costs.

Compliance: If dealers are responsible for paying for dockside monitoring, they may pay less for each pound of groundfish in order to remain cost-neutral, decreasing ex-vessel price received by vessels. Decreasing ex-vessel price will increase the ratio of ex-vessel price to the ACE lease price for a given stock, holding all else constant, which will increase the vessel's incentive to be noncompliant either dockside or at-sea. However, if a dockside monitoring program is comprehensive, the opportunity for noncompliance will depend on the level of at-sea monitoring, either through humans or EM—therefore the risk for noncompliance depends on the level of at sea monitoring coverage (i.e., anywhere from high to low). Therefore, on its own, funding responsibility has a neutral impact on compliance. Relative to Option B, this measure is expected to have a neutral effect on compliance.

Enforceability: Dealer funding responsibility has a relatively neutral impact on enforceability relative to Option B since the presence of a dockside monitor and the creation of an independent data source will further enable enforcement action regardless of whether the program is dealer or vessel based.

7.5.4.2.1.2 Dockside Monitoring Program Funding Responsibility Option B – Vessel Responsibility

Under this option sectors would develop and implement a third-party dockside monitoring program. Sectors will have some level of discretion in how they would have their members contribute to the funding of the program. The most straightforward, and perhaps most likely, would be to institute a fee on landings. Many sectors already have a landings fee in place in order to cover the administrative costs with running a sector. Under this payment regime, costs would be proportional to landings, with the possible exception of low volume vessels that could qualify for lower coverage if this option is selected.

The difference in total costs for the program between Option A and Option B is uncertain. Under both Options A and B there will be many buyers of dockside monitoring services. The number of dockside monitoring providers that will be approved by NMFS is not certain. Sectors and common pool vessels will work to identify dockside monitoring providers that can cover their primary ports at the lowest possible cost. The transition to industry-funded at-sea monitoring may provide some insight into how sector contract negotiations with providers may occur. Sectors will work to have dockside monitors close to their primary ports, and would ideally have wide windows for landing, without added costs. With ASM, sectors have been able to incur very low costs related to observer travel to and from ports due to observers being stationed in close proximity. Sectors have also been able to negotiate seaday rates to minimize costs, based on the makeup of trips in the sector. Sectors may work to do something similar in terms of offload times for cost minimization.

Compliance: If vessels are responsible for dockside monitoring, it may also increase the incentive to be non-compliant at sea, similar to a dealer-based program. Instead of a decrease in the ex-vessel price, costs associated with landing each unit of fish will increase, which may similarly increase the incentive to illegally discard, resulting in a neutral impact on compliance relative to Option B as long as total dockside monitoring costs are the same regardless of whether the program is dealer or vessel based.

Enforceability: Vessel funding responsibility will have a neutral impact on enforceability as compared to Option 1, since the presence of a dockside monitor and the creation of an independent data source will further enable enforcement action regardless of whether the program is dealer or vessel based.

7.5.4.2.2 Dockside Monitoring Program Administration

7.5.4.2.2.1 Dockside Monitoring Program Administration Option A – Individual contracts with dockside monitor providers

Under Option A, either vessels or dealers (depending on 7.5.4.2.1) would be responsible for contracting with dockside monitoring providers to cover the cost of groundfish monitoring. Under both Options A and B there will be many buyers of dockside monitoring services. The difference between the two Options whether individual vessels or dealers must directly negotiate contracts with dockside monitoring providers or if they will simply be responsible for selecting from the approved providers on a trip-by-trip basis. Under both options, there will be no limit on the number of providers that may apply for approval or be approved in a given year. In each case, dealers/vessels will work to identify a dockside monitoring provider that can cover their activities at the lowest possible cost.

The potential for lower costs to vessels/dealers exists under Option A relative to Option B. These lower costs could be realized if increased competition and flexibility drives down rates. As discussed in Sub-Option B, the transition to industry-funded at-sea monitoring may provide some insight into how contract negotiations with providers may occur. Dealers/vessels will work to contract with providers that have dockside monitors stationed close to their primary ports, with wide windows for catch offloading. However, under Option A, dealers/vessels would be required to directly contract with one or more dockside monitoring providers to meet their needs, which may increase transaction costs, as compared to Option B.

Administrative costs to NMFS may be higher under Option A, relative to Option B. NMFS may have to review and approve more dockside monitoring applications, as is currently done in the at-sea monitoring program. Additionally, dealers/vessels may end up changing dockside monitoring providers on a semi-regular basis (e.g. annual or semi-annual), creating the potential for added administrative costs relative to Option B.

Compliance and enforceability are likely to be minimally affected by either Option A or B. If costs are lower under Option A due to increased competition between providers, then cost of landing each unit will be lower than Option B as a result, which could reduce the incentive to illegally discard, which would have a positive impact on compliance, but the likelihood and magnitude of this impact is uncertain. Enforceability of Option A relative to Option B is neutral since neither changes the amount of information available for enforcement.

7.5.4.2.2.2 Dockside Monitoring Program Administration Option B – NMFS-administered dockside monitoring program

Under Option B, either vessels or dealers (depending on 7.5.4.2.1) would be responsible for hiring dockside monitoring providers to cover the cost of groundfish monitoring. Under both Options A and B there will be many buyers of dockside monitoring services. The difference between the two Options is whether individual vessels or dealers must directly negotiate contracts with dockside monitoring providers or if they will simply be responsible for selecting from the approved providers on a trip-by-trip basis. Under both options, there will be no limit on the number of providers that may apply for approval or be approved in a given year. In each case, dealers/vessels will in the supply of dockside monitoring providers that will be approved by NMFS. Under Option B, dealers/vessels will work to identify a dockside monitoring provider that can cover their activities at the lowest possible cost, but would not be required to directly contract with any provider, reducing flexibility stemming from the ability to negotiate on costs, but reducing possible transaction costs.

The potential for higher costs to vessels/dealers exists under Option B relative to Option A. These higher costs could be realized due to decreased competition. The bidding process under Option B would be competitive, but will cover the entirety of the groundfish fishery. Rates could potentially be higher relative to Option A, since providers will have to cover a wide region. Lower dockside coverage rates in remote ports could help mitigate these higher rates. Compared to Option A, transaction costs may be minimized for individual common pool vessels, since they will not have to negotiate individual contracts with providers under Option B.

Administrative costs to NMFS are likely to be lower under Option B, relative to Option A. While multiple dockside monitoring providers may bid for the NMFS contract, the chosen providers will cover the entirety of the groundfish fishery. Option B does not specify how frequent the bidding process will occur. A multi-year contract will result in a reduction in NMFS administrative costs.

Compliance and enforceability are likely to be minimally affected by either Option A or B. If costs are higher under Option B due to reduced competition between providers, then cost of landing each unit will be lower than Option B as a result, which could reduce the incentive to illegally discard, which would have a positive impact on compliance, but the likelihood and magnitude of this impact is uncertain. Enforceability of Option A relative to Option B is neutral since neither changes the amount of information available for enforcement.

7.5.4.2.3 Options for Lower Dockside Monitoring Coverage Levels (20 percent coverage

7.5.4.2.3.1 Option A – Lower coverage levels for ports with low volumes of groundfish landings

Instead of a program with 100% DSM coverage of all offloads for all sector and common pool trips, this alternative proposes randomized coverage in minor ports and full coverage in major ports. Major ports under this alternative include Boston, New Bedford, Gloucester, Portland, Point Judith, Seabrook, Portsmouth, Rye, and Chatham. The major ports were chosen based on the proportion of groundfish pounds landed over the last 3 years, with the major ports representing the vast majority (97%) of the total pounds and total groundfish revenue. Twenty percent of trips in each of the other ports were randomly selected in each year FY 2016 to FY 2018 200 times to obtain an estimate of mean monitoring costs in each year.

From FY 2016 to FY 2018 only 20% of offloads were to small ports, but under DSM Option 2 (Figure 3), monitoring costs in minor ports were estimated to be approximately $404,000 to $441,000 in any given year, or approximately 44% of total DSM costs. Under this option, DSM costs in minor ports are estimated to be between $80,000 and $87,000, reducing total estimated dockside monitoring costs by 35% from $950,000 to $613,000 over 2016 to 2018 (Table 212).

Despite large reductions in cost, random monitoring of small ports would likely have a small impact on the total proportion of groundfish pounds monitored. Between 2016-2018, major ports accounted for 98.5% of all pounds landed of any allocated groundfish stock and 89% of all non-groundfish pounds. Further, the vast majority of groundfish revenue is landed in these ports, 97% over the last three years (Table 211).

Compliance: Spot-check coverage rates may need to be revisited to revised in order to ensure compliance. Random coverage at 20% may be sufficiently high to deter violations due to a sufficiently high probability of detection, but only if fishery participants do not know they will be monitored while fishing is occurring. If that can be achieved, the compliance score of this alternative may be ‘high’. In the current maximized retention EFP, the vessel and the DSM coordinate and communicate when the vessel will be at port, this type of communication and knowledge would reduce the compliance benefit of randomized coverage for minor ports and the compliance score may be **“medium” to “high”.**

Enforceability: While minor ports account for very small amounts of groundfish pounds in recent years, a key assumption of this option is that effort would not shift to minor ports. Because of the reduction in monitoring costs, an incentive would exist for vessels to deliver to minor ports, provided that infrastructure was available. Enforceability benefits of a full DSM program may be weakened somewhat if violators are able to take advantage of the monitoring program and shift their operations. Furthermore, if participants know when they will be monitored, spot-check coverage will not be effective at deterring noncompliance. Therefore, the enforceability score of this alternative is **'medium' to 'high',** depending on the ability for participants to shift their operations and/or the efficacy of DSMs when they are present.

Impact summary: Relative to No Action, full coverage of major ports and 20% random coverage at minor ports would increase operational costs for the fishery by approximately $613,000 if fishing effort remains similar to previous years. This would likely have low negative direct impacts on the fishery overall, since this represents a small proportion of fleetwide fishing revenue (less than 1%), impacts are likely to be more negative for the common pool component of the fishery and for vessels less than 35 feet in length. Relative to Dockside Monitoring Option 2 (full coverage), economic impacts of this alternative are positive, since it reduces the estimated program cost, on average, by 35% over 2016-2018. Relative to Option B, lower coverage for low volume vessels, impacts of this alternative are low negative to neutral, since total dockside monitoring costs are estimated to be somewhat higher in all years under Option A. Furthermore, under full coverage, vessels delivering to minor ports are the most expensive to monitor, particularly those south of Point Judith. For instance, New York is estimated to be one of the most expensive states to monitor since observers are assumed to be deployed from Point Judith and incur additional travel costs, such as ferry costs. Random coverage of these low-volume ports reduces total estimated monitoring costs yet would have a minimal impact on the total amount of groundfish pounds monitored moving from 100% to 97.6%[75], assuming no changes in the distribution of offloading activity. If offloading shifts to low coverage ports, efficacy of random coverage may be reduced, particularly for deterring noncompliance and increasing enforceability of reporting regulations, therefore relative to No Action/Option 1 there are positive compliance and enforceability benefits, but relative to DSM Option 2 there are low negative to negative impacts on compliance and enforceability from Option A. Furthermore, random DSM coverage will be most effective when participants do not know that they will be monitored, if participants delivering to minor ports know they will be monitored there will be a negative impact on compliance relative to Option 2. If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

[75] Slight differences in the proportion of total groundfish pounds monitored stem from different data sources "live pounds" was used for the original designation, "landed pounds" is reported here.

Table 211 - Groundfish (GF) and non-groundfish (NGF) landed pounds and ex-vessel value (thousands of pounds/2018$) by port category (major or minor) and group (sector or common pool).

FY	Port cat	group	GF (lbs)	NGF (lbs)	GF ($)	NGF ($)	Trips*	Vessels*
2016	minor	sector	275	1,607	738	3,398	677	75
2016	major	sector	33,225	19,519	49,774	20,514	5966	188
2016	minor	common pool	198	1,784	501	618	465	37
2016	major	common pool	130	769	338	423	370	32
2017	minor	sector	446	933	1,099	2,561	789	66
2017	major	sector	36,606	21,169	45,138	19,214	6192	180
2017	minor	common pool	75	1,106	185	484	284	31
2017	major	common pool	111	857	261	275	331	29
2018	minor	sector	709	1,273	1,363	2,753	863	53
2018	major	sector	43,412	19,328	47,551	18,350	6510	165
2018	minor	common pool	50	1,196	110	591	274	33
2018	major	common pool	100	719	183	232	297	26
Minor port proportion (%)			*1.5%*	*11.2%*	*2.7%*	*15.0%*	*14.6%*	*32.2%*

Major ports include Boston, Number of trips and vessels exceeds the total number in any given year because of trips with multiple offloads (<6% of total trips). Source: NMFS dealer, trip, and permit data

Table 212 - Estimated costs for randomized selection of trips for minor ports (200 simulations). Total is based on mean estimated cost of randomly observing 20% of offloads in small/remote ports (2018$).

	Low coverage ports						
FY	Mean cost	Median cost	Standard deviation	25th percentile	75th percentile	Major port cost	**Total DSM cost**
2016	87,389	87,388	550	87,067	87,739	504,844	**592,233**
2017	80,661	80,668	503	80,313	81,029	527,071	**607,733**
2018	79,692	79,721	530	79,331	80,009	559,435	**639,127**
Average	*82,581*	*82,592*	*528*	*82,237*	*82,926*	*530,450*	***613,031***

7.5.4.2.3.2 Option B – Lower coverage levels for vessels with total groundfish landings volumes in the 5th percentile of total annual landings

Vessels landing less than the lowest 5th percentile across 2016-2018 were randomly selected for DSM coverage on 20% of their trips ("low coverage vessels", vessels landings less than 46,297 groundfish pounds in each of the last three fishing years). This included 97 unique sector or common pool vessels and 11,063 groundfish trips across 2016-2018, (approximately one quarter of all trips). The lower coverage rate reduces total estimated costs in FY 2018 from $964,000 to $609,000 or by approximately 37% (Table 214). Across all three years costs were reduced by 39%.

Low coverage vessels account for a minority of landed groundfish pounds but the majority of landed non-groundfish pounds in any year. Overall, low coverage vessels account for 65% of landed non-groundfish pounds but only 2.3% of all landed groundfish pounds. The majority of non-groundfish revenue is still accounted by vessels in the large category; only 33.9% of non-groundfish revenue accounted by low coverage vessels. While high coverage vessels account for the vast majority of landed groundfish pounds, their share of groundfish revenue is slightly less predominant—across all years the share is approximately 96% (Table 213).

Compliance: Spot-check coverage rates may need to be revisited to revised in order to ensure compliance. Random coverage at 20% may be sufficiently high to deter violations due to a sufficiently high probability of detection, but only if fishery participants do not know they will be monitored while fishing is occurring. If that can be achieved, the compliance score of this alternative may be 'high'. In the current maximized retention EFP, the vessel and the DSM coordinate and communicate when the vessel will be at port, this type of communication and knowledge would reduce the compliance benefit of randomized coverage for minor ports and the compliance score may be **"medium" to "high".**

Enforceability: While low coverage vessels account for very low amounts of groundfish pounds in recent years, a key assumption of this option is that effort would not increase. Because of the reduction in monitoring costs, some vessels may have an economic advantage relative to full-coverage vessels. Enforceability benefits of a full DSM program may be weakened somewhat if violators are able to take advantage of the monitoring program and increase their operations, however compared to Option A, this may be easier to track and regulate than at the port-level. Furthermore, if participants know when they will be monitored, spot-check coverage will not be effective at deterring noncompliance. Therefore, the enforceability score of this alternative is **'medium' to 'high',** depending on the ability for participants to shift their operations and/or the efficacy of DSMs when they are present.

Impact summary: Relative to No Action, impacts of Option B are expected to be neutral to low negative since it is expected to increase monitoring costs by approximately $582,000 if effort remains similar to recent years. However, compared to Dockside Monitoring Option 2, impacts are positive since it would reduce total monitoring costs by nearly 40%. Impacts are also neutral to low positive relative to Option A, lower coverage for small ports, since estimated costs are slightly lower under this Option. In addition, distributional impacts on low-volume vessels, those participating in the common pool, or delivering to minor ports will also be minimized under Option A while providing some compliance and enforceability benefit from randomized coverage, as long as participants do not know when they will be monitored. Because overall opportunity for noncompliance is higher than in Option 2, there are some negative compliance and enforceability impacts, but there are relatively minor because of the low amounts of groundfish caught by vessels in the low-coverage category. If monitoring costs continue to be subsidized, as they have been in past years, economic impacts may be lower, if not neutral relative to Status Quo, depending on the amount of the subsidy.

Table 213 - Groundfish (GF) and non-groundfish (NGF) landed pounds and ex-vessel value (thousands of 2018$) by vessel category (small or large) and group (sector or common pool).

FY	Coverage	Group	GF (lbs)	NGF (lbs)	GF ($)	NGF ($)	Trips*	Vessels
2016	low	sector	712	13,642	1,829	7,341	3,110	74
2016	high	sector	32,787	7,485	48,683	16,571	3,397	135
2016	low	common pool	202	1,144	516	616	461	23
2016	high	common pool	126	1,409	323	426	355	36
2017	low	sector	748	14,397	1,857	7,065	3,237	68
2017	high	sector	36,304	7,705	44,380	14,710	3,520	130
2017	low	common pool	165	1,858	397	660	509	29
2017	high	common pool	20	105	49	99	85	25
2018	low	sector	721	13,421	1,532	7,276	3,332	69
2018	high	sector	43,400	7,180	47,383	13,827	3,803	110
2018	low	common pool	123	1,316	247	559	414	28
2018	high	common pool	26	599	46	263	144	26
Low coverage proportion %			*2.3%*	*65.2%*	*4.3%*	*33.9%*	*49.5%*	*38.6%*

Source: NMFS dealer, trip, and permit data.

Table 214 - Estimated costs for randomized selection of trips for low-volume vessels (200 simulations). Total is based on mean estimated cost of randomly observing 20% of trips for low-volume vessels (2018$).

	Low coverage vessels						
FY	Mean cost	Median cost	Standard deviation	25th percentile	75th percentile	Large vessel cost	**Total DSM cost**
2016	90,252	90,142	1,753	88,928	91,292	499,701	**589,953**
2017	97,146	96,967	1,845	95,902	98,196	450,760	**547,906**
2018	87,332	87,260	1,095	86,616	87,981	522,014	**609,347**
Average	91,577	91,456	1,564	90,482	92,490	490,825	**582,402**

7.5.4.2.4 Dockside Monitoring Fish Hold Inspection Requirements

7.5.4.2.4.1 Fish Hold Inspection Option A – Dockside monitor fish hold inspections required

This measure would require that monitors be allowed to access the fish hold of vessels directly to verify that all of the retained catch is offloaded and accounted for at the conclusion of an offload. This option would require that the dockside monitoring service provider is responsible for providing insurance liability associated with having monitors inspect the fish hold of the vessel, similar to how at-sea monitor and observer providers are responsible for providing insurance liability for at-sea observers on board vessels, therefore this option may increase the cost burden (low negative economic impacts) to either dealers or vessels depending on what sub-option is selected under Section 4.2.2.1. Due to safety reasons, dockside monitors would only enter fish holds that have been emptied in order to verify that the fish hold is empty and therefore would be unlikely to have captured gases.

This option is expected to have low negative, neutral, or low positive economic impacts relative to Option B, since vessels would not have to purchase cameras or other equipment to perform hold inspections.

Compliance: Ensuring that the fish hold is empty helps ensure that all landed catch went to a dealer, and that reported landings are accurate and comprehensive of kept catch. If the fish hold is not empty, it is expected that there will be at least one other offload that needs to be observed. Without hold inspections, the ability to misreport landings is increased, and in a quota managed fishery there exists an incentive to evade quota constraints through misreporting or underreporting catch (see Appendix V, #1a). Therefore, ensuring fish holds are empty is expected to increase compliance with reporting requirements. Relative to Option B and C this is expected to have neutral effects on compliance as long as monitor reports are assumed accurate and unbiased.

Enforceability: Requiring a dockside monitor to inspect fish holds creates an opportunity for enforcement action if it is discovered that the fish hold is not empty, and no other offloads were reported to other dealers for that trip, such as through an attempt to conceal fish. Dockside monitors, like observers, are not enforcement agents and cannot take enforcement actions but their reports can be used by enforcement (see appendix of discard incentive model, appendix 1). Therefore, requiring dockside monitors to perform fish hold inspections is expected to increase the enforceability of reporting requirements. Relative to Option B, this option is expected to have neutral effects on enforceability as long as monitor reports are assumed accurate and unbiased.

Relative to Option C, this option is expected to have low positive to positive impacts on both compliance and enforceability since reducing the ability to perform hold inspections has been noted by enforcement to limit their capabilities to investigate possible illegal activities (Attachment 6, Groundfish PDT memo to the Groundfish Committee, May 3rd 2018).

7.5.4.2.4.2 Fish Hold Inspection Option B – Alternatives method for inspecting (cameras)

This measure would allow for the use of cameras to verify that all of the retained catch is offloaded and accounted for, as an alternative method to dockside monitors directly accessing fish holds for inspections. This option may be particularly well suited for use on vessels with EM systems. This option is expected to have neutral to low negative economic impacts relative to Option A, since vessels with EM will use their cameras to perform inspections and incur no additional costs, but other vessels may have to purchase cameras or other equipment, therefore direct economic impacts may be neutral to negative relative to Options A or C.

Relative to Option A, this option is expected to have neutral effects on compliance and enforceability as long as monitor reports are assumed accurate and unbiased but may have some positive impacts if electronic records are perceived to be more robust in enforcement actions that human-based reports. Relative to Option C, this alternative is expected to have low positive to positive impacts on both compliance and enforceability since reducing the ability to perform hold inspections has been noted by enforcement to limit their capabilities to investigate possible illegal activities (Attachment 6, Groundfish PDT memo to the Groundfish Committee, May 3rd 2018).

7.5.4.2.4.3 Fish Hold Inspection Option C – No fish hold inspection required, captain signs affidavit

This option would not require inspections of fish holds at the conclusion of an offload as a part of dockside monitoring, and instead would require captains to sign an affidavit, subject to the penalties of perjury, certifying that all catch has been removed from the fish hold concluding the offload, or an estimate of retained catch. This alternative would have neutral economic impacts relative to Option A, since neither requires vessels to purchase and maintain additional equipment, but potentially positive economic impacts relative to Option B, for vessels that do not already have cameras as part of an EM system.

Relative to Options A and B, this alternative is expected to have a negative impact on both compliance and enforceability relative to Option B or C since reducing the ability to perform hold inspections has been noted by enforcement to limit their capabilities to investigate possible illegal activities (Attachment 6, Groundfish PDT memo to the Groundfish Committee, May 3rd 2018).

7.5.4.3 Combined impacts of enhanced at-sea monitoring coverage and dockside monitoring program

Since this action is considering alternatives to enhance monitoring standards, up to 100% at-sea monitoring coverage levels for sector vessels as well as implementing a mandatory dockside monitoring program for the entire commercial groundfish fishery, the potential combined economic impacts of those measures is described in this section. The previous sections evaluate the static and dynamic costs of at-sea monitoring standards for 25% to 100%. The static estimates range from about $1 million under No Action to over $5 million under 100% coverage levels; so negative economic impacts are expected under higher coverage levels from reduced profits (caused by increased monitoring costs), noting that impacts may be more negative for vessels in some homeports, vessel size classes, or who participate less in the fishery.

However, the higher coverage level alternatives have positive impacts on compliance and enforceability, which could offset some of the direct negative economic impacts: if the opportunity for illegal activity at sea is low than the fishery may experience positive economic impacts from improved compliance and enforceability with at-sea reporting requirements. Benefits stemming from improved compliance and enforceability include accurate accounting of true catch and proper allocation of fishing opportunities. Full catch accounting in the form of comprehensive at-sea and dockside monitoring is expected to increase the functionality of the ACE lease market by ensuring that prices are reflective of true opportunity costs. A functioning ACE lease market not only benefits skilled, active fishermen who can avoid bycatch and maximize the value of their catch relative to ACE costs, but also benefits fishermen who join sectors and choose to lease their ACE. However, it is important to note that benefits associated with accurate catch accounting may be reduced, or nullified, if monitoring levels are not sufficiently high at-sea as well as shoreside: Increased monitoring at-sea alone s may have the adverse effect of increasing incentives to misreport, non-report, or otherwise be non-compliant with dockside reporting requirements.

A comprehensive dockside monitoring program would discourage non-compliant behavior shoreside, in a similar way that at-sea monitoring does when fishing. If the dockside monitoring program is adopted in this action it is predicted to have an overall cost of approximately $1 million dollars for the entire fishery (sectors and common pool), or $3,500-$4,200 per vessel. The sector component of the fishery represents the majority of landings and effort, and therefore majority of cost, around $800,000 per year. There are several measures in this action that could reduce these costs if some vessels are exempt from higher at-sea coverage and/or 100% dockside monitoring. At the extreme, total costs may be reduced by 39% to nearly $600,000. However, a comprehensive at-sea and dockside monitoring program would ensure a more complete catch accounting system, by discouraging shoreside noncompliance, and impacts stemming from improved compliance and enforceability are expected to neutralize some of those costs.

Additionally, if both enhanced at-sea monitoring and mandatory dockside monitoring are adopted in this action the incremental costs of a dockside monitoring program might be much lower than the predicted standalone cost. For example, if 100% ASM coverage is selected and human at-sea monitors are the primary monitoring tool, then the ASM may be able to serve as the DSM on the same trip, reducing travel costs, or additional time coordinating and/or waiting for a vessel to arrive, which in turn could reduce estimated DSM costs considerably (travel costs alone were estimated to be approximately one third of total estimated costs). The maximized retention model also requires DSM presence to account for sub-legal landings, which is already factored into the cost of that EM alternative, thus another DSM would not need to be present on those trips. The blended analysis suggests that between 15 and 23 vessels potentially might adopt maximized retention under higher levels of monitoring coverage, further reducing additional DSM costs. The extent of these cost-efficiencies might be limited depending on both the ultimate coverage rate chosen, the types of EM tools available, and other alternatives in the document, such as funding responsibility.

7.5.5 Sector Reporting

7.5.5.1 Sector reporting Option 1: No Action

Option 1/No Action would continue to require sectors to report all landings and discards to NMFS on a weekly or daily basis, and would continue to require that sectors submit annual year-end reports to NMFS and the Council. This is expected to have neutral to low negative impacts on the groundfish fishery to the extent that it simplifies the reporting process and reduces transaction costs associated with complying with regulations.

7.5.5.2 Sector reporting Option 2 – Grant Regional Administrator the Authority to Streamline Sector Reporting Requirements

This measure would grant the Regional Administrator authority to revise the sector monitoring and reporting requirements currently prescribed in the regulations [648.87(b)(1)(v) and (vi)] to streamline the sector reporting process, this is expected to have neutral to low positive impacts on the groundfish fishery to the extent that it simplifies the reporting process and reduces transaction costs associated with complying with regulations. In addition, if discards and ACE balances were determined more quickly, fishing businesses might make benefit from more certain financial planning, such as when to lease in or lease out quota.

7.5.6 Funding/Operational Provisions of Groundfish Monitoring (Sectors and Common Pool)

7.5.6.1 Funding Provisions Option A: No Action

Option 1/No Action would continue to require industry to fund at-sea monitoring costs. However, NMFS would be required to acquire funding for shoreside administrative costs of the program, which may be limited in any given year. If a fixed rate of target monitoring coverage is required, then vessels would be required to reduce fishing effort to match the available level of monitoring that can be covered by available funding for NMFS' shoreside costs. Therefore, Option A/No Action may have neutral to high negative impacts on the groundfish fishery, depending if and what the degree of funding limitations might be for NMFS to administer the program.

7.5.6.2 Funding Provisions Option 2 – Provisions for an Increase or Decrease in Funding for the Groundfish Monitoring Program

7.5.6.2.1 Funding Provisions Sub-Option 2A – Higher Monitoring Coverage Levels if NMFS Funds are Available (Sectors Only)

This measure would allow for at-sea monitoring at a high coverage level than the target coverage required (see section 4.1.1), up to 100 percent provided that NMFS has determined funding is available to cover the additional administrative costs to NMFS as well as sampling costs to industry in a given year. This option is expected to have neutral to strongly positive impacts relative to No Action/Option 1 depending on the coverage rate and programs selected under Sector Monitoring Standards and Tools since it could cover up to 100% of monitoring costs in a given year which could compromise a significant proportion of operating costs in any given year, particularly if a significant increases in monitoring coverage are selected under 4.1.1.

7.5.6.2.2 Funding Provisions Sub-Option 2B – Waivers from Monitoring Requirements Allowed (Sectors and Common Pool) (*Preferred Alternative*)

This measure would allow vessels to obtain waivers to exempt them from industry funded monitoring requirements for either a trip or the fishing year, if coverage was unavailable due to insufficient funding for NMFS shoreside costs at the specified coverage level, including at-sea monitoring, electronic monitoring, and dockside monitoring, as required. Compared to No Action, this Sub-Option is expected to have positive impacts on fishing businesses to the extent that fishing effort would be constrained by the monitoring standard and coverage rate selected under 4.1.1 to the level that NMFS could fund.

7.5.7 Management Uncertainty Buffers for the Commercial Groundfish Fishery (Sectors and Common Pool)

7.5.7.1 Management Uncertainty Buffer Option 1: No Action

The current default adjustment for management uncertainty for groundfish stocks is currently 5 percent of the ABC. For stocks with less management uncertainty, the buffer is set at 3 percent of the ABC; for stocks with more uncertainty, the buffer is set at 7 percent of the ABC. Currently, the sector and common pool components of the groundfish fishery have identical management uncertainty buffers for each groundfish stock. Stocks without state waters catches have a lower management uncertainty buffer of 3 percent of the ABC; zero possession, discard-only stocks have a higher management uncertainty buffer of 7 percent of the ABC. A table of the status quo management uncertainty buffers are provided in Section 4.5.1.

Overall, the direct economic impacts of Option A/No Action are the loss of potential fishery revenue, 3-7% of each stock's ACL, which has a neutral to low-negative impact on the fishery, depending on the stock and fishing effort in any given year.

Compliance: The current management uncertainty buffers have a **neutral to low negative** impact on compliance in the Northeast multispecies fishery. As discussed under 7.4.5, reductions in the sub-ACL for stocks may increase the discard incentive for that stock to the extent that it increases the ACE lease price to ex-vessel price ratio. At current levels of monitoring, instead of reducing effort to restrict catch of constraining stocks, on unobserved trips discard-incentivized stocks will be illegally discarded and unreported, which does not work to ensure the fishery stays within the sub-ACL as adjusted by the buffer, and possible ACL exceedances cannot be measured.

Enforceability: At current levels of monitoring it is not possible to ascertain whether or not illegal discarding is occurring at levels that exceed the ACL with or without the buffer, so the current management uncertainty buffers are not conducive for the detection of enforcement violations. Therefore, Option 1 has a neutral impact on enforceability.

7.5.7.2 Management Uncertainty Buffer Option 2 – Elimination of Management Uncertainty Buffer for Sector ACLs with 100 Percent Monitoring of All Sector Trips (*Preferred Alternative*)

Option 2 would revise the management uncertainty buffer for the sector ACL for all allocated groundfish stocks to be zero, if the option for 100 percent at-sea monitoring, whether as a fixed percentage of sector trips (Section 4.1.1.2) or as a percentage of catch (Section 4.1.1.3) is selected. Thus, this option would increase the sector ACL's by 3 to 7 percent, depending upon the stock.

To estimate the effects of removing the management uncertainty buffers, the sector sub-ACLs that would result were input into the QCM and used in the stand-alone ASM and blended EM and ASM models (with and without subsidy).

Table 215 - Table 217 show that catch increases are not uniform across stocks, and that removal of the management uncertainty buffers will not benefit all fisherman equally.

Table 215 - Estimated catch under the Status Quo and with the management uncertainty buffers removed contingent upon 100% monitoring, with three 100% monitoring conditions as stand-alone ASM, blended ASM and EM without a subsidy and blended ASM and EM with a subsidy (metric tons).

Stock	Status Quo	buffers-ASM_only	buffers-Blended_0	buffers-Blended_1
NONGROUNDFISH	16,071	16,674	16,861	16,767
Redfish	5,189	5,632	5,851	5,678
GB Haddock West	4,353	4,762	4,615	4,836
Pollock	3,249	3,443	3,593	3,667
GOM Haddock	2,908	3,094	3,119	3,087
White Hake	2,162	2,272	2,314	2,281
Plaice	1,125	1,166	1,161	1,148
Witch Flounder	830	871	871	871
GB Cod West	735	792	794	785
GB Haddock East	622	471	616	599
GB Winter Flounder	363	461	423	440
GOM Cod	302	291	302	301
SNE Winter Flounder	224	262	259	253
CC/GOM Yellowtail Flounder	179	175	178	184
GB Cod East	105	114	99	105
GOM Winter Flounder	98	94	97	100
Halibut	68	75	75	77
Southern Windowpane	52	53	53	54
TOTAL GROUNDFISH	22,564	24,026	24,420	24,469
TOTAL CATCH	38,635	40,700	41,281	41,235

Table 216 - Estimated gross revenues under the Status Quo and with the management uncertainty buffers removed contingent upon 100% monitoring, with three 100% monitoring conditions as stand-alone ASM, blended ASM and EM without a subsidy and blended ASM and EM with a subsidy (2018$, mil).

Stock	Status Quo	buffers-ASM_only	buffers-Blended_0	buffers-Blended_1
NONGROUNDFISH	21.50	22.54	22.82	22.60
GB Haddock West	7.44	8.13	7.94	8.35
GOM Haddock	6.43	6.84	6.89	6.85
Redfish	5.70	6.23	6.50	6.29
Pollock	5.23	5.51	5.65	5.83
Plaice	5.08	5.33	5.30	5.28
White Hake	4.52	4.78	4.81	4.78
GB Cod West	3.16	3.40	3.43	3.40
Witch Flounder	2.88	3.05	3.02	3.05
GB Winter Flounder	2.67	3.34	3.04	3.18
GOM Cod	1.58	1.54	1.60	1.60
SNE Winter Flounder	1.39	1.57	1.56	1.52
GB Haddock East	1.02	0.81	1.00	0.99
GOM Winter Flounder	0.57	0.55	0.57	0.58
GB Cod East	0.48	0.53	0.45	0.48
CC/GOM Yellowtail Flounder	0.40	0.40	0.41	0.42
Halibut	0.37	0.39	0.39	0.40
GB Yellowtail Flounder	0.08	0.09	0.08	0.07
TOTAL GROUNDFISH	49.00	52.49	52.64	53.07
TOTAL REVENUES	70.50	75.03	75.46	75.67

Table 217 - Estimated utilization rates under the Status Quo and with the management uncertainty buffers removed contingent upon 100% monitoring, with three 100% monitoring conditions as stand-alone ASM, blended ASM and EM without a subsidy and blended ASM and EM with a subsidy.

Stock	Status Quo	buffers-ASM_only	buffers-Blended_0	buffers-Blended_1
Witch Flounder	1.00	1.00	1.00	1.00
GOM Cod	0.80	0.73	0.76	0.76
White Hake	0.80	0.80	0.81	0.80
Plaice	0.73	0.72	0.71	0.71
GB Cod West	0.68	0.71	0.71	0.70
GB Winter Flounder	0.50	0.62	0.57	0.59
Redfish	0.49	0.50	0.52	0.51
SNE Winter Flounder	0.49	0.55	0.54	0.53
CC/GOM Yellowtail Flounder	0.47	0.44	0.45	0.46
GB Cod East	0.41	0.44	0.38	0.40
GOM Haddock	0.34	0.34	0.34	0.34
GOM Winter Flounder	0.29	0.26	0.27	0.28
SNE/MA Yellowtail Flounder	0.21	0.20	0.19	0.20
GB Haddock West	0.15	0.16	0.16	0.16
GB Yellowtail Flounder	0.12	0.14	0.13	0.12
Pollock	0.09	0.09	0.09	0.09
GB Haddock East	0.04	0.03	0.04	0.04

- ***100% Coverage***

Noting that costs were estimated based on 91% ASM coverage, the dynamically-estimated monitoring cost when EM is a substitute for ASM under 100% coverage with the management uncertainty buffers removed is $3.3 mil for the no-subsidy model, and with the subsidy $0 mil. Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $4.7 mil without subsidy and $4.8 mil with subsidy. Operating profits are increased by $0.4 mil without subsidy, and $1.6 mil with subsidy, relative to the Status Quo (Table 218 - Table 221).

Compare these aggregate estimates to the case where ASM is the only technology available for monitoring (no EM) and with management uncertainty buffers removed, the dynamically-estimated monitoring cost is predicted to be $5.9. Fishery revenues relative to the Status Quo are estimated to be higher, generating an additional $4.2 mil. Operating profits, however, are decreased by $-2.6 mil, relative to the Status Quo.

Note that, for non-USCA stocks, the management uncertainty buffer is 5% and for USCA stocks it is 3%. Under FY18 conditions, a ~3-5% increase in the sector sub-ACLs allows fleet-wide catch and revenues from groundfish to increase by 7-8%, and overall catch and revenue to increase by greater than 5% (~5.5%).

Compliance and Enforceability

Compliance: As discussed under 7.5.3.1.2.4, a move to 100% ASM coverage would dramatically reduce the risk of non-compliance as compared to No Action/Option 1. The reduction of the management uncertainty buffer has a possible positive impact on compliance as well since the incentive to discard may be reduced because more quota will be available, decreasing demand for quota and resultantly, ACE lease prices, by some margin. Overall, this alternative gets a **'high'** compliance score, owning mostly to the fact that comprehensive monitoring would be implemented, but an additional factor is reduced discard incentives.

Enforceability: As discussed under 7.5.3.1.2.4, a move to 100% ASM coverage achieves a **'high'** enforceability score since it greatly increases the amount of information available for enforcement officials to detect and prosecute violations, if and when violations occur. The removal of the uncertainty buffer alone has a neutral impact on enforceability relative to No Action/Option 1 since it neither increases or decreases the information available for enforcement and does not impact the enforceability of groundfish reporting requirements.

Table 218 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage with management uncertainty buffers removed, aggregate fleet totals by days absent category (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Cat	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
ASM only	<=5	0.2	0.0	0.1	0.1	54.9	0.0
	>5, <=20	1.8	0.2	0.5	1.1	61.3	-15.4
	>20, <=50	7.9	1.1	2.2	4.6	58.5	-17.9
	>50, <=80	6.8	0.7	2.3	3.7	55.4	-9.8
	>80, <=160	29.0	2.1	7.7	19.3	66.4	-4.9
	>160	29.4	1.8	7.7	19.9	67.8	0.0
	TOTAL	*75.1*	*5.9*	*20.5*	*48.7*	*64.8*	*-4.5*
Blended, 0	<=5	0.2	0.0	0.0	0.1	46.6	0.0
	>5, <=20	1.8	0.2	0.4	1.1	62.5	-15.4
	>20, <=50	8.1	0.7	2.3	5.1	63.1	-8.9
	>50, <=80	6.6	0.4	2.3	4.0	60.2	-2.4
	>80, <=160	28.9	1.1	7.7	20.1	69.6	-1.0
	>160	30.0	0.9	7.8	21.3	71.0	7.0
	TOTAL	*75.6*	*3.3*	*20.5*	*51.7*	*68.4*	*1.4*
Blended, 1	<=5	0.2	0.0	0.1	0.1	51.8	0.0
	>5, <=20	1.8	0.2	0.5	1.2	64.8	-7.7
	>20, <=50	7.7	0.5	2.2	5.1	65.7	-8.9
	>50, <=80	6.8	0.2	2.3	4.3	62.6	4.9
	>80, <=160	29.0	0.9	7.7	20.4	70.2	0.5
	>160	30.2	0.7	7.8	21.8	72.0	9.5
	TOTAL	*75.7*	*2.5*	*20.6*	*52.9*	*69.9*	*3.7*

Table 219 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage with management uncertainty buffers removed, aggregate fleet totals by vessel home port (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Home Port	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
ASM only	CT PORTS	0.2	0.0	0.0	0.1	74.7	0.0
	OTHER MA PORTS	6.0	0.5	1.9	3.6	60.4	-7.7
	BOSTON	18.0	1.3	5.0	11.7	65.3	-0.8
	CHATHAM	4.8	0.3	0.8	3.7	76.5	-7.5
	GLOUCESTER	16.8	1.3	4.4	11.0	65.8	-8.3
	NEW BEDFORD	12.7	0.9	3.9	8.0	62.9	1.3
	OTHER ME PORTS	2.2	0.3	0.7	1.2	54.9	-14.3
	PORTLAND	5.3	0.4	1.5	3.4	64.2	-15.0
	NH PORTS	2.2	0.4	0.7	1.2	52.7	-20.0
	NY PORTS	0.6	0.1	0.1	0.4	75.5	-20.0
	OTHER RI PORTS	0.4	0.0	0.2	0.2	54.4	-33.3
	POINT JUDITH	2.5	0.4	0.6	1.5	60.0	-16.7
	OTHER NORTHEAST PORTS	C	C	C	C	C	0.0
Blended, 0	CT PORTS	0.2	0.0	0.1	0.2	76.8	100.0
	OTHER MA PORTS	5.9	0.3	1.9	3.8	63.3	-2.6
	BOSTON	17.2	0.6	4.8	11.8	68.7	0.0
	CHATHAM	4.9	0.3	0.8	3.8	78.0	-5.0
	GLOUCESTER	17.0	0.7	4.5	11.9	69.8	-0.8
	NEW BEDFORD	13.0	0.4	4.1	8.6	65.8	8.9
	OTHER ME PORTS	2.2	0.2	0.7	1.3	59.5	-7.1
	PORTLAND	5.5	0.2	1.6	3.8	68.1	-5.0
	NH PORTS	2.3	0.2	0.7	1.4	59.2	-6.7
	NY PORTS	0.6	0.1	0.1	0.5	78.9	0.0
	OTHER RI PORTS	0.4	0.0	0.2	0.2	52.1	-33.3
	POINT JUDITH	2.5	0.2	0.6	1.6	65.2	-11.1
	OTHER NORTHEAST PORTS	C	C	C	C	C	0.0
Blended, 1	CT PORTS	0.2	0.0	0.0	0.1	76.3	0.0
	OTHER MA PORTS	6.1	0.2	1.9	3.9	64.2	0.0
	BOSTON	17.8	0.5	4.9	12.4	69.5	5.1
	CHATHAM	4.7	0.2	0.8	3.8	79.8	-5.0
	GLOUCESTER	16.8	0.5	4.5	11.8	70.3	-1.7
	NEW BEDFORD	13.2	0.4	4.0	8.9	67.3	12.7
	OTHER ME PORTS	2.2	0.1	0.7	1.4	63.0	0.0
	PORTLAND	5.6	0.2	1.6	3.8	68.2	-5.0
	NH PORTS	2.3	0.2	0.7	1.4	62.9	-6.7
	NY PORTS	0.6	0.0	0.1	0.5	83.0	0.0
	OTHER RI PORTS	0.3	0.0	0.1	0.2	57.0	-33.3
	POINT JUDITH	2.4	0.1	0.6	1.7	69.3	-5.6
	OTHER NORTHEAST PORTS	C	C	C	C	C	0.0

Table 220 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage with management uncertainty buffers removed, aggregate fleet totals by vessel size class (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Size Class	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
ASM only	30'to<50'	14.9	1.9	3.6	9.4	63.1	-14.5
	50'to<75'	25.4	2.0	6.3	17.1	67.6	-1.7
	75'+	34.8	2.1	10.4	22.2	63.9	-3.1
Blended, 0	30'to<50'	15.0	1.2	3.7	10.1	67.7	-8.2
	50'to<75'	25.7	1.1	6.4	18.3	71.1	5.2
	75'+	34.8	1.1	10.5	23.2	66.8	1.3
Blended, 1	30'to<50'	14.9	0.8	3.7	10.4	69.9	-5.5
	50'to<75'	25.5	0.8	6.3	18.4	72.1	5.7
	75'+	35.4	0.9	10.5	24.0	67.7	4.8

Table 221 - Estimated dynamic impacts of monitoring under blended ASM and EM with 100% coverage with management uncertainty buffers removed, aggregate fleet totals by sector (91% coverage analyzed, 2018$, mil, costs based on 3 year average for EM).

Subsidy	Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
ASM only	Sustainable Harvest Sector	26.4	1.6	7.3	17.6	66.6	-1.1
	Northeast Fishery Sector II	14.9	1.1	3.8	10.1	67.4	-5.6
	Northeast Fishery Sector VI	5.9	0.5	1.6	3.8	65.1	-5.0
	Northeast Fishery Sector XIII	6.0	0.5	2.1	3.4	56.4	-2.9
	Northeast Fishery Sector VIII	5.6	0.4	1.6	3.6	64.0	0.0
	Georges Bank Cod Fixed Gear	4.8	0.3	0.8	3.7	77.2	-7.5
	Maine Coast Community Sector	2.8	0.3	0.8	1.8	63.0	-5.3
	Northeast Fishery Sector XI	2.3	0.4	0.7	1.2	52.9	-20.0
	Sustainable Harvest Sector -	2.0	0.2	0.8	1.1	52.5	-8.3
	Northeast Fishery Sector V	1.9	0.3	0.4	1.2	62.8	-14.3
	Northeast Fishery Sector XII	1.4	0.2	0.4	0.8	59.2	-20.0
	Northeast Coastal Communities	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.4	0.0	0.1	0.3	58.6	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.1	48.0	0.0
	Northeast Fishery Sector VII	C	C	C	C	C	0.0
Blended, 0	Sustainable Harvest Sector	26.9	0.8	7.3	18.7	69.8	5.1
	Northeast Fishery Sector II	15.1	0.6	3.8	10.7	70.9	0.0
	Northeast Fishery Sector VI	5.8	0.2	1.6	4.0	68.6	0.0
	Northeast Fishery Sector XIII	5.8	0.3	2.1	3.5	59.7	0.0
	Northeast Fishery Sector VIII	5.6	0.2	1.6	3.7	67.1	2.8
	Georges Bank Cod Fixed Gear	4.9	0.3	0.8	3.8	78.8	-5.0
	Maine Coast Community Sector	2.7	0.2	0.7	1.8	65.9	-5.3

Subsidy	Sector	Gross Rev	ASM Cost	Cost of Ops	Operational Profit	Profit (%)	Rel to SQ (%)
	Northeast Fishery Sector XI	2.3	0.2	0.7	1.4	59.7	-6.7
	Sustainable Harvest Sector -	2.0	0.1	0.8	1.1	54.9	-8.3
	Northeast Fishery Sector V	1.9	0.2	0.4	1.3	68.6	-7.1
	Northeast Fishery Sector XII	1.4	0.1	0.4	0.9	66.5	-10.0
	Northeast Coastal Communities	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.5	0.0	0.1	0.3	63.2	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.0	41.5	-100.0
Blended, 1	Sustainable Harvest Sector	27.5	0.7	7.4	19.5	70.6	9.6
	Northeast Fishery Sector II	14.8	0.4	3.8	10.6	71.6	-0.9
	Northeast Fishery Sector VI	5.9	0.2	1.6	4.1	69.1	2.5
	Northeast Fishery Sector XIII	5.8	0.2	2.0	3.6	61.3	2.9
	Northeast Fishery Sector VIII	5.6	0.2	1.6	3.8	67.8	5.6
	Georges Bank Cod Fixed Gear	4.8	0.2	0.8	3.9	80.3	-2.5
	Maine Coast Community Sector	2.6	0.1	0.7	1.8	67.9	-5.3
	Northeast Fishery Sector XI	2.3	0.2	0.7	1.4	63.5	-6.7
	Sustainable Harvest Sector -	2.0	0.1	0.8	1.2	57.8	0.0
	Northeast Fishery Sector V	1.9	0.1	0.4	1.4	73.2	0.0
	Northeast Fishery Sector XII	1.4	0.1	0.4	1.0	68.9	0.0
	Northeast Coastal Communities	C	C	C	C	C	0.0
	Northeast Fishery Sector III	0.5	0.0	0.2	0.3	61.0	0.0
	Northeast Fishery Sector X	0.1	0.0	0.0	0.1	51.3	0.0

7.5.8 Remove Commercial Groundfish Monitoring Requirements for Certain Vessels Fishing Under Certain Circumstances

7.5.8.1 Removal of Monitoring Program Requirements Option 1: No Action (Sectors Only)

Option 1/No Action would maintain the existing maintain the existing measures for removal of groundfish monitoring program requirements. Sector vessels fishing exclusively with extra-large mesh (ELM) gillnets of 10 inches (25.4 cm) or greater on a sector trip fishing exclusively in the SNE/MA and Inshore GB Broad Stock Areas would continue to be removed from the at-sea monitoring coverage requirement. No Action has positive economic impacts on the groundfish fishery to the extent that it minimizes trips monitoring costs, but may carry some risk of non-compliance since discards and landings are not independently verified and incentives for non-compliance exist in the fishery, even when catch of allocated stocks may be small.

7.5.8.2 Removal of Monitoring Program Requirements Option 2 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 72 Degrees 30 Minutes West Longitude

7.5.8.2.1 Removal of Monitoring Program Requirements Sub-option 2A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only)

This alternative would remove the at-sea monitoring requirement for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a trip (see Map 2). VMS declaration and application of transit rules east of the line would be required.

An analysis of groundfish catch west of 72.5 degrees longitude (see Section 6.6.11.2) calculated total landings of groundfish stocks across 2010-2017. For most stocks, catches have been minimal in recent years. Winter flounder had the highest landings in 2016 and 2017 with 8,600 pounds in 2017, or approximately 1% of total landings. In previous years, greater quantities of both SNE winter flounder and SNE yellowtail flounder were landed in this area, but no more than 50,0000 pounds of any stock were landed in any year. While landings of windowpane flounder were low in 2016 and 2017, in 2014 nearly 8% of total windowpane landings were caught in the proposed exemption area. Because of the low levels of groundfish landings in this area, exempting these trips from monitoring coverage is expected to result in positive economic impacts to those who fish in the exempted area, but neutral economic impacts on the fishery as a whole, relative to No Action/Option 1 since total estimated ASM cost savings are less than $30,000 in each fishing year, and less than $3,000 in FY 2018, covering just two vessels and four days absent (Table 222). In FY 2016, effort in this area was higher, but still limited to 4 vessels and 41 days absent, a relatively small proportion of total groundfish effort and a small proportion of the fleet which included 209 vessels in FY 2016 and 179 in FY 2018. Estimated ASM costs are a maximum as well, considering that the target coverage rate may be far less than 100% depending on what is selected in this action and what NEFOP coverage rates are.

Compliance: While very little groundfish is landed in the proposed exempted area under Option 2, this may nevertheless incentivize increased effort and possibly illegal behavior in the fishery in order to avoid observer costs as well as costs imposed by being fully accountable to your quota when an observer is onboard. Effort west of the proposed boundary may increase as a result of these increased economic incentives to the extent it is more profitable to fish there, without an observer, than it is in other areas when you must carry an observer some proportion of the time (depending on the coverage rate selected under 4.1.1). Compared to Sub-Option 2B, this option is expected to have positive impacts on compliance to the extent that it potentially affects less of current fishing effort.

Enforceability: This alternative is expected to have neutral to low negative impacts on enforceability impacts compared to No Action and neutral impacts relative to Sub-Option 2B. If new VMS codes and transit rules are put in place alongside this action enforcement may be able to detect violators who did not indicate that they would be fishing under the exemption, but would not increase the ability for enforcement to detect misreporting or illegal discarding.

Impact Summary: Overall, direct economic impacts of Sub-Option 2A relative to No Action are neutral to low positive, since the entire groundfish fishery is minimally affected even if 100% ASM coverage were to be selected, but distributional impacts could be more positive to affected vessels, since it reduces their potential total ASM cost obligation. However, exempting vessels based on area fished may mean the incentive to discard illegally, or otherwise conduct illegal activities, is greater than in adjacent areas, depending on the total coverage selected in this action, resulting in low negative indirect impacts on compliance. While is it difficult to enforce retention requirements without an observer onboard, other illegal behavior, just as stat area misreporting, is enforceable to the extent enforcement agents investigate discrepancies between VMS fishing locations and VTR reported locations, therefore this measure will have a low negative to neutral impact on enforceability, but may increase workloads for enforcement agents.

Table 222 - Potential ASM costs for exempted sector trips West of 72.5 degrees. Total pounds represent live pounds of groundfish (GF) and nongroundfish (NGF), while NGF and GF pounds are landed dealer pounds. All revenue and costs are in $2018.

FY	Group	Vessels	Trips	Days Absent	Total Pounds	GF (lbs)	NGF (lbs)	GF ($)	NGF ($)	ASM ($)
2016	sector	4	8	41	192,807	29,270	92,716	28,348	242,824	28,759
2017	sector	4	6	8	29,313	2,949	14,470	8,338	39,509	5,451
2018	sector	2	6	4	c	c	c	c	c	3,029

Source: GARFO DMIS data.

7.5.8.2.2 Removal of Monitoring Program Requirements Sub-option 2B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool)

This alternative would remove the dockside monitoring requirement (if implemented) for vessels fishing exclusively west of 72 degrees 30 minutes west longitude on a trip (see Map 2). VMS declaration and application of transit rules east of the line would be required.

An analysis of groundfish catch west of 72.5 degrees longitude (see Section 6.6.11.2) calculated total landings of groundfish stocks across 2010-2017. For most stocks, catches have been minimal in recent years. Winter flounder had the highest landings in 2016 and 2017 with 8,600 pounds in 2017, or approximately 1% of total landings. In previous years, greater quantities of both SNE winter flounder and SNE yellowtail flounder were landed in this area, but no more than 50,0000 pounds of any stock were landed in any year. While landings of windowpane flounder were low in 2016 and 2017, in 2014 nearly 8% of total windowpane landings were caught in the proposed exemption area. Because of the low levels of groundfish landings in this area, exempting these trips from monitoring coverage is expected to result in positive economic impacts to those who fish in the exempted area, but neutral economic impacts on the fishery as a whole, relative to No Action/Option 1.

Overall, based on VTR reported fishing location, Sub-Option 2B would have affected a minority of groundfish vessels and trips between FY 2016 and FY 2018 (Table 223). In FY 2018, only 2 sector vessels and 4 common pool vessels reported fishing west of 7.5 degrees longitude, for a total of 15 trips in that fishing year. Using the DSM cost model, cost savings under 100% DSM monitoring would be approximately $16,720, less than 2% of total estimated DSM costs under full coverage. Under the lower-coverage options, this alternative offers even lower cost-savings.

Between groups, over the three fishing years examined, majority of the effort west of 72.5 degrees west is by the common pool. In 2017, 32 common pool trips occurred west of 72.5 which accounted for approximately 15% of total estimated DSM costs for the common pool. In other years, trips occurring in this area would have accounted for approximately 5% of total estimated DSM costs, which is much larger than for sectors, which at most was 1.5% of total estimated cost in FY 2016.

Compliance: While very little groundfish effort occurs in the proposed exempted area under Option 2, minimizing direct economic impacts, this option may nevertheless incentivize increased effort and possibly illegal behavior in the fishery in order to avoid DSM costs as well as costs imposed by being fully accountable to your quota dockside in the case of sector vessels. Effort west of the proposed boundary may increase as a result of these increased economic incentives to the extent it is more profitable to fish there, depending on the coverage rate selected under 4.1.1, as well if ASM coverage is also exempted. It is expected that for at least groundfish vessels near or after the proposed line, such as those that are homeported or deliver to New York or Connecticut Ports, some shifts in effort and landing locations may occur, depending on what is selected under 4.1.1. Approximately 6-9 sector trips reported fishing in the proposed area between FY 2016 and FY 2018 while slightly more common pool trips (9-32) occurred there in the same period. Compared to Sub-Option 3B, this option is expected to have positive impacts on compliance to the extent that it potentially affects less fishing effort.

Enforceability: This alternative is expected to have negative impacts on enforceability impacts compared to No Action if 100% DSM is selected, and low positive impacts relative to Sub-Option 3B, since this option would reduce the ability for enforcement to detect misreporting dockside, but would affect a smaller proportion of trips relative to Sub-Option 3B.

Impact Summary: Overall, direct economic impacts of Sub-Option 2B are low positive to positive when compared to a comprehensive DSM program under Option 2, as discussed in Section 7.5.4.1.2. Overall direct economic impacts are low positive because the overall cost reductions of this alternative are small compared to the estimated cost of a comprehensive DSM program, but distributional impacts may be more strongly positive. In particular, common pool vessels and vessels whose activities are concentrated in southern ports may benefit more from Sub Option 2B, particularly because DSM costs are estimated to be proportionally higher for vessels offloading in New York and other states south of Point Judith. Indirect economic impacts may be low negative relative to No Action due to possible negative impacts on compliance and enforceability of reporting requirements, particularly if a high ASM/DSM rate is selected, but are relatively positive compared to Sub-Option 3B.

Table 223 - Vessel and trip characteristics for vessels reporting fishing west of 72.5 W including estimated DSM costs.

FY	Group	Vessels	Trips	Landed pounds	Revenue ($)	Offloading costs ($)	Travel costs ($)	Total costs ($)	% of total DSM costs*
2016	common pool	3	10	30,643	32,325	686	4,829	5,791	4.5%
2016	sector	4	8	121,986	271,172	821	9,925	11,283	1.5%
2017	common pool	6	32	23,775	47,430	2,083	16,119	19,112	15.2%
2017	sector	4	6	17,419	47,847	378	4,216	4,823	0.6%
2018	common pool	4	9	17,041	33,770	548	4,976	5,800	5.0%
2018	sector	2	6	2,718	17,029	411	2,782	3,353	0.4%

Source: GARFO DMIS data. Note: Not all reported groundfish trips reported fishing location on their VTR or VTR location information was otherwise unable to be matched with groundfish trip data, resulting in some loss of information (approximately 1,500 trips were unable to be matched, or 7.5% of all trips). Estimates here may be underestimates as a result.

7.5.8.3 Removal of Monitoring Program Requirements Option 3 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 71 Degrees 30 Minutes West Longitude (*Preferred Alternative*)

7.5.8.3.1 Removal of Monitoring Program Requirements Sub-option 3A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only) (*Preferred Alternative*)

This alternative would remove the at-sea monitoring requirement for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a trip (see Map 2). VMS declaration and application of transit rules east of the line would be required.

An analysis of groundfish catch west of 71.5 degrees longitude (see Section 6.6.11.2) calculated total landings of groundfish stocks across 2010-2017. For most stocks, catches have been minimal in recent years. low amounts of groundfish landings and discards are apparent west of –71.5 degrees, particularly in more recent years, though non-negligible catch of southern windowpane, SNE winter flounder, SNE yellowtail flounder, and ocean pout are apparent. Specifically, 242,067 pounds of SNE winter flounder were landed in 2016, while 166,647 pounds were landed in 2017. 43,188 pounds and 41,138 pounds of SNE yellowtail flounder and western GB cod were also landed in 2016. On aggregate, between 2.8 and 3.5 million pounds of groundfish and non-groundfish were landed on 500 to 600 sector groundfish trips per year between FY 2016 and FY 2018 (live pounds, Table 225). The value of groundfish landings on these trips ranged between $230,000 in FY18 to $591,000 in FY16. Using the average ASM daily rate of $698 per day absent, the maximum cost of observing these trips is between $214,000 and $304,000 per year, assuming every trip is observed (Table 224). Actual costs, and therefore cost savings, will depend on the level of ASM coverage selected in this action and NEFOP coverage in a given year.

Compliance: Because of the level of groundfish effort and groundfish landed in the proposed exempted area under Option 3A, this may incentivize increased effort and possibly illegal behavior in the fishery in order to avoid observer costs as well as costs imposed by being fully accountable to your quota when an observer is onboard. Effort west of the proposed boundary may increase as a result of these increased economic incentives to the extent it is more profitable to fish there, without an observer, than it is in other areas when you must carry an observer some proportion of the time (depending on the coverage rate selected under 4.1.1). Compared to Sub-Option 2A, this option is expected to have negative impacts on compliance to the extent that it potentially affects more of current fishing effort.

Enforceability: This alternative is expected to have neutral to low negative impacts on enforceability impacts compared to No Action and neutral impacts relative to Sub-Option 2A. If new VMS codes and transit rules are put in place alongside this action enforcement may be able to detect violators who did not indicate that they would be fishing under the exemption, but would not increase the ability for enforcement to detect misreporting or illegal discarding.

Impact Summary: Compared to Sub-Option 2A, levels of groundfish landings in the proposed exemption area are substantially higher, exempting these trips from monitoring coverage is expected to result in positive to high positive economic impacts to those who fish in the exempted area, but at most low positive economic impacts on the fishery as a whole, relative to No Action/Option 1, depending on the coverage rate selected under 4.1.1. However, these positive impacts result from cost savings to the fishery alone, in the form of reducing the number of trips needing to be covered by monitors, but could result in negative compliance outcomes to the extent that true catch in this area (landings plus unreported discards) would be unknown and effort may shift to this area in order to further reduce monitoring costs and additional costs imposed by quota constraints that cannot be easily evaded when a monitor is onboard. Compared to Sub-Option 2A, this option is expected to have negative effects on compliance since it affects a larger proportion of total fishing effort. With respect to enforceability, this alternative is expected to have neutral to low negative impacts compared to No Action and neutral to low negative impacts relative to Sub-Option 2A. If new VMS codes and transit rules are put in place alongside this action enforcement may be able to detect violators who did not indicate that they would be fishing under the exemption, but would not increase the ability for enforcement to detect misreporting or illegal discarding.

Table 224 - Potential ASM costs for exempted sector trips West of 72.5 degrees. Total pounds represent live pounds of groundfish (GF) and non-groundfish (NGF), while NGF and GF pounds are landed dealer pounds. All revenue and costs are in $2018.

FY	Group	Vessels	Trips	DA	Total (lbs)	GF (lbs)	NGF (lbs)	GF ($)	NGF ($)	ASM ($)
2016	sector	43	562	393	3,213,959	220,788	2,294,520	590,763	1,864,783	274,646
2017	sector	30	497	284	2,710,428	108,957	1,847,053	321,658	1,405,670	198,424
2018	sector	29	461	305	2,560,984	107,952	1,825,791	230,651	1,359,682	213,048

Source: GARFO DMIS data. Note: ELM exempted trips not removed.

7.5.8.3.2 Removal of Monitoring Program Requirements Sub-option 3B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool) (*Preferred Alternative*)

This alternative would remove the dockside monitoring requirement (if implemented) for vessels fishing exclusively west of 71 degrees 30 minutes west longitude on a trip (see Map 2). VMS declaration and application of transit rules east of the line would be required.

An analysis of groundfish catch west of 71.5 degrees longitude (see 6.6.11.2) calculated total landings of groundfish stocks across 2010-2017. For most stocks, catches have been minimal in recent years. low amounts of groundfish landings and discards are apparent west of –71.5 degrees, particularly in more recent years, though non-negligible catch of southern windowpane, SNE winter flounder, SNE yellowtail flounder, and ocean pout are apparent. Specifically, 242,067 pounds of SNE winter flounder were landed in 2016, while 166,647 pounds were landed in 2017. 43,188 pounds and 41,138 pounds of SNE yellowtail flounder and western GB cod were also landed in 2016.

Over FY 2016 to FY 2018, between 460 and 560 sector trips and 29 to 43 sector vessels reporting fishing in this proposed exempted area, landing approximately 2 million pounds of groundfish and non-groundfish species in each year (Table 225). While majority of landed pounds were non-groundfish pounds, between 100,000 and 200,000 pounds were of allocated groundfish stocks (Table 224). Common pool vessels also took between 205 and 277 trips per year and landed between 1 and 2 million pounds of all species. The DSM model was used to estimate potential DSM costs, as cost savings, as a result of this option. In total, between $214,000 and $269,000 per year could be saved if these trips were exempted from comprehensive DSM coverage. Cost savings would be less if either of the lower coverage options were implemented, which affect low groundfish volume vessels or low volume ports. Because trips in this area typically deliver to southern ports, travel costs are estimated to be quite high relative to offloading costs, resulting in a high relative cost savings compared to trips in other states, like Massachusetts (total DSM costs were estimated to be approximately $940,000 to $964,000 per year).

Compliance: Because of the current levels of effort in the proposed area, this option is likely to incentivize increased effort and possibly illegal behavior in the fishery in order to avoid DSM costs as well as costs imposed by being fully accountable to your quota dockside in the case of sector vessels. Effort west of the proposed boundary may increase as a result of these increased economic incentives to the extent it is more profitable to fish and land there, depending on the coverage rate selected under 4.1.1.1, as well if ASM coverage is also exempted. It is expected that for at least groundfish vessels near or after the proposed line, such as those that are homeported or deliver to New York or Connecticut Ports, some shifts in effort and landing locations may occur, depending on what is selected under 4.1.1. Compared to Sub-Option 2B, this option is expected to have negative impacts on compliance to the extent that it potentially affects more fishing effort.

Enforceability: This alternative is expected to have negative impacts on enforceability impacts compared to No Action if 100% DSM is selected, and low negative impacts relative to Sub-Option 2B, since this option would reduce the ability for enforcement to detect misreporting dockside, but would affect a greater proportion of trips relative to Sub-Option 2B.

Impact Summary: Compared to Sub-Option 2B, levels of groundfish landings in this area are substantially higher, exempting these trips from monitoring coverage is expected to result in positive to high positive economic impacts to those who fish in the exempted area, and low positive to positive economic impacts on the fishery as a whole, relative to No Action/Option 1, depending on the DSM coverage rate selected under 4.1.1. However, these positive impacts result from cost savings to the fishery alone, in the form of reducing the number of offloads needing to be covered by monitors, but could result in negative compliance outcomes to the extent that true landings in this area would be unknown and effort may shift to this area in order to further reduce monitoring costs and additional costs imposed by quota constraints. Compared to Sub-Option 2B, this option is expected to have negative effects on compliance since it affects a larger proportion of total fishing effort. With respect to enforceability, this alternative is expected to have negative impacts compared to No Action and low negative impacts relative to Sub-Option 2B since it may reduce the ability for enforcement to detect misreporting dockside.

Table 225 - Vessel and trip characteristics for vessels reporting fishing west of 72.5 W including estimated DSM costs. Source: GARFO DMIS data.

FY	Group	Vessels	Trips	Landed pounds	Revenue ($)	Offloading costs ($)	Travel costs ($)	Total costs ($)	% Total DSM costs*
2016	common pool	21	277	1,887,757	932,646	23,101	67,529	95,162	74.2%
2016	sector	43	562	2,515,308	2,455,546	36,446	129,575	174,321	23.2%
2017	common pool	26	262	1,269,505	692,755	19,658	73,914	98,251	78.0%
2017	sector	30	497	1,956,010	1,727,328	31,794	107,296	146,045	19.4%
2018	common pool	25	205	1,182,573	575,204	16,291	54,544	74,377	63.6%
2018	sector	29	461	1,933,742	1,590,333	30,097	102,592	139,324	17.8%

Note: Not all reported groundfish trips reported fishing location on their VTR or VTR location information was otherwise unable to be matched with groundfish trip data, resulting in some loss of information (approximately 1,500 trips were unable to be matched, or 7.5% of all trips). Estimates here may be underestimates as a result.

7.5.8.4 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements

7.5.8.4.1 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 1: No Action

Under Option 1/No Action, there is no formal review process to verify that catch composition from vessels fishing on trips that are removed from monitoring requirements have little to no groundfish. Overall, this alternative is expected to have neutral economic impacts since it is not expected that a review will impose any additional costs on fishing businesses. There may be some negative, indirect economic impacts if no review process is implemented and changes in effort or catch composition by exempted vessels change drastically.

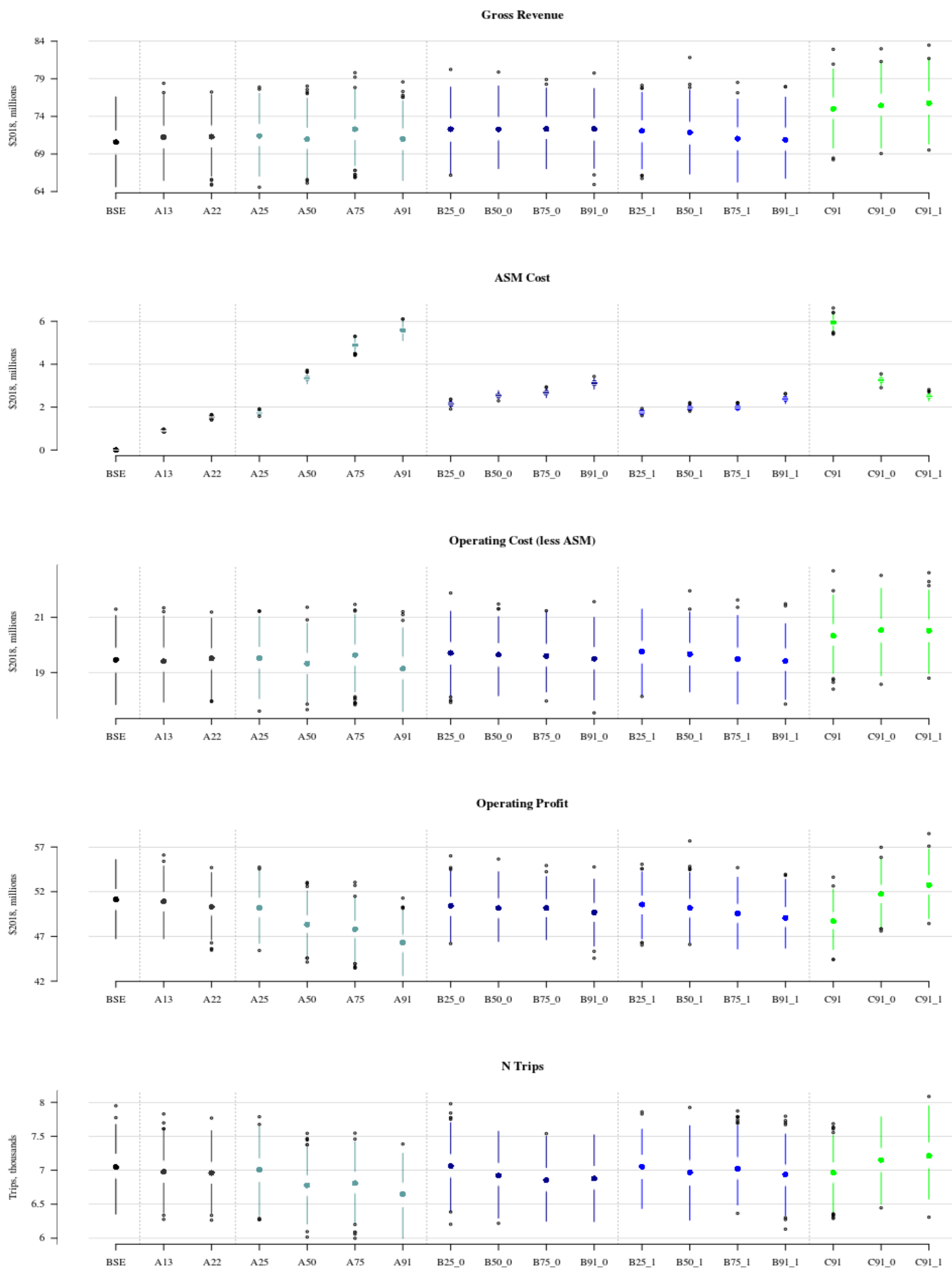
7.5.8.4.2 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 2 – Implement a Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements (*Preferred Alternative*)

This option, if selected, would establish a process for review of measures for removal of monitoring requirements for vessels that are based on catch composition, should the Council select these measures, to occur after two years of fishing data is available and every three years after that. Overall, this alternative is expected to have neutral economic impacts since it is not expected that a review will impose any additional costs on fishing businesses. However, this option is expected to have neutral to low positive impacts on compliance relative to status quo if it limits potential effort shifts in the two years before the review begins, however, if fishermen have a high discount rate, they may still perceive that benefits associated with reducing or eliminating short-term (1-2 year) monitoring costs to be worth shifting operations to an exempted area, depending on whether Option 2 or 3 is ultimately selected.

7.5.9 Summary of quantitative analysis (coverage rates, at-sea monitoring tools, buffers, and dockside monitoring)

- Costs matter, and the relationship between static cost and dynamic operating profit is not linear because quota are tradeable;
- EM is substantially less costly than ASM for all vessels fishing in the (non-FW55 exempt) groundfish fishery more than 20 days per year;
- The ability to select into EM reduces cost by 44% - 60% when costs are averaged over three years, noting that even this cost reduction is based on an estimate that is not optimized (ASM alone could be roughly 70% more expensive to industry than the low-cost frontier when equipment and installation are subsidized);
- Subsidizing equipment and installation in year 1 brings the three-year average cost of comprehensive monitoring below the cost of partial monitoring as they were initially analyzed in A16; and,
- Gross revenues and operating profits are all higher for comprehensive (100%) monitoring than they are estimated to be under the Status Quo (no industry funded monitoring) scenario, when the option to remove management uncertainty buffers is selected, noting that these increased profits are not uniformly distributed across the fishing fleet.
- Dockside monitoring is expected to cost between $0.8 and $1 million dollars per year if it is a completely independent program from ASM and ensures accurate catch accounting will occur dockside.
- Lower DSM coverage level options for low-volume ports or vessels may reduce DSM costs by 35% to 39%, and carries low risk of non-compliance due to the low-volume of groundfish caught (<5%).
- Exempting effort W of 71.5 degrees longitude may reduce potential DSM costs, but comes at the risk for higher non-compliance and lack of enforceability on those trips. Exempting effort W of 72.5 degrees longitude carries less risk since a smaller proportion of groundfish effort takes place in that area.
- Some DSM cost components may be reduced, or be eliminated if the DSM program is coupled with the ASM program, particularly if a high overall coverage rate is selected. In addition, under high ASM coverage, incentives for non-compliance with shoreside regulations may increase, reducing the overall compliance and enforceability benefits of the program.

Figure 53 - Summary of aggregate results across several metric for various quantitatively analyzed options under consideration (2018$, mil.)



Key: Black = SQ (BSE) and No Action, Aqua = Stand-alone ASM options (A_XX), Dark blue = Blended EM and ASM options with no subsidy (B_XX_0), Blue = Blended EM and ASM options with subsidy (B_XX_1) and Green = 100% monitoring with management uncertainty buffers removed under three scenarios, stand-alone ASM (C91), blended EM and ASM with no subsidy (C91_0) and blended EM and ASM with subsidy (C91_1))

7.6 IMPACTS ON HUMAN COMMUNITIES – SOCIAL

National Standard 8 (NS8) requires the Council to consider the importance of fishery resources to affected communities and provide those communities with continuing access to fishery resources, but it does not allow the Council to compromise the conservation objectives of the management measures. Thus, continued overall access to fishery resources is a consideration, but not a guarantee that fishermen would be able to use a particular gear type, harvest a particular species of fish, fish in a particular area, or fish during a certain time of the year.

A fundamental difficulty exists in forecasting social change relative to management alternatives, since communities or other societal groups are constantly evolving in response to external factors (e.g., market conditions, technology, alternate uses of waterfront, tourism). Certainly, fishery regulations influence the direction and magnitude of social change, but attribution is difficult with the tools and data available.

While the focus here is on the social impacts of the alternatives, external factors may also influence change, both positive and negative, in the affected communities. External factors may also lead to unanticipated consequences of a regulation, due to cumulative impacts. These factors contribute to a community's ability to adapt to new regulations. When examining potential social impacts of management measures, it is important to consider impacts on the following: the fishing fleet (vessels grouped by fishery, primary gear type, and/or size); vessel owners and employees (captains and crew); groundfish dealers and processors; final users of groundfish; community cooperatives; fishing industry associations; cultural components of the community; and fishing families. While some management measures may have a short-term negative impact on some communities, these should be weighed against potential long-term benefits to all communities which can be derived from a sustainable groundfish fishery.

Social Impact Factors. The social impact factors outlined below can be used to describe the Northeast multispecies (groundfish) fishery, its sociocultural and community context, and its participants. These factors or variables are considered relative to the management alternatives and used as a basis for comparison between alternatives. Use of these kinds of factors in social impact assessment is based on NMFS guidance (NMFS 2007a) and other texts (e.g., Burdge 1998). Longitudinal data describing these social factors region-wide and in comparable terms is limited. Qualitative discussion of the potential changes to the factors characterizes the likely direction and magnitude of the impacts.

The social impact factors fit into five categories:

1. *Size and Demographic Characteristics* of the fishery-related workforce residing in the area; these determine demographic, income, and employment effects in relation to the workforce as a whole, by community and region.
2. The *Attitudes, Beliefs, and Values* of fishermen, fishery-related workers, other stakeholders and their communities; these are central to understanding the behavior of fishermen on the fishing grounds and in their communities.
3. The *Social Structure and Organization*; that is, changes in the fishery's ability to provide necessary social support and services to families and communities, as well as effects on the community's social structure, politics, etc.
4. The *Non-Economic Social Aspects* of the fishery; these include lifestyle, health, and safety issues, and the non-consumptive and recreational uses of living marine resources and their habitats.

5. The *Historical Dependence on and Participation in* the fishery by fishermen and communities, reflected in the structure of fishing practices, income distribution, and rights (NMFS 2007a).

Data utilized to inform the social impact factors include the 2004-2018 Groundfish-Specific Commercial Engagement Indicators, the 2012-2016 Community Social Vulnerability Indicators (CSVI), and results from both the 2012-13 and 2018-19 Socio-Economic Surveys of Hired Captains and Crew in New England and Mid-Atlantic Commercial Fisheries (Crew Survey). These data and methods for collecting them are described in Section 6.6.6.

7.6.1 Commercial Groundfish Monitoring Program Revisions (Sectors Only)

7.6.1.1 Sector Monitoring Standards (Target Coverage Levels)

7.6.1.1.1 Sector Monitoring Standard Option 1: No Action

Option 1 would likely result in neutral to positive impacts on the participants in the commercial groundfish fishery relative to Options 2 and 3. Substantial majorities of groundfish-targeting crew surveyed in both 2012-13 (77%) and 2018-19 (63%) responded that they either agreed or strongly agreed that regulations in their primary fishery are too restrictive. Additional monitoring could be viewed by sector program participants as further restricting their operations. The target and realized coverage levels from FY2010-FY2017 have ranged from 14-38%, and 14-32% respectively, resulting in an average target and realized coverage level of 25% and 22%. The coverage levels under Option 1, therefore, are similar to the option for 25% coverage, and lower than the options for 50% to 100% coverage.

7.6.1.1.2 Sector Monitoring Standard Option 2: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Trips (*Preferred Alternative*)

Option 2 would likely result in neutral to negative social impacts relative to the No Action alternative. Majorities of groundfish crew surveyed in both 2012-13 and 2018-19 reported that regulations in their primary fishery are too restrictive (77% in 2012-13; 63% in 2018-19) and they change so quickly that it is hard to keep up (91% in 2012-13; 75% in 2018-19). Increased at-sea monitoring coverage, especially at higher levels, could exacerbate existing negative attitudes towards management among commercial fishing crew. However, lower fixed coverage levels may attenuate these negative impacts.

Assuming costs associated with implementing increased at-sea monitoring are passed on to crew in the form of decreased compensation, additional monitoring may also result in dissatisfaction among commercial groundfish crew. While only about 41% of groundfish crew in 2012-13 reported being satisfied or very satisfied with their actual earnings, this percentage increased dramatically in 2018-19 with three in four (75%) groundfish crew members reporting feeling either satisfied or very satisfied with their actual earnings. In addition to increased satisfaction with earnings, groundfish crew more often reported feeling satisfied or very satisfied with the predictability of their earnings in 2018-19 (42%) versus 2012-13 (13%). Given these gains in satisfaction with earnings among groundfish crew over time, Option 2 could produce negative impacts on crew attitudes if the costs associated with increased at-sea monitoring result in decreases in crew compensation. That said, lower fixed coverage levels could attenuate the negative impact on this aspect of crew job satisfaction.

Given that these coverage levels would be percentages of trips, the impact may be disproportionately negative for commercial groundfish sector program participants operating smaller vessels or vessels contributing relatively small proportions to overall groundfish landings. Commercial groundfish sector program participants landing catch primarily with dealers in Cape May, NJ, Scituate, MA, Hampton Bays/Shinnecock, NY, Chatham, MA, Portland, ME, and Narragansett, RI may endure relatively greater negative social impacts as a result of at-sea monitoring coverage on higher percentages of trips. While all among the top ten in engagement in the commercial groundfish fishery, these ports hosted substantially less commercial groundfish activity in recent years than the top three ports, New Bedford, MA, Gloucester, MA, and Boston, MA, and in some cases have seen declining or fluctuating engagement in commercial groundfish over time, particularly in Portland, ME and Chatham, MA (Figure 7 in Section 6.6.6.1.1).

7.6.1.1.2.1 Sub-option 2A – 25 percent

For the reasons given above, at-sea monitoring coverage on 25% of trips would produce perhaps the least negative impact on attitudes towards management among commercial fishing crew. Assuming 25% coverage will cost vessel owners less, the 25% coverage level may produce less negative impacts than options for higher levels of coverage in terms of attitudes related to possible decreases in crew compensation from costs associated with increased at-sea monitoring. This option, therefore, would likely have neutral impacts relative to Option 1/No Action, and positive impacts compared to the options for higher monitoring coverage levels.

7.6.1.1.2.2 Sub-option 2B – 50 percent

For the reasons given above, at-sea monitoring coverage on 50% of trips would likely result in greater negative impacts on attitudes towards management among commercial groundfish crew and in terms of attitudes related to possible decreases in crew compensation from costs associated with increased at-sea monitoring. This option, therefore, would lively have negative impacts relative to Option 1/No Action and the option for 25% coverage, and positive impacts compared to the options for higher monitoring coverage levels (75% and 100%).

7.6.1.1.2.3 Sub-option 2C – 75 percent

For the reasons given above, at-sea monitoring coverage on 75% of trips would likely result in greater negative impacts on attitudes towards management among commercial groundfish crew and in terms of attitudes related to possible decreases in crew compensation from costs associated with increased at-sea monitoring. This option, therefore, would lively have negative impacts relative to Option 1/No Action and the options for 25% and 50% coverage, and positive impacts compared to the option for 100% coverage.

7.6.1.1.2.4 Sub-option 2D – 100 percent (*Preferred Alternative*)

For the reasons given above, at-sea monitoring coverage on 100% of trips would likely result in greater negative impacts on attitudes towards management among commercial groundfish crew and in terms of attitudes related to possible decreases in crew compensation from costs associated with increased at-sea monitoring. This option, therefore, would lively have negative impacts relative to Option 1/No Action and the options for 25%, 50%, and 75% coverage.

7.6.1.1.3 Sector Monitoring Standard Option 3: Fixed Total At-Sea Monitoring Coverage Level Based on Percentage of Catch

Option 3 may result in neutral-to-negative social impacts relative to the No Action alternative, and may have negative impacts relative to Option 2. Since Option 3 applies the target coverage level of catch to each allocated groundfish stock, there is the potential to need a higher overall coverage level in order to reliably achieve the target coverage level for each stock (see Section 7.5.3.1.3). Similar to Option 2, increased at-sea monitoring coverage, especially at higher levels, could exacerbate existing negative attitudes towards management among commercial fishing crew. However, lower fixed coverage levels may attenuate these negative impacts. Lower levels of coverage under this option may mitigate the negative social impacts related to the size and demographics, as well as attitudes and beliefs, of sector participants. Assuming costs associated with implementing increased at-sea monitoring are passed on to crew in the form of decreased compensation, additional monitoring may also result in dissatisfaction among commercial groundfish crew. Similar to Option 2, Option 3 could produce negative impacts on crew attitudes if the costs associated with increased at-sea monitoring result in decreases in crew compensation. That said, lower fixed coverage levels could attenuate the negative impact on this aspect of crew job satisfaction.

Given that these coverage levels would be target percentages of catch of each allocated groundfish stock, which would determine an overall coverage level, the impact may be disproportionately negative for commercial groundfish sector program participants operating smaller vessels or vessels contributing relatively small proportions to overall groundfish landings. Commercial groundfish sector program participants landing catch primarily with dealers in Cape May, NJ, Scituate, MA, Hampton Bays/Shinnecock, NY, Chatham, MA, Portland, ME, and Narragansett, RI may endure relatively greater negative social impacts as a result of at-sea monitoring coverage on higher percentages of trips. While all among the top ten in engagement in the commercial groundfish fishery, these ports hosted substantially less commercial groundfish activity in recent years than the top three ports, New Bedford, MA, Gloucester, MA, and Boston, MA, and in some cases have seen declining or fluctuating engagement in commercial groundfish over time, particularly in Portland, ME and Chatham, MA (Figure 7 in 6.6.6.1.1).

7.6.1.1.3.1 Sub-option 3A – 25 percent

As described above, since Option 3 applies the target coverage level of catch to each allocated groundfish stock, there is the potential to need a higher overall coverage level in order to reliably achieve the target coverage level for each stock (see section 7.5.3.1.3). A simulation exercise (see section 7.5.3.1.3) demonstrates that 50% randomized observer coverage across all FY2018 sector trips would result in a 90% probability that at least 25% of the total catch of every allocated stock (and halibut) was observed (Figure 45, Table 136 in section 7.5.3.1.3). The option for 25% as a target percentage of catch, therefore, may have negative impacts on attitudes towards management among commercial groundfish crew and in terms of attitudes related to possible decreases in crew compensation from costs associated with increased at-sea monitoring that are more similar to the options for higher coverage levels as described above in section 7.6.1.1.2. A coverage rate based on 25 percent of catch would likely produce the least negative impacts in terms of the size and demographics, as well as the attitudes and beliefs, of sector participants in the commercial groundfish fishery, compared to the options for higher coverage.

7.6.1.1.3.2 Sub-option 3B – 50 percent

As described above, since Option 3 applies the target coverage level of catch to each allocated groundfish stock, there is the potential to need a higher overall coverage level in order to reliably achieve the target coverage level for each stock (see section 7.5.3.1.3). A simulation exercise (see section 7.5.3.1.3) demonstrates that 70% randomized observer coverage across all FY2018 sector trips would result in a 90% probability that at least 50% of the total catch of every allocated stock (and halibut) was observed (Figure 46, Table 136 in section 7.5.3.1.3). The option for 50% as a target percentage of catch, therefore, may have negative impacts on attitudes towards management among commercial groundfish crew and in terms of attitudes related to possible decreases in crew compensation from costs associated with increased at-sea monitoring that are similar to the options for higher coverage levels as described above in section 7.6.1.1.2. A coverage rate based on 50 percent of catch would likely produce greater negative impacts in terms of the size and demographics, as well as the attitudes and beliefs, of sector participants in the commercial groundfish fishery, compared to the options for lower coverage.

7.6.1.1.3.3 Sub-option 3C – 75 percent

As described above, since Option 3 applies the target coverage level of catch to each allocated groundfish stock, there is the potential to need a higher overall coverage level in order to reliably achieve the target coverage level for each stock (see section 7.5.3.1.3). A simulation exercise (see section 7.5.3.1.3) demonstrates that 90% randomized observer coverage across all FY2018 sector trips would result in a 90% probability that at least 75% of the total catch of every allocated stock (and halibut) was observed (Figure 47, Table 136 in section 7.5.3.1.3). The option for 50% as a target percentage of catch, therefore, may have negative impacts on attitudes towards management among commercial groundfish crew and in terms of attitudes related to possible decreases in crew compensation from costs associated with increased at-sea monitoring that are similar to the options for higher coverage levels as described above in section 7.6.1.1.2. A coverage rate based on 75 percent of catch would likely produce greater negative impacts in terms of the size and demographics, as well as the attitudes and beliefs, of sector participants in the commercial groundfish fishery, compared to the options for lower coverage.

7.6.1.1.3.4 Sub-option 3D – 100 percent

100% coverage as a percentage of catch would likely result in greater negative impacts in terms of the size and demographics, as well as the attitudes and beliefs, of sector participants in the commercial groundfish fishery. This option, therefore, would lively have negative impacts relative to Option 1/No Action and the options for 25%, 50%, and 75% coverage.

7.6.1.2 Sector Monitoring Tools (Options for meeting monitoring standards)

7.6.1.2.1 Sector Monitoring Tools Option 1: Electronic Monitoring in place of Human At-Sea Monitors

Sector Monitoring Tools Option 1, electronic monitoring in place of at-sea monitors, could potentially result in long-term neutral-to-positive impacts relative to Sector Monitoring Standards Option 2 or Option

3 alone, in which at-sea monitors would be used to monitor catch, but short-term impacts may be negative as a result of the initial costs associated with installing electronic monitoring equipment and additional responsibilities that accompany the maintenance of electronic monitoring systems. Assuming electronic monitoring is more cost effective than human at-sea monitors over time, however, Option 1 can provide for positive long-term social impacts by reducing costs associated with monitoring at higher coverage levels over time. There may be a lag in terms of positive impacts on the attitudes, beliefs, and values of commercial groundfish vessel crew and hired captains due to frustrations that may arise from the initial start-up costs and obligations associated with this new electronic monitoring program.

7.6.1.2.2 Sector Monitoring Tools Option 2: Audit Model Electronic Monitoring Option

Sector Monitoring Tools Option 2, audit model electronic monitoring, could result in neutral-to-positive social impacts for commercial groundfish fishery sector program participants relative to Sector Monitoring Tools Option 1 or Sector Monitoring Standards Option 2 or Option 3 alone, in which at-sea monitors would be used to monitor catch. Under an audit model, the electronic monitoring equipment would operate on 100 percent of trips, but only a subset of these hauls or trips would be reviewed to verify vessel trip-reported discards. The review rate could theoretically even be reduced over time through future evaluations of data by NMFS staff, particularly for those vessels that are found to report accurately. That said, the audit model option may also result in negative social impacts as some sector participants may perceive 100% monitoring via electronic surveillance to be intrusive and a violation of privacy, as well as overly burdensome given extra catch handling and reporting requirements, especially in view of Crew Survey results that suggest that the majority of groundfish-targeting crew in 2018-19 feel that the rules and regulations are too restrictive (63%; Table 46 in Section 6.6.6.2.5). Additionally, the added responsibilities associated with extra catch handling and reporting requirements could increase the number of working hours per day for crew assigned these new responsibilities as a result of this action. According to Crew Survey results, groundfish-targeting crew have seen an increase in working hours between 2012 and 2018, with an eleven percent increase in those working 15 hours or more per day (58% in 2012-13 versus 69% in 2018-19; Table 41 and Table 42 in Section 6.6.6.2.3).

7.6.1.2.3 Sector Monitoring Tools Option 3: Maximized Retention Electronic Monitoring Option

Sector Monitoring Tools Option 3, maximized retention electronic monitoring, could result in neutral-to-negative social impacts for commercial groundfish fishery sector program participants relative to Sector Monitoring Tools Option 1 and Option 2, or Sector Monitoring Standards Option 2 or Option 3 alone, in which at-sea monitors would be used to monitor catch. Under the maximized retention model, the electronic monitoring would operate on 100 percent of trips and dockside monitoring would be required on 100 percent of trips as well. While video review rates may be lower than 100 percent once vessels establish compliance in initial reviews, the extensive monitoring coverage associated with both 100 percent electronic and dockside monitoring could be perceived by sector participants as overly burdensome, intrusive, and unnecessary, especially in view of Crew Survey results that suggest that the majority of groundfish-targeting crew in 2018-19 feel that the rules and regulations are too restrictive (63%; Table 46 in Section 6.6.6.2.5). Additionally, the added responsibilities associated with extra catch handling and reporting requirements could increase the number of working hours per day for crew assigned these new responsibilities as a result of this action. According to Crew Survey results, groundfish-targeting crew have seen an increase in working hours between 2012 and 2018, with an eleven percent increase in those working 15 hours or more per day (58% in 2012-13 versus 69% in 2018-19; Table 41 and Table 42 in Section 6.6.6.2.3).

7.6.1.3 Combined impacts of enhanced monitoring standards and dockside monitoring program

Since this action is considering alternatives to enhance monitoring standards, up to 100% at-sea monitoring coverage levels for sector vessels as well as implementing a mandatory dockside monitoring program for the entire commercial groundfish fishery, the potential combined social impacts of those measures is described in this section. Requirements for higher at-sea monitoring coverage levels, up to 100% for sector vessels, combined with a mandatory dockside monitoring program would have increased costs to participants and community members and would create additional burdensome responsibilities for many vessel owners and crew members. However, as noted above in Section 7.5.3.3, if both enhanced at-sea monitoring and mandatory dockside monitoring are adopted in this action the incremental costs of a dockside monitoring program might be much lower than the predicted standalone cost, as there could be cost efficiencies, described above. The extent of these cost-efficiencies might be limited depending on a number of factors described above. Additionally, a comprehensive at-sea and dockside monitoring program would ensure a more complete catch accounting system, which should create a level playing field where all participants are equally held accountable to available ACE. If participants perceive this to create more fairness in the management system, there could be possible positive social impacts to partially offset some of the negative impacts from increased costs.

7.6.1.4 Total Monitoring Coverage Level Timing

7.6.1.4.1 Coverage Level Timing Option 1: No Action

Option 1 would likely result in negative social impacts related to the attitudes and beliefs of stakeholders in the commercial groundfish fishery. The current system for determining the monitoring coverage level is contingent upon the completion of necessary analyses, which often leads to uncertainty about coverage levels among commercial groundfish sector participants. According to results from the Crew Survey, about 75% of groundfish-targeting crew surveyed in 2018-19 reported that they either agree or strongly that the “rules and regulations change so quickly that it is hard to keep up,” (Table 46 in Section 6.6.6.2.5). About 14% fewer crew (61%) in other fisheries reported the same concerns about the pace of change in rules and regulations (Table 46 in Section 6.6.6.2.5). Therefore, uncertainty in rules and regulations is a particularly salient issue among groundfish fishery participants compared with those in other fisheries.

7.6.1.4.2 Coverage Level Timing Option 2: Knowing Total Monitoring Coverage Level at a Time Certain

Option 2 would likely result in positive social impacts related to the attitudes and beliefs of stakeholders in the commercial groundfish fishery relative to the No Action alternative. In establishing a specified date by which monitoring coverage levels will be announced to fishery participants, Option 2 will provide certainty for fishery participants in order to finalize business and fishing year planning decisions. It may also increase flexibility for vessel owners and captains to make changes to business plans and fishing activity decisions. As described in Table 46 in Section 6.6.6.2.5, about three-quarters of crew and hired captains in the groundfish fishery felt that rules change too quickly for them to be able to keep up. Option 2 may improve these conditions so that industry participants have certainty in at least this aspect of groundfish fishery management.

7.6.1.5 Review process for Sector Monitoring Coverage

7.6.1.5.1 Coverage Review Process Option 1: No Action

Option 1 will likely have neutral social impacts on the commercial groundfish fishery and fishing communities. While a review process for sector monitoring coverage might improve attitudes among fishery participants about the transparency and accountability of the monitoring program, there is no expectation that forgoing the creation of such a review process would either positively or negatively impact the social circumstances of fishery participants and communities. At best, No Action would not improve attitudes and beliefs about a program that may already be very unpopular among fishery participants.

7.6.1.5.2 Coverage Review Process Option 2: Establish a Review Process for Monitoring Coverage Rates (*Preferred Alternative*)

Relative to No Action, Option 2 may have positive social impacts with respect to the attitudes and beliefs of commercial groundfish fishery participants and communities. The implementation of a review process could improve attitudes among fishery participants and community members about the transparency and accountability of the process to determine monitoring coverage rates.

7.6.1.6 Addition to List of Framework Items (*Preferred Alternative*)

The administrative measure to add new sector monitoring tools to the list of management measures that can be adjusted through a framework action would have neutral positive social impacts on the commercial groundfish fishery and communities. While the framework process will provide greater flexibility for management and stakeholders to consider the use of new monitoring tools in the future, there is no expectation that the establishment of this administrative measure will have any discernibly positive or negative impact in terms of any of the social impact factors outlined above.

Additionally, this administrative measure would add vessel specific coverage levels to the list of management measures that can be adjusted through a framework action. Similar to above, this framework process will provide greater flexibility for management and stakeholders to consider the use of new monitoring tools in the future. Initial discussion and analysis on possible impacts of vessel coverage levels can be found in "Memo from Groundfish PDT to Groundfish Committee re vessel specific coverage level option"[76], as well as in a letter from the NEFSC to the Council[77] in response to a request for information on observer deployment data at the vessel level for groundfish trips.

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[76] "Memo from Groundfish PDT to Groundfish Committee re vessel specific coverage level option", dated November 19, 2019; https://s3.amazonaws.com/nefmc.org/191119-GF-PDT-memo-to-GF-Committee-re-vessel-specific-coverage-level-option-with-attachments.pdf

[77] Letter from NEFSC to NEFMC, dated November 22, 2019; https://s3.amazonaws.com/nefmc.org/191122_Letter_NEFSC-to-NEFMC_vessel-observer-coverage-rates.pdf

7.6.2 Commercial Groundfish Monitoring Program Revisions (Sectors and Common Pool)

7.6.2.1 Dockside Monitoring Program (Sectors and Common Pool)

7.6.2.1.1 Dockside Monitoring Option 1: No Action (*Preferred Alternative*)

Option 1 would likely have a neutral to positive social impact in terms of the size and demographics and attitudes and beliefs among commercial groundfish fishery participants and communities. Recent past efforts to implement dockside monitoring in the region were not viewed favorably by industry participants, communities, and relevant stakeholders, as evidenced by submissions to public comment during scoping hearings for Amendment 23 and other NEFMC meetings. At most, No Action with respect to the establishment of a new dockside monitoring program would precipitate positive impacts on the attitudes and beliefs among fishery participants and stakeholders who have in the past voiced concerns with such a program. At the very least, No Action would resume the status quo with respect to having no requirements for dockside monitoring and therefore would have neutral social impacts to the fishery and associated communities.

7.6.2.1.2 Dockside Monitoring Option 2: Mandatory Dockside Monitoring Program for the Commercial Groundfish Fishery

Option 2 would likely result in negative social impacts for commercial groundfish fishery participants and fishing communities. Dockside monitoring implemented across 100 percent of the fishery, including sectors and the common pool, would likely result in increased costs to participants and community members and would create additional burdensome responsibilities for many vessel owners and crew members. These impacts may even be disproportionately impactful for smaller vessels and remote communities with proportionally less engagement in commercial groundfish than the top two or three engaged communities, such as Chatham and Scituate, MA, or Hampton Bays and Montauk, NY (Section 6.6.6.1.1). Regardless of remoteness or extent of commercial engagement in the groundfish fishery, however, every port with substantial groundfish engagement will likely experience negative impacts in terms of the size and demographic and historical dependence on the commercial groundfish industry. In New Bedford, in particular, existing high social vulnerabilities (Table 36 in 6.6.6.1.2) and moderate gentrification pressures (Table 37 in Section 6.6.6.1.2) could exacerbate negative social impacts resulting from increased costs and reductions in employment opportunities tied to the local groundfish industry activity.

Assuming increased costs and responsibilities for commercial groundfish captains and crew, Option 2 would also likely result in negative impacts on the attitudes and beliefs of commercial groundfish crew and hired captains. According to Crew Survey data, the large majority of groundfish-targeting crew and hired captains from surveyed in both 2012 and 2018 either agreed or strongly agreed that the regulations in their primary fisheries are too restrictive (Table 45 and Table 46 in Section 6.6.6.2.5).

7.6.2.2 Dockside Monitoring Program Structure and Design

7.6.2.2.1 Dockside Monitoring Program Funding Responsibility

7.6.2.2.1.1 Dockside Monitoring Program Funding Responsibility Option A – Dealer Responsibility

Option A will likely have neutral to negative impacts on commercial groundfish fishery participants and communities. Placing the responsibility of funding a dockside program on dealers would likely increase costs for dealers and these costs could theoretically be passed on to either the consumers/customers or the vessels, or both. Moreover, very little correspondence has taken place with dealers to strategize how this approach would be implemented and to understand their attitudes and beliefs about this potential Sub-Option. Given high social vulnerabilities and gentrification pressures (Table 36 and Table 37 in Section 6.6.6.1.2) among many of the most commercially engaged communities in the groundfish fishery Figure 7 in Section 6.6.6.1.1), dealer costs could exacerbate existing social problems in these communities if these costs result in reduced employment opportunities, tax base, and economic activity related to commercial groundfish.

7.6.2.2.1.2 Dockside Monitoring Program Funding Responsibility Option B – Vessel Responsibility

Option B would likely result in negative social impacts for commercial groundfish fishery participants and communities. In particular, vessel-funded dockside monitoring would have a disproportionately negative impact on smaller vessels contributing less to the overall amount of catch and landings in the commercial groundfish fishery. It may also have an outsized negative impact on lower engagement (Figure 7 in Section 6.6.6.1.1) and remote communities due to reductions in employment opportunities and economic activity.

Additionally, Option B will likely produce negative social impacts with respect to the attitudes and beliefs of hired captains and crew in the commercial groundfish fishery. The large majority of groundfish-targeting crew and hired captains from surveyed in both 2012 and 2018 either agreed or strongly agreed that the regulations in their primary fisheries are too restrictive (Table 45 and Table 46 in Section 6.6.6.2.5). Moreover, while most crew respondents in 2018 reported that they were satisfied with their earnings, less than half reported that they were satisfied with the predictability of their earnings (Table 44in Section 6.6.6.2.4). Assuming increased vessel costs from funding a dockside monitoring program, crew earnings would likely be negatively impacted and their earnings may become less predictable depending upon the affordability for vessels to continue to participate in the commercial groundfish fishery.

7.6.2.2.2 Dockside Monitoring Program Administration

7.6.2.2.2.1 Dockside Monitoring Program Administration Option A – Individual contracts with dockside monitor providers

Option A may result in neutral to negative social impacts on commercial groundfish fishery participants and communities. While individual contracts to administer the dockside monitoring program may provide greater flexibility to dealers or vessels to establish these third-party contracts and their parameters, this Sub-Option may also become burdensome by increasing the responsibilities and duties for hired captains and vessel owners to operate in the commercial groundfish fishery.

7.6.2.2.2.2 Dockside Monitoring Program Administration Option B – NMFS-administered dockside monitoring program

Option B would likely result in neutral social impacts on the commercial groundfish fishery participants and communities. Though a NMFS-administered dockside monitoring program would remove the administrative and logistical burdens that an individually-contracted system would likely put in place, the dockside monitoring program has been historically unpopular among industry participants. Therefore, the preferable option in terms of social impacts related to the attitudes and beliefs, size and demographics, and historical dependence among commercial groundfish communities would be Option 1/No Action.

7.6.2.2.3 Options for Lower Dockside Monitoring Coverage Levels (20 percent coverage)

7.6.2.2.3.1 Option A – Lower coverage levels for <u>ports</u> with low volumes of groundfish landings

Option A would likely result in positive social impacts in terms of the size and demographics, attitudes and beliefs, and historical dependence of commercial fishing communities and stakeholders. Assuming dockside monitoring becomes a mandatory program, this sub-option would provide needed relief to smaller, lesser engaged ports that are geographically remote and would require additional logistical and technical burdens and costs under such a program. The remote ports that are substantially engaged in commercial groundfish include, but are not limited to, Montauk and Hampton Bays, NY (Figure 7 in Section 6.6.6.1.1). Other ports that have substantial engagement in commercial groundfish and would most likely benefit from Option A may also include, but are not limited to, Portland, ME, Narragansett, RI, Chatham, MA, Scituate, MA, and Cape May, NJ.

7.6.2.2.3.2 Option B – Lower coverage levels for <u>vessels</u> with total groundfish landings volumes in the 5th percentile of total annual landings

Option B is expected to have positive social impacts on the attitudes and beliefs, size and demographics, and historical dependence of commercial groundfish fishery participants and communities. Vessel owners, hired captains, and crew members on vessels that are smaller in size or catch lower volumes of groundfish relative to larger and more engaged vessels will benefit most from this Sub-Option. The large majority of groundfish-targeting crew and hired captains surveyed in both 2012 and 2018 either agreed or strongly agreed that the regulations in their primary fisheries are too restrictive (Table 45 and Table 46 in Section 6.6.6.2.5). Assuming lower coverage for low volume vessels mitigates the costs associated with dockside monitoring for some of these smaller or proportionally lesser engaged commercial fishing vessels, Sub-Option 4B may improve attitudes towards management among these fishery participants and their communities.

7.6.2.2.4 Dockside Monitoring Fish Hold Inspection Requirements

7.6.2.2.4.1 Fish Hold Inspection Option A – Dockside monitor fish hold inspections required

Option A may produce neutral to negative social impacts with respect to the attitudes and beliefs and size and demographics of commercial groundfish fishery participants and stakeholders. Concerns related to the safety of monitors entering fish holds and the insurance liability of vessels have been raised numerous times at NEFMC meetings during public comment. By mandating fish hold inspections, Option A may worsen already negative viewpoints among hired captains and crew about the restrictive and punitive nature of fisheries management. The majority of hired captains and crew captains either agree or strongly agree that the rules and regulations are too restrictive and only about one in four agree that the fines associated with breaking the rules are fair (Table 46 in Section 6.6.6.2.5). If additional insurance liability coverage is perceived as a penalty or undue cost, it is likely that commercial groundfish fishery participants will view this measure unfavorably. Additionally, if Option A results in increased costs for fishery participants, this measure may produce disproportionate negative impacts on participants that catch lower volumes or are lesser engaged in commercial groundfish.

7.6.2.2.4.2 Fish Hold Inspection Option B – Alternatives method for inspecting fish holds (cameras)

Option B may produce neutral to negative social impacts related to the attitudes and beliefs and size and demographics of commercial groundfish fishery communities and participants. Relative to Option A, it may produce neutral social impacts because while it removes the potential safety and liability concerns associated with monitors entering the fish hold it still could precipitate increased costs in the form of purchasing and maintaining additional electronic monitoring equipment.

7.6.2.2.4.3 Fish Hold Inspection Option C – No fish hold inspection required, captain signs affidavit

Option C may result in neutral to positive social impacts for commercial groundfish fishery participants and communities. With no requirement for fish hold inspections, hired captains and vessel owners would likely have more favorable attitudes towards a dockside monitoring program

7.6.2.3 Combined impacts of enhanced at-sea monitoring coverage and dockside monitoring program

Since this action is considering alternatives to enhance monitoring standards, up to 100% at-sea monitoring coverage levels for sector vessels as well as implementing a mandatory dockside monitoring program for the entire commercial groundfish fishery, the potential combined social impacts of those measures is described in this section. Requirements for higher at-sea monitoring coverage levels, up to 100% for sector vessels, combined with a mandatory dockside monitoring program would have increased costs to participants and community members and would create additional burdensome responsibilities for many vessel owners and crew members. However, as noted above in Section 7.5.4.3 if both enhanced at-sea monitoring and mandatory dockside monitoring are adopted in this action the incremental costs of a dockside monitoring program might be much lower than the predicted standalone cost, as there could be cost efficiencies, described above. The extent of these cost-efficiencies might be limited depending on a number of factors described above. Additionally, a comprehensive at-sea and dockside monitoring program would ensure a more complete catch accounting system, which should create a level playing field where all participants are equally held accountable to available ACE. If participants perceive this to create more fairness in the management system, there could be possible positive social impacts to partially offset some of the negative impacts from increased costs.

7.6.3 Sector Reporting

7.6.3.1 Sector reporting Option 1: No Action

Option 1 would likely result in neutral to negative social impacts for commercial groundfish fishery participants and communities. While no change in reporting procedures may be viewed by some as welcome given that many groundfish-targeting crew have reported that the rules change too quickly to keep up (Table 46 in Section 6.6.6.2.5), many others may find that no action with respect to the current status quo for reporting requirements would provide for the continuation of a process that is generally perceived as burdensome.

7.6.3.2 Sector reporting Option 2 – Grant Regional Administrator the Authority to Streamline Sector Reporting Requirements

Relative to no action under Option 1, Option 2 may result in positive social impacts for commercial groundfish fishery participants and communities. A streamlined process for sector reporting requirements may reduce administrative burdens on sector program participants and would likely result in more favorable attitudes among these participants towards fisheries management.

7.6.4 Funding/Operational Provisions of Groundfish Monitoring (Sectors and Common Pool)

7.6.4.1 Funding Provisions Option A: No Action

Option 1 would likely result in negative social impacts for commercial groundfish fishery participants and communities. With the continuation of industry-funded monitoring and the possibility of reductions in fishing effort mandated by the availability of coverage, the No Action alternative would exacerbate already existing negative attitudes towards fisheries management (Table 46 in Section 6.6.6.2.5) and would produce disproportionate social impacts on smaller, lesser engaged ports (Figure 7 in Section 6.6.6.1.1) and smaller or lower volume vessels due to the likelihood of outsized costs and reductions in profitability due to restrictions on fishing effort.

7.6.4.2 Funding Provisions Option 2 – Provisions for an Increase or Decrease in Funding for the Groundfish Monitoring Program

7.6.4.2.1 Funding Provisions Sub-Option 2A – Higher Monitoring Coverage Levels if NMFS Funds are Available (Sectors Only)

Sub-Option 2A under Option 2 would likely result in neutral to positive social impacts relative to Option 1, the No Action alternative, due to its potential for mitigating the costs associated with increases in monitoring within the context of an industry-funded system. Additional NMFS funding for the groundfish monitoring program would reduce costs associated with monitoring for vessels and other fishery stakeholders, but regardless of the source of funding any increase in monitoring could still be perceived as overly burdensome and intrusive among fishery participants and stakeholders. The economic benefits may not always align with social and cultural costs of monitoring, which can include distrust of management intentions and objectives or frustrations with the restrictiveness and fairness of management actions among fishery stakeholders.

7.6.4.2.2 Funding Provisions Sub-Option 2B – Waivers from Monitoring Requirements Allowed (Sectors and Common Pool) (*Preferred Alternative*)

Sub-Option 2B under Option 2 would likely result in positive social impacts related to the attitudes and beliefs and size and demographics of commercial groundfish fishery participants and communities. Allowing waivers from monitoring requirements when fishing effort might be restricted due to NMFS funding lapses would avoid the potential for substantial reductions in employment opportunities, income, and revenue for fishery participants, stakeholders, and community members.

7.6.5 Management Uncertainty Buffers for the Commercial Groundfish Fishery (Sectors)

7.6.5.1 Management Uncertainty Buffer Option 1: No Action

Option 1 may result in neutral to positive social impacts for commercial groundfish fishery participants and communities. Revisions to the management uncertainty buffers may not be warranted, especially in the event of the implementation of comprehensive (100%) catch monitoring through various monitoring tools. Commercial groundfish catch limits may also increase with reductions or removal of uncertainty buffers, but any revision that would result in an increase could further restrict catch, especially if accountability measures are triggered.

7.6.5.2 Management Uncertainty Buffer Option 2 – Elimination of Management Uncertainty Buffer for Sector ACLs with 100 Percent Monitoring of All Sector Trips (*Preferred Alternative*)

Option 2 may produce neutral to positive social impacts for commercial groundfish fishery participants and communities relative to Options 1. The elimination of management uncertainty buffers could lead to increased quotas and/or a reduced likelihood for triggering any accountability measures associated with exceeding the buffers on the ACLs for any given stocks. While comprehensive (100%) monitoring may increase costs for commercial groundfish fishery participants, the elimination of the uncertainty buffer could help mitigate the negative impacts associated with the costs of monitoring.

7.6.6 Remove Commercial Groundfish Monitoring Requirements for Certain Vessels Fishing Under Certain Circumstances

7.6.6.1 Removal of Monitoring Program Requirements Option 1: No Action (Sectors Only)

Option 1 would likely result in neutral social impacts for commercial groundfish fishery participants and communities. Since the measures to remove monitoring requirements apply to vessels using gear that primarily target non-groundfish stocks and species, and therefore these vessels catch very few groundfish, these measures, or any changes to them, would likely not affect any commercial groundfish fishery participants.

7.6.6.2 Removal of Monitoring Program Requirements Option 2 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 72 Degrees 30 Minutes West Longitude

7.6.6.2.1 Removal of Monitoring Program Requirements Sub-option 2A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only)

Sub-Option 2A would likely result in neutral social impacts for commercial groundfish fishery participants and communities. Since the measures to remove at-sea monitoring requirements apply to vessels that primarily target non-groundfish stocks and species, and therefore catch very few groundfish, these measures, or any changes to them, would likely not affect any commercial groundfish fishery participants.

7.6.6.2.2 Removal of Monitoring Program Requirements Sub-option 2B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool)

Sub-Option 2B would likely result in neutral social impacts for commercial groundfish fishery participants and communities. Since the measures to remove dockside monitoring requirements (if implemented) apply to vessels that primarily target non-groundfish stocks and species, and therefore catch very few groundfish, these measures, or any changes to them, would likely not affect any commercial groundfish fishery participants.

7.6.6.3 Removal of Monitoring Program Requirements Option 3 – Remove Monitoring Requirements for Vessels Fishing Exclusively West of 71 Degrees 30 Minutes West Longitude (*Preferred Alternative*)

7.6.6.3.1 Removal of Monitoring Program Requirements Sub-option 3A – Remove At-Sea Monitoring Coverage Requirement (Sectors Only) (*Preferred Alternative*)

Sub-Option 3A would likely result in neutral social impacts for commercial groundfish fishery participants and communities. Since the measures to remove at-sea monitoring requirements apply to vessels that primarily target non-groundfish stocks and species, and therefore catch very few groundfish, these exemptions, or any changes to them, would likely not affect any commercial groundfish fishery participants.

7.6.6.3.2 Removal of Monitoring Program Requirements Sub-option 3B – Remove Dockside Monitoring Coverage Requirement (Sectors and Common Pool) (*Preferred Alternative*)

Sub-Option 3B would likely result in neutral social impacts for commercial groundfish fishery participants and communities. Since the measures to remove dockside monitoring requirements (if implemented) apply to vessels that primarily target non-groundfish stocks and species, and therefore catch very few groundfish, these exemptions, or any changes to them, would likely not affect any commercial groundfish fishery participants.

7.6.6.4 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements

7.6.6.4.1 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 1: No Action

This administrative measure would likely result in neutral social impacts for commercial groundfish fishery participants and communities. Since the measures to remove monitoring requirements apply to vessels that primarily target non-groundfish stocks and species, and therefore catch very few groundfish, these measures, or any changes to them, would likely not affect any commercial groundfish fishery participants.

7.6.6.4.2 Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements Option 2 – Implement a Review Process for Vessels Removed from Commercial Groundfish Monitoring Program Requirements (*Preferred Alternative*)

This administrative measure would likely result in neutral social impacts for commercial groundfish fishery participants and communities. Since the measures to remove monitoring requirements apply to vessels that primarily target non-groundfish stocks and species, and therefore catch very few groundfish, these measures, or any changes to them, would likely not affect any commercial groundfish fishery participants.

7.7 Cumulative Effects

7.7.1 Introduction

A cumulative effects assessment (CEA) is a required part of an EIS or EA according to the Council on Environmental Quality (CEQ) (40 CFR part 1508.7) and NOAA's agency policy and procedures for NEPA, found in NOAA Administrative Order 216-6A (Companion Manual, January 13, 2017). The purpose of the CEA is to integrate into the impact analyses, the combined effects of many actions over time that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective but rather, the intent is to focus on those effects that are truly meaningful. This section serves to examine the potential direct and indirect effects of the alternatives in Amendment 23 together with past, present, and reasonably foreseeable future actions that affect the human environment. It should also be noted that the predictions of potential synergistic effects from multiple actions, past, present and/or future will generally be qualitative in nature.

Valued Ecosystem Components (VEC)
As noted in Section 6.0 (Description of the Affected Environment), the VECs that exist within the groundfish fishery are identified and the basis for their selection is established. Those VECs were identified as follows:

1. Regulated groundfish stocks (target and non-target);
2. Non-groundfish species (incidental catch and bycatch);
3. Endangered and other protected species;
4. Habitat, including non-fishing effects; and
5. Human Communities (includes economic and social effects on the fishery and fishing communities).

Temporal Scope of the VECs
While the effects of historical fisheries are considered, the temporal scope of past and present actions for regulated groundfish stocks, non-groundfish species, habitat and the human environment is primarily focused on actions that have taken place since implementation of the initial NE Multispecies FMP in 1977. An assessment using this timeframe demonstrates the changes to resources and the human environment that have resulted through management under the Council process and through U.S. prosecution of the fishery, rather than foreign fleets. For endangered and other protected species, the context is largely focused on the 1980s and 1990s, when NMFS began generating stock assessments for marine mammals and turtles that inhabit waters of the U.S. EEZ. In terms of future actions, this analysis examines the period between the expected implementation of this amendment (May 2021) and 2026.

Geographic Scope of the VECs
The geographic scope of the analysis of impacts to regulated groundfish stocks, non-groundfish species and habitat for this action is the total range of these VECs in the Western Atlantic Ocean, as described in the Affected Environment section of the document (Section 6.0). However, the analyses of impacts presented in this framework focuses primarily on actions related to the harvest of the managed resources. The result is a more limited geographic area used to define the core geographic scope within which the majority of harvest effort for the managed resources occurs. For protected species, the geographic range is the total range of each species (Section 6.5).

Because the potential exists for far-reaching sociological or economic impacts on U.S. citizens who may not be directly involved in fishing for the managed resources, the overall geographic scope for human communities is defined as all U.S. human communities. Limitations on the availability of information needed to measure sociological and economic impacts at such a broad level necessitate the delineation of core boundaries for the human communities. Therefore, the geographic range for the human environment is defined as those primary and secondary ports bordering the range of the groundfish fishery (Section 6.6) from the U.S.-Canada border to, and including, North Carolina.

Analysis of Total Cumulative Effects

A cumulative effects assessment ideally makes effect determinations based on the culmination of the following: (1) impacts from past, present and reasonably foreseeable future actions; PLUS (2) the baseline condition for resources and human communities (note – the baseline condition consists of the present condition of the VECs plus the combined effects of past, present and reasonably foreseeable future actions); PLUS (3) impacts from the Preferred Alternative and other alternatives.

A description of past, present and reasonably foreseeable future actions is presented in Table 226. The baseline conditions of the resources and human community are subsequently summarized although it is important to note that beyond the stocks managed under this FMP and protected species, quantitative metrics for the baseline conditions are not available. Finally, a brief summary of the impacts from the alternatives contained in this amendment is included. The culmination of all these factors is considered when making the cumulative effects assessment.

Impact definitions for the tables in this section are as summarized in Table 71.

7.7.2 Past, Present, and Reasonably Foreseeable Actions

The following is a synopsis of the most applicable past, present, and reasonably foreseeable future actions (PPRFFA) that have the potential to interact with the current action. For a complete historical list of PPRFFAs, please see Amendment 16 and Amendment 18– the last EIS developed for the NE Multispecies FMP.

Table 226 - Summary of Effects on VECs from Past, Present, and Reasonably Foreseeable Future FMP and Other Fishery Related Actions.

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
Past and Present Fishing Actions					
Amendment 13 (2004) – Implemented requirements for stock rebuilding plans and dramatically cut fishing effort on groundfish stocks. Implemented the process for creating sectors and established the GB Cod Hook Gear Sector	L+	H+	+ .	L+ .	Mixed
FW 40A (2004) – allowed additional fishing on GB haddock for sector and non-sector hook gear vessels, created the GB haddock Special Access Pilot Program, and created flexibility by allowing vessels to fish inside and outside the U.S./Canada Area on the same trip	Negl	L-	L-	Negl	+
FW40B (2005) – Allowed Hook Sector members to use GB cod landings caught while using a different gear during the landings history qualification period to count toward the share of GB cod that will be allocated to the sector, revised DAS leasing and transfer programs, modified provisions for the Closed Area II yellowtail flounder SAP, established a DAS credit for vessels standing by an entangled whale, implemented new notification requirements for Category I herring vessels, and removed the net limit for trip gillnet vessels.	Negl to L+	L-	L-	Negl	L+
FW41 (2005) – Allowed for participation in the Hook Gear Haddock SAP by non-sector vessels	Negl	Negl	Negl to L -	Negl	+
FW42 (2006) – Implemented further reductions in fishing effort based upon stock assessment data and stock rebuilding needs, implemented GB Cod Fixed Gear Sector	L+	+	+	L+	Mixed
Atlantic Large Whale Take Reduction Plan	Negl to L-	Negl	Negl	+	L-
Monkfish Fishery Management Plan and Amendment 5 (2011) Implemented ACLs and AMs; set the specifications of DAS and trip limits; and make other adjustments to measures in the Monkfish FMP.	L+	+	+	+	Mixed
Spiny Dogfish Fishery Management Plan	Negl	Negl	+	Negl	L+

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
Amendment 16 to the Northeast Multispecies FMP (2009) Implemented DAS reductions and gear restrictions for the common pool, approved formation of additional 17 sectors	+	+	+	+	Mixed
Skate Fishery Management Plan and Amendment 3 (2010) Amendment 3 implemented final specifications for the 2010 and 2011 FYs, implemented ACLs and AMs, implemented a rebuilding plan for smooth skate and established an ACL and annual catch target for the skate complex, total allowable landings for the skate wing and bait fisheries, seasonal quotas for the bait fishery, new possession limits, in season possession limit triggers.	+	+	+	+	-
FW 44 to the Northeast Multispecies FMP (2010) Set ACLs, established TACs for transboundary U.S./CA stocks, and made adjustments to trip limits/DAS measures	+	+	+	+	Mixed
FW 45 to the Northeast Multispecies FMP (2011) Revised the biological reference points and stock status for pollock, updated ACLs for several stocks for FYs 2011–2012, adjusted the rebuilding program for GB yellowtail flounder, increased scallop vessel access to the Great South Channel Exemption Area, modified the existing dockside and at-sea monitoring requirements, established a GOM Cod Spawning Protection Area, authorized new sectors and adjusted TACs for stocks harvested in the US/ CA area for FY 2011.	L+	L+	L+	L+	Mixed
FW 46 to the Northeast Multispecies FMP (2011) Increased the haddock catch cap for the herring fishery to 1% of the haddock ABC for each stock of haddock.	Negl	Negl	Negl	Negl	L-

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
Harbor Porpoise Take Reduction Plan (2010) Plan was amended to expand seasonal and temporal requirements within the HPTRP management areas; incorporate additional management areas; and create areas that would be closed to gillnet fisheries if certain levels of harbor porpoise bycatch occurs.	Likely +	Likely +	Likely +	Likely +	Likely -
Scallop Amendment 15 (2011) Implemented ACLs and AMs to prevent overfishing of scallops and yellowtail flounder; addressed excess capacity in the LA scallop fishery; and adjusted several aspects of the overall program to make the Scallop FMP more effective, including making the EFH closed areas consistent under both the scallop and groundfish FMPs for scallop vessels.	Negl	L+	Negl	Negl	L+
Amendment 17 to the Northeast Multispecies FMP This amendment streamlined the administration process whereby NOAA-sponsored, state-operated permit banks can operate in the sector allocation management program	Negl	Negl	Negl	Negl	Negl
FW 47 to the Northeast Multispecies FMP (2012) FW 47 measures include revisions to the status determination for winter flounder, revising the rebuilding strategy for GB yellowtail flounder, Measures to adopt ACLs, including relevant sub-ACLs and incidental catch TACs; adopting TACs for U.S/Canada area, as well as modifying management measures for SNE/MA winter flounder, restrictions on catch of yellowtail flounder in GB access areas and accountability measures for certain stocks	Negl	+	+	Negl	-
Secretarial Amendment to Establish Annual Catch Limits and Accountability Measures for the Small-Mesh Multispecies Fishery This amendment established the mechanism for implementing ACLs and AMs.	Negl to L+	Negl	Negl	Negl	Negl to +

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
Amendment 3 to the Spiny Dogfish FMP This amendment established a research set aside program, updates to EFH definitions, year-end rollover of management measures and revisions to the quota allocation scheme.	Likely Negl	Likely Negl	Likely L+	Likely Negl	Likely L+
Framework 24 to the Atlantic Sea Scallop FMP (Framework 49 to the Northeast Multispecies FMP) This framework set specifications for scallop FY 2013 and 2014. It is also considered measures to refine the management of yellowtail flounder bycatch in the scallop fishery	Likely Negl	Likely Negl to L+	Likely Negl to L+	Likely Negl	Likely - to +
FW 48 to the Northeast Multispecies FMP This FW modified the ACL components for several stocks, adjust AMs for commercial and recreational vessels, modify catch monitoring provisions, and allow sectors to request access to parts of groundfish closed areas.	Mixed	+	+	+	Mixed
FW50 to the Multispecies FMP This FW adopted FY2013-2015 ACLs and specifications for the U.S./Canada Total Allowable Catches (TACs)	+	+	+	Negl	-
FW51 to the Multispecies FMP This FW adopted FY2014-2016 ACLs and specifications for the U.S./Canada Total Allowable Catches (TACs) and included changes to management measures	Mixed	+	+	Negl	Mixed
Framework 25 to the Atlantic Sea Scallop FMP This framework set specifications for scallop FY 2014 and 2015. It is also considered accountability measures for windowpane flounder stocks.	Likely Negl	Likely Negl to L+	Likely Negl to L+	Likely Negl	Likely - to +
FW52 to the Multispecies FMP This FW modified existing AMs for northern and southern windowpane flounder	Likely L+	Likely +	Likely +	Negl	Likely +
FW53 to the Multispecies FMP This FW adopted FY2015-2017 ACLs and specifications for the U.S./Canada Total Allowable Catches (TACs) and included changes to management measures including measures to protect GOM cod.	Mixed	Mixed	Mixed	Negl to Low -	Mixed

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
Framework 26 to the Atlantic Sea Scallop FMP This framework set specifications for scallop FY 2016 and 2017. It is established proactive accountability measures for windowpane flounder.	Likely Negl	Likely Negl to L+	Likely Negl to L+	Likely Negl	Likely - to +
FW 54 to the Multispecies FMP/ Joint Monkfish Framework 9 This framework modified regulations for vessels in the DAS program.	Neg to Low-	Mixed	Mixed	Negl	Neg to L+
Amendment 19 to the Atlantic Sea Scallop FMP This amendment changed the start of the Scallop FY to April 1, and developed a specification setting process	Negl	Negl	Negl	Negl	Likely +
Framework 27 to the Atlantic Sea Scallop FMP This framework set specifications for scallop FY 2017 and 2018. It established access areas.	Likely Negl	Likely Negl	Likely Negl	Likely Negl	Likely +
FW55 to the Multispecies FMP This FW adopted FY2016-2018 ACLs and specifications for the U.S./Canada Total Allowable Catches (TACs) and included changes to commercial and recreational management measures.	Mixed	Mixed	Mixed	Negl to Low -	Mixed
Framework 28 to the Atlantic Sea Scallop FMP This framework set specifications for scallop FY 2018 and 2019. It also established access areas.	Likely Negl	Likely Negl	Likely Negl	Likely Negl	Likely +
Omnibus Essential Fish Habitat Amendment Phase 2 of the Omnibus EFH Amendment considered the effects of fishing gear on EFH and move to minimize, mitigate or avoid those impacts that are more than minimal and temporary in nature. Further, Phase 2 reconsidered closures put in place to protect EFH and groundfish mortality in the Northeast Region.	Likely +	Negl to L+	Negl to L+	Negl to Slight -	Mixed
FW56 to the Multispecies FMP This FW adopted FY2017- 2019 ACLs for witch flounder and specifications for the U.S./Canada Total Allowable Catches (TACs) and included changes to commercial management measures.	Mixed	Mixed	Mixed	Neutral to Low -	Mixed

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
A18 to the Multispecies FMP This amendment created accumulation limits, adjustments to management of Handgear A permits, and inshore/offshore measures could be developed through a framework.	Negl	Likely L+	Likely L+	Negl	Mixed
Framework 29 to the Atlantic Sea Scallop FMP This framework set specifications for scallop FY 2018 and 2019 and modified accountability measures for groundfish. It established access areas.	Likely Negl	Likely Negl	Likely Negl	Likely Negl	Likely +
FW57 to the Multispecies FMP This FW adopted FY2018- 2020 ACLs for all groundfish stocks and included changes to commercial and recreational management measures.	Mixed	Mixed	Mixed	Neutral to Low -	Mixed
Framework 30 to the Atlantic Sea Scallop FMP This framework set specifications for scallop FY 2019 and 2020 and other measures. It established access areas.	Likely Negl	Likely Negl	Likely Negl	Likely Negl	Likely +
FW58 to the Multispecies FMP. This FW set quotas for US/CA stocks, set rebuilding plans for several stocks, and made changes to commercial fishery measures.	Mixed	Mixed	Mixed	Mixed	Mixed
Reasonably Foreseeable Future Fishing Actions					
Harbor Porpoise Take Reduction Plan (Potential Future Actions) Future changes to the plan in response to additional information and data about abundance and bycatch rates.	Likely L+	Likely +	Likely +	Likely +	Likely -
Offshore wind project construction south of MA/RI may begin in 2021 (multiple projects are under development including Vineyard Wind). Additional areas offshore MA, RI, NY, and NJ (plus areas further south) have been leased and will have site assessment and potentially construction activities in the next few years.	Likely L-	Likely L-	Likely L-	Likely L-	Mixed

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
The North Atlantic Planning Area could be part of the 2019-2024 Oil and Gas Leasing Program, which would allow 2 leases over that period. Leases would lead to resource assessment activities such as seismic surveys. Actual site development would be outside the time horizon considered here. The timing of when an updated program might be announced is unknown, but was planned for 2019.	Likely L-	Likely L-	Likely L-	Likely L-	Mixed
Framework 60 – Omnibus Clam Dredge Framework This framework would authorize clam and mussel dredging in three exemption areas within the Great South Channel Habitat Management Area.	Likely L-	Likely L-	Likely L-	Likely neutral; possible L- impacts of mussel fishery on turtles and sturgeon	Likely L- to positive, depending on fishery sector
Framework 31 to the Atlantic Sea Scallop FMP This framework would set specifications for scallop FY 2020 and 2021 and other measures. It established access areas.	Likely Negl	Likely Negl	Likely Negl	Likely Negl	Likely +
FW59 to the Multispecies FMP This FW would adopt FY2020- 2022 ACLs for 15 groundfish stocks and make changes to commercial and recreational management measures.	Mixed	Mixed	Mixed	Neutral to Low -	Mixed

Note: ND = not determined

Table 226 summarizes the combined effects of past, present and reasonably foreseeable future actions that affect the VECs, i.e., actions other than those alternatives under development in this document.

Note that most of the actions affecting this framework and considered in Table 226 come from fishery-related activities (e.g., federal fishery management actions – many of which are identified above in Table 227). As expected, these activities have fairly straightforward effects on environmental conditions, and were, are, or will be taken, in large part, to improve those conditions. The reason for this is the statutory basis for federal fisheries management: the reauthorized Magnuson-Stevens Act. That legislation was enacted to promote long-term positive impacts on the environment in the context of fisheries activities. More specifically, the act stipulates that management comply with a set of National Standards that collectively serve to optimize the conditions of the human environment. Under this regulatory regime, the cumulative impacts of past, present, and future Federal fishery management actions on the VECs should be expected to result in positive long-term outcomes. Nevertheless, these actions are often associated with offsetting impacts. For example, constraining fishing effort frequently results in negative short-term social and economic impacts for fishery participants. However, these impacts are often the result from actions needed to ensure the long-term sustainability of a fishery resource and, in the long-term, have positive effects on human communities, especially those that are economically dependent upon the managed resource.

Non-fishing activities were also considered when determining the combined effects from past, present and reasonably foreseeable future actions. Activities that have meaningful effects on the VECs include the introduction of chemical pollutants, sewage, changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the marine environment. These activities pose a risk to the all of the identified VECs in the long term. Human induced non-fishing activities that affect the VECs under consideration in this document tend to be concentrated in near shore areas. Examples of these activities include, but are not limited to agriculture, port maintenance, beach nourishment, coastal development, marine transportation, marine mining, dredging and the disposal of dredged material. For protected species, primary concerns associated with non-fishing activities include vessel strikes, dredge interactions (e.g. entrainment or impingement, especially for sea turtles and sturgeon), and underwater noise. These activities have both direct and indirect impacts on protected species. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and, as a result, may indirectly reduce the sustainability of the managed resources, non-target species, and protected resources. Decreased habitat suitability would tend to reduce the tolerance of these VECs to the impacts of fishing effort. Mitigation of this outcome through regulations that would reduce fishing effort could then negatively impact human communities.

Energy exploration. Offshore wind farms will impact the marine environment during construction (~2 years), operations (~25 years), and decommissioning. Construction activities associated with both turbine installation and cable laying will generate noise and disturb benthic habitats. These activities may have direct and indirect impacts on marine resources, ranging from temporary changes in availability of habitat to injury to mortality (e.g. through vessel strikes on protected resources). Some effects may be mitigated by implementing best management practice, such as time of year restrictions, marine mammal observers, or sound-dampening measures. During the operational phase, areas immediately surrounding fixed turbine locations will have scour protection installed, resulting in conversion from soft to hard bottom habitat and associated ecological changes. Cables may also have armoring devices placed over them if they cannot be buried, leading to long term changes in benthic habitats along the cable route. Wind turbines generate sound during the operational phase, which may have sub-lethal effects on marine organisms. Inter-array electrical cables (between turbines) and export cables (those running from the wind farm to shore) generate electromagnetic fields, which can also affect marine species. Broader oceanographic changes may occur as well. As turbines pull kinetic energy out of the system, this influences the circulation of air and water, which can affect patterns of movement for various species (target, non-target, protected). Decommissioning activities will also have acoustic and mechanical effects on marine habitats and species but are beyond the temporal scope of this analysis.

Impacts of offshore wind farm development on human communities will be mixed. There will be positive economic benefits in the form of jobs associated with project development, construction and maintenance. Replacement of some electricity generated using fossil fuels with renewable sources will also create societal benefits in terms of improved air quality and greenhouse gas emissions. But there may be negative effects on fishing activities in terms of effort displacement, or if fishing becomes more difficult, expensive, or dangerous near the turbines or cables. These effects are likely to vary according to gear type and target species.

For oil and gas, this timeframe could include leasing and possible surveys if the North Atlantic is included in the 2019-2024 program, which remains pending. Seismic air gun surveys to identify the extent of mineral resources alter the acoustic environment within which marine species live, and have uncertain effects on fish behaviors that could cumulatively lead to negative population level impacts. The science on this is fairly uncertain and different species are likely to experience different impacts. Exposure to elevated levels of sound during these surveys can have both direct and indirect impacts on marine life, particularly protected species or other species which are highly dependent on sound for inter-specific communication or feeding. Depending on the sound frequency and magnitude, noise impacts to protected species may be direct or indirect. Exposure to underwater noise can directly affect species via behavioral modification (avoiding a feeding or spawning area) or injury (sound exposure results in internal damage to hearing structures or internal organs). Indirect effects are likely to result from changes to the acoustic environment of the species, which may affect the completion of essential life functions (e.g., migrating, breeding, communicating, resting, foraging). If marine resources are affected by seismic surveys, then the fishermen targeting these resources would in turn be affected. Despite potential negative environmental effects, there would be an economic component in the form of increased jobs whereby there may be some positive effects of oil and gas leasing and surveys on human communities. Actual construction and operations of oil and gas platforms would have a different set of potential impacts that are not discussed here.

The overall impacts of offshore wind energy and oil and gas exploration on the marine species and their habitats at a population level is unknown, but likely to range from no impact to moderate negative, depending on the number and locations of projects that occur, as well as the effects of mitigation efforts.

Climate Change. Global climate change will affect all components of marine ecosystems, including human communities. Physical changes that are occurring and will continue to occur to these systems include sea-level rise, changes in sediment deposition, changes in ocean circulation, increased frequency, intensity and duration of extreme climate events, changing ocean chemistry, and warming ocean temperatures. Emerging evidence suggests that these physical changes may have direct and indirect ecological responses within marine ecosystems which may alter the fundamental production characteristics of marine systems (Stenseth et al. 2002). Climate change could potentially exacerbate the stresses imposed by fishing and other non-fishing human activities and stressors (described in this section).

Results from the Northeast Fisheries Climate Vulnerability Assessment (Hare et al., 2016) indicate that climate change could have overall directional impacts on all VECs that range from negative to positive depending on the species, their climate vulnerability, potential for distribution change, and other factors. However, future mitigation and adaptation strategies to climate change may mitigate some of these impacts as more information becomes available to predict, evaluate, monitor, and categorize these changes.

Table 227 - Summary effects of past, present, and reasonably foreseeable future actions on the VECs identified for Amendment 23.

VEC	Past Actions	Present Actions	Reasonably Foreseeable Future Actions	Combined Effects of Past, Present, Future Actions
Regulated Groundfish Stocks	**Mixed** Combined effects of past actions have decreased effort, improved habitat protection, and implemented rebuilding plans when necessary. However, some stocks remain overfished	**Positive** Current regulations continue to manage for sustainable stocks	**Positive** Future actions are anticipated to continue rebuilding and strive to maintain sustainable stocks	**Short-term Negative** Several stocks are currently overfished, have overfishing occurring, or both **Long-Term Positive** Stocks are being managed to attain rebuilt status
Non-Groundfish Species	**Positive** Combined effects of past actions have decreased effort and improved habitat protection	**Positive** Current regulations continue to manage for sustainable stocks, thus controlling effort on direct and discard/bycatch species	**Positive** Future actions are anticipated to continue rebuilding and target healthy stocks, thus limiting the take of discards/bycatch	**Positive** Continued management of directed stocks will also control incidental catch/bycatch
Endangered and Other Protected Species	**Low Positive** Combined effects of past fishery actions have reduced effort and thus interactions with protected resources	**Low Positive** Current regulations continue to control effort, thus reducing opportunities for interactions	**Mixed** Future regulations will likely control effort and thus protected species interactions, but as stocks improve, effort will likely increase, possibly increasing interactions	**Low Positive** Continued catch and effort controls are likely to reduce gear encounters through effort reductions. Additional management actions taken under ESA/MMPA should also help mitigate the risk of gear interaction
Habitat	**Mixed** Combined effects of effort reductions and better control of non-fishing activities have been positive but fishing activities and non-fishing activities continue to reduce habitat quality	**Mixed** Effort reductions and better control of non-fishing activities have been positive but fishing activities and non-fishing activities continue to reduce habitat quality	**Mixed** Future regulations will likely control effort and thus habitat impacts but as stocks improve, effort will likely increase along with additional non-fishing activities	**Mixed** Continued fisheries management will likely control effort and thus fishery related habitat impacts but fishery and non-fishery related activities will continue to reduce habitat quality
Human Communities	**Mixed** Fishery resources have supported profitable industries and communities but increasing effort and catch limit controls have curtailed fishing opportunities	**Mixed** Fishery resources continue to support communities but increasing effort and catch limit controls combined with non-fishing impacts such as high fuel costs have had a negative economic impact	**Short-term Negative** As effort controls are maintained or strengthened, economic impacts will be negative **Long-term Positive** As stocks improve, effort will likely increase which would have a positive impact	**Short-term Negative** Revenues would likely decline dramatically in the short term and may remain low until stocks are fully rebuilt **Long-term Positive** Sustainable resources should support viable communities and economies

Impact Definitions:
-Regulated Groundfish Stocks, Non-groundfish species, Endangered and Other Protected Species: positive=actions that increase stock size and negative=actions that decrease stock size
-Habitat: positive=actions that improve or reduce disturbance of habitat and negative=actions that degrade or increase disturbance of habitat
-Human Communities: positive=actions that increase revenue and well-being of fishermen and/or associated businesses and negative=actions that decrease revenue and well-being of fishermen and/or associated businesses

7.7.3 Baseline Conditions for Resources and Human Communities

For the purposes of a cumulative effects assessment, the baseline conditions for resources and human communities is considered the present condition of the VECs plus the combined effects of the past, present, and reasonably foreseeable future actions. The following tables (Table 228 and Table 229) summarizes the added effects of the condition of the VECs (i.e., status/trends from Section 6.2) and the sum effect of the past, present and reasonably foreseeable future actions (from Table 227 above). The resulting CEA baseline for each VEC is exhibited in the last column (shaded). In general, straightforward quantitative metrics of the baseline conditions are only available for the managed resources, non-target species, and protected resources. The conditions of the habitat and human communities VECs are complex and varied. As such, the reader should refer to the characterizations given in Sections 6.4 and 6.6, respectively. As mentioned above, this cumulative effects baseline is then used to assess cumulative effects of the proposed management actions in Table 230.

Table 228 - Cumulative effects assessment baseline conditions of regulated groundfish stocks.

VEC		Status/Trends, Overfishing	Status/Trends, Overfished	Combined Effects of Past, Present Reasonably Foreseeable Future Actions	Combined CEA Baseline Conditions
Regulated Groundfish Stocks	GB Cod	***Yes***	***Yes***	**Negative** – short term: Several stocks are currently overfished, have overfishing occurring, or both; **Positive** – long term: Stocks are being managed to attain rebuilt status	**Negative** – short term: Overharvesting in the past contributed to several stocks being overfished or where overfishing is occurring; **Positive –** long term: Regulatory actions taken over time have reduced fishing effort and with the addition of Amendment 16, stocks are expected to rebuild in the future
	GOM Cod	***Yes***	***Yes***		
	GB Haddock	No	No, Rebuilt		
	GOM Haddock	No	No, Rebuilt		
	GB Yellowtail Flounder	***Yes***	***Yes***		
	SNE/MA Yellowtail Flounder	No	***Yes***		
	CC/GOM Yellowtail Flounder	No	No		
	American Plaice	No	No, Rebuilt		
	Witch Flounder	Unknown	***Yes***		
	GB Winter Flounder	No	***Yes***		
	GOM Winter Flounder	No	Unknown		
	SNE/MA Winter Flounder	No	***Yes***		
	Acadian Redfish	No	No, Rebuilt		
	White Hake	No	***Yes***		
	Pollock	No	No, Rebuilt		
	Northern (GOM-GB) Windowpane Flounder	No	***Yes***		
	Southern (SNE-MA) Windowpane Flounder	No	No		
	Ocean Pout	No	***Yes***		
	Atlantic Halibut	No	***Yes***		
	Atlantic Wolffish	No	***Yes***		

Table 229 – Cumulative effects assessment baseline conditions of non-groundfish species, habitat, protected resources, and human communities.

VEC		Status/Trends	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 227)	Combined CEA Baseline Conditions
Non-groundfish Species (principal species listed in Section 6.3)	**Monkfish**	Not overfished and overfishing is not occurring.	**Positive** – Continued management of directed stocks will also control incidental catch/bycatch.	**Positive** – Although prior groundfish management measures likely contributed to redirecting effort onto non-groundfish species, as groundfish rebuild this pressure should lessen and all of these species are also managed through their own FMP.
	Dogfish	Not overfished and overfishing is not occurring.		
	Skates	Thorny skate is overfished and overfishing is not occurring. All other skate species are not overfished and overfishing is not occurring.		
Habitat		Fishing impacts are complex and variable and typically adverse (see section 7.3) Non-fishing activities had historically negative but site-specific effects on habitat quality.	**Mixed** – Future regulations will likely control effort and thus habitat impacts but as stocks improve, effort will likely increase along with additional non-fishing activities. An omnibus amendment to the FMP with mitigating habitat measures is under development.	**Mixed** - reduced habitat disturbance by fishing gear but impacts from non-fishing actions, such as climate change, could increase and have a negative impact.
Protected Resources	**Sea Turtles**	Leatherback and Kemp's ridley sea turtles are classified as endangered under the ESA; loggerhead (NW Atlantic DPS) and green (North Atlantic DPS) sea turtles are classified as threatened.		**Low Positive** – Continued catch and effort controls, is likely to reduce gear encounters through effort reductions. Additional management actions

	Fish	Atlantic salmon (Gulf of Maine DPS): threatened under ESA Atlantic sturgeon: New York Bight, Chesapeake, Carolina, and South Atlantic DPSs are endangered under ESA; Gulf of Maine DPS is listed as threatened under the ESA	**Low Positive** – reduced gear encounters through effort reductions and management actions taken under the ESA/MMPA should also help mitigate the risk of gear interactions	taken under ESA/MMPA should also help mitigate the risk of gear interactions .
	Large Cetaceans	All large whales in the Northwest Atlantic are protected under the MMPA. Of these large whales, North Atlantic right, fin, blue, sei, and sperm whales are also listed as endangered under the ESA.		
	Small Cetaceans	All are protected under the MMPA		

Table 229, continued

VEC		Status/Trends	Combined Effects of Past, Present Reasonably Foreseeable Future Actions	Combined CEA Baseline Conditions
Protected Resources	**Pinnipeds**	All are protected under the MMPA	**Low Positive** – reduced gear encounters through effort reductions and management actions taken under the ESA and MMPA have had a positive impact	**Low Positive** – reduced gear encounters through effort reductions and additional management actions taken under the ESA and MMPA.
Human Communities		Complex and variable (see Section 6.6). Although there are exceptions, generally groundfish landings have decreased for most New England states since 2001. Declines in groundfish revenues since 2001 have also generally occurred.	**Negative** – Although future sustainable resources should support viable communities and economies, continued effort reductions over the past several years have had negative impacts on communities	**Negative –** short term: lower revenues would continue until stocks are sustainable **Positive** – long term: sustainable resources should support viable communities and economies

7.7.4 Summary Effects of Amendment 23 Action

The alternatives contained in Amendment 23 are focused on improving the commercial groundfish monitoring program. Currently, this section summarizes the potential impacts of the preferred alternatives identified by the Council on each valued ecosystem component (VEC). After final action, this section will be updated with the final proposed action. The preferred alternatives would establish a sector monitoring standard to set an annual target at-sea monitoring coverage level of 100 percent of sector trips; allow additional sector monitoring tools, including audit model electronic monitoring and maximized retention electronic monitoring, for sectors to have as options to use in place of human at-sea monitors to achieve monitoring standards; establish a formal review process for monitoring coverage levels; allow new sector monitoring tools and vessel specific coverage levels to be considered in a framework action; allow waivers from monitoring requirements if NMFS does not have shoreside funding; remove management uncertainty buffers for sector ACLs for allocated groundfish stocks; remove monitoring requirements for vessels fishing exclusively on a trip in a certain geographic area; and establish a formal review process for vessels that are removed from monitoring requirements. The preferred alternative is No Action on a mandatory dockside monitoring program; to date this action would not include a mandatory dockside monitoring program. These measures affect the prosecution of the commercial fishery only.

Table 230 - Cumulative effects expected on the VECs of Amendment 23 preferred alternatives

Measure	VECs				
	Managed Resources (Groundfish Species)	**Nontarget Species**	**Physical/EFH**	**Protected Resources**	**Human Communities**
Sector Monitoring Standards (Target Coverage Levels) (Section 4.1.1)	**Positive.** When compared to No Action, because discard mortality would be fully accounted for and fishing mortality should be reduced with 100% coverage.	**Positive.** When compared to No Action, because discard mortality would be fully accounted for and fishing mortality should be reduced with higher coverage.	**Positive.** 100% monitoring may reduce within-fishery fishing effort or behavior. Over the long-term if 100% coverage contributes to higher catch limits, fishing effort could increase, which could have **negative** impacts.	Indirect **positive.** 100% monitoring would reduce uncertainty in bycatch estimates (through increased data on interactions with fishing gear). Over the long-term if 100% coverage contributes to higher catch limits, fishing effort could increase, which could have **negative** impacts.	**Mixed.** Operating costs are higher under 100% coverage, but enforceability and risk of non-compliance improve. 100% monitoring coverage may be seen as overly burdensome. Varying short-and long-term impacts.
Sector Monitoring Tools (Section 4.1.2)	**Positive.** When compared to human at-sea monitor coverage and No Action coverage levels. EM may improve data quality and reduce uncertainty.	**Positive.** When compared to human at-sea monitor coverage and No Action coverage levels. EM may improve data quality and reduce uncertainty.	**Low negative.** If use of EM in place of human at-sea monitors as a monitoring tool facilitates greater effort. Over the long-term if use of EM contributes to higher catch limits (through improved data quality), fishing effort could increase, which could have **negative** impacts.	Indirect **negative.** Potential loss of information on interactions with fishing gear for EM compared to human at-sea monitors, but these are not expected to have a significant adverse impact.	**Mixed.** Initial costs of installing EM may be high, but over long-term EM may be more cost effective than human at-sea monitors. Distributional impacts expected – vessels that participate more, or are more efficient, may have positive impacts (EM cheaper than human observers), and vessels that participate less may have negative impacts. Varying short-and long-term impacts.

Program Administration (Sector At-Sea Monitoring) (Section 4.1.3, 4.1.4, 4.1.5)	**No impact.** Measures are administrative, with no change to total fishing effort. Indirect **positive** impacts of a review process established.	**No impact.** Measures are administrative, with no change to total fishing effort. Indirect **positive** impacts of a review process established.	**No impact.** Measures are administrative, with no change to total fishing effort.	**No impact.** Measures are administrative, with no change to total fishing effort.	**No impact.** Measures are administrative, with no change to total fishing effort. Indirect **positive** impacts of a review process established.
Dockside Monitoring Program (Section 4.2)	**Negative.** Without independent verification of landings, information on sector and common pool catches may be less reliable, increasing the risk of overfishing.	**Negative.** Without independent verification of landings, information on groundfish catches will be unverified, and sectors could potentially exceed their ACE and common pool exceed trip limits. It is less likely that fishing effort would be reduced under this option.	**Neutral to slight positive.** In the short term, there would be no change to total fishing effort. If landings verification would result in higher catch limits over the long term, fishing effort may be lower under this option.	**No impact.** Dockside monitoring has no impact on protected resources.	**No impact.** No additional requirements and costs. Indirect **negative** impacts from lower enforceability and higher risk of non-compliance. **Positive** impacts on attitudes and beliefs of participants who have concerns with a DSM program.
Sector Reporting (Section 4.3)	**No impact.** Measures are administrative, with no change to total fishing effort.	**No impact.** Measures are administrative, with no change to total fishing effort.	**No impact.** Measures are administrative, with no change to total fishing effort.	**No impact.** Measures are administrative, with no change to total fishing effort.	**Neutral** to **low negative.** If streamlining reporting would reduce transaction costs.
Funding Provisions (Section 4.4)	Indirect **low negative.** Could potentially result in lower coverage.	Indirect **low negative.** Could potentially result in lower coverage.	**No impact.** No change to total fishing effort expected.	Indirect **low negative.** Could potentially result in lower coverage.	**Positive.** To the extent that fishing effort is constrained by the selected coverage level.

MANAGEMENT UNCERTAINTY BUFFERS (SECTION 4.5)	**Low negative** to **positive.** May increase fishing effort, but 100% monitoring coverage required has benefits (reduced uncertainty in estimates and reduced fishing mortality).	**Low negative** to **positive.** May increase fishing effort, but 100% monitoring coverage required has benefits (reduced uncertainty in estimates and reduced fishing mortality).	**Negative.** May increase fishing effort. 100% monitoring required may reduce within-fishery fishing effort or behavior. Over the long-term if 100% coverage contributes to higher catch limits, fishing effort could increase.	**Low negative** to **negative impacts,** to indirect **low positive impacts.** May increase fishing effort, but 100% monitoring coverage required has benefits (improve bycatch estimates).	**Mixed.** Operating costs increase since 100% monitoring coverage is required for this option; however, revenues are maximized relative to other monitoring options in this action, maximizing operating profits relative to the other 100% monitoring options.
REMOVAL OF MONITORING REQUIREMENTS (SECTION 4.6)	**Negative.** Lower coverage likely reduces accuracy of catch estimates. While groundfish catch is low in the exemption area, there are substantial catches for some stocks (SNE/MA winter flounder, SNE/MA yellowtail flounder, southern windowpane flounder, and ocean pout), some of which are in rebuilding plans. Impacts on GOM and GB stocks are expected to be **low negative**, but impacts on SNE/MA stocks expected to be **high negative**.	**Negative.** Under lower coverage information on groundfish catches will be less reliable, and sectors could potentially exceed their ACE. It is less likely that fishing effort would be reduced under this option.	**Negligible** to **slight negative.** Slight increases of effort in the fishery overall.	Directly and indirectly **low negative** to **negative.** May incentivize increased fishing effort in the exemption area, and some loss of data on interactions with fishing gear.	**Positive.** Costs would be reduced for vessels fishing exclusively in the exemption area. **Low positive** impacts for the fleet overall.

7.7.5 Cumulative Effects Summary

The regulatory atmosphere within which Federal fishery management operates requires that management actions be taken in a manner that will optimize the conditions of resources, habitat, and human communities. Consistent with NEPA, the MSFCMA requires that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment. Given this, and because fishery management actions must strive to create and maintain sustainable resources, impacts on all VECs (except short-term impacts to human communities) from past, present and reasonably foreseeable future actions, when combined with baseline conditions, have generally been positive and are expected to continue in that manner for the foreseeable future. This is not to say that some aspects of the various VECs are not experiencing negative impacts, but rather that when taken as a whole and compared to the level of unsustainable effort that existed prior to and just after the fishery came under management control, the overall long-term trend is positive.

Table 230 summarizes the likely cumulative effects found in the different sections of the preferred alternatives contained in A23. The CEA baseline that, as described above in Table 228 and Table 229, represents the sum of the past, present, and reasonably foreseeable future (identified hereafter as "other") actions and conditions of each VEC. When an alternative has a positive effect on a VEC, for example, reduced fishing mortality on a managed species, it has a positive cumulative effect on the stock size of the species when combined with the "other" actions that were also designed to increase stock size. In contrast, when an alternative has a negative effect on a VEC, such as increased mortality, the cumulative effects on the VEC are expected to be negative and tend to reduce the positive effects of the "other" actions. The resultant positive and negative cumulative effects are described below for each VEC.

Managed Resources

As noted in Table 226 and Table 227, the combined impacts of past federal fishery management actions have led to short-term impacts that result in overfishing and/or overfished status for several stocks. However, management measures, in particular modifications implemented through Amendment 16 to the FMP, are expected to yield rebuilt sustainable groundfish stocks in the future.

The preferred alternatives for A23 are expected to continue this trend, and are expected to have positive impacts on the managed resource. Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which should result in more accurate information on catch and fully accounted for discard mortality. In the short term, improved catch accounting should reduce fishing effort and fishing mortality, which in the long term should allow for rebuilding of overfished stocks. In the longer-term analytical assessments should improve with better catch data. Allowing sectors to use additional sector monitoring tools should improve data quality and reduce uncertainty, and contribute to improved catch accounting. Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and may have indirect impacts on the managed resource but would not be expected to change total fishing effort. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort but could result in lower monitoring coverage levels, which could impact the managed resource. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. This option requires that 100% monitoring coverage is selected, which will reduce uncertainty in catch information and reduce fishing mortality. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have negative impacts on the managed resource, particularly for stocks with substantial catches in this area (SNE/MA stocks, some of which are in rebuilding plans) as catch information would be less accurate and fishing effort in this area may increase; however, total fishing effort is not expected to be affected. The past and present impacts, combined with the Preferred Alternatives and future actions which are expected to continue rebuilding and strive to maintain sustainable stocks, should yield positive non-significant impacts to managed resources in the long term.

Non-Target Species

As noted in Table 226 and Table 227, the combined impacts of past federal fishery management actions have decreased fishing effort and improved habitat protection for non-target species. Current management measures, including those implemented through Amendment 16 to the FMP, are expected to continue to control effort, and decrease bycatch and discards.

The preferred alternatives in A23 are expected to continue this trend. Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which should result in more accurate information on catch and fully accounted for discard mortality. In the short term, improved catch accounting should reduce fishing effort and fishing mortality, which in the long term should allow for rebuilding of overfished stocks. Allowing sectors to use additional sector monitoring tools should improve data quality and reduce uncertainty, and contribute to improved catch accounting. Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and may have indirect impacts on non-target species but would not be expected to change total fishing effort. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort but could result in lower monitoring coverage levels, which could impact non-target species. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. This option requires that 100% monitoring coverage is selected, which will reduce uncertainty in catch information and reduce fishing mortality. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have negative impacts on non-target species, as catch information would be less accurate and fishing effort in this area may increase; however, total fishing effort is not expected to be affected. The past and present impacts, combined with the Preferred Alternatives and future actions which are expected to continue rebuilding and strive to maintain sustainable stocks, should yield positive non-significant impacts to non-target species in the long term. The past and present impacts, combined with the Preferred Alternative and future actions which are expected to continue rebuilding and strive to maintain sustainable stocks, should yield positive non-significant impacts to non-target species.

Habitat, Including EFH

As noted in Table 226 and Table 227, the combined impacts of past federal fishery management actions have reduced fishing effort, and therefore have been positive for habitat protection. In addition, better control of non-fishing activities has also been positive for habitat protection. However, both fishing and non-fishing activities continue to decrease habitat quality.

The preferred alternatives in A23 are expected to continue this trend. Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, may result in reduced groundfish fishing activity and provide some minor short-term benefits to habitat. Over the long term, if 100% coverage contributes to higher catch limits, fishing effort could increase in the future, which would have negative impacts to habitat. Allowing sectors to use additional sector monitoring tools could increase fishing effort, if the use of EM in place of human at-sea monitors as a monitoring tool facilitates greater effort. Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and would not be expected to change total fishing effort. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have slight negative impacts on habitat, as fishing effort in this area may increase; however, total fishing effort is not expected to be affected. Overall, the combination of past, present, and future actions is expected to reduce fishing effort and hence reduce damage to habitat, resulting in slightly positive, non-significant cumulative impacts. However, it is likely that fishing and non-fishing activities will continue to degrade habitat quality.

Protected Resources

As noted in Table 226 and Table 227, the combined impacts of past federal fishery management actions have reduced fishing effort. With a reduction in effort, the potential for interactions with protected resources may have also decreased. However, both fishing and non-fishing activities continue to directly or indirectly cause some level of negative impacts to protected resources. Current management measures, including those implemented through Amendment 16 to the FMP, and subsequent actions (FW48 - FW58) are expected to continue to control effort and catch, and therefore continue to aid in lessening potential interactions with protected resources.

The preferred alternatives in A23 are expected to continue this trend. The modifications in management measures may affect protected resources, but the preferred alternatives identified in A23 are not expected to have substantial impacts on protected resources. Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which should have indirect benefits to protected resources by providing additional information on interactions with fishing gear, which should reduce uncertainty in bycatch estimates. While changes in total fishing effort are not expected, if over the long term 100% monitoring coverage contributes to rebuilding of stocks to sustainable levels and higher catch limits, fishing effort could increase in the future, which may increase potential interactions with protected species. With rebuilt stocks and higher catch limits, more vessels in the groundfish fleet may actively fish, which would equate to more gear in the water, which is likely to result in an increase in interactions with protected species. Alternatively, with rebuilt stocks and higher catch limits, vessels may catch their quota faster, which may mean gear may be present in the water for less time and therefore, interactions could be less. At this time, without additional information, it is difficult to state with certainty which scenario is more likely. Allowing sectors to use additional sector monitoring tools is expected to have indirect negative impacts on protected resources, as there may be a loss of data on interactions with fishing gear compared to use of human at-sea monitors if information on protected species is not collected through EM. However, any indirect negative impacts would not be expected to have a significant adverse impact, and could be mitigated with a properly designed protocol including specific camera angles and data recording standards to potentially document more protected species interactions (see Section 7.4.1.2). Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and would not have impacts on protected resources. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is not expected to affect total fishing effort but could result in lower monitoring coverage levels, which could indirectly impact protected resources.

Eliminating the management uncertainty buffers for sector ACLs for allocated stocks may result in an increase in fishing effort, but this is uncertain. This option requires that 100% monitoring coverage is selected, which will provide additional information on gear interactions which reduces uncertainty in bycatch estimates. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have direct and indirect low negative impacts on protected resources, as fishing effort may increase in the exemption area, and a loss of data on interactions with fishing gear would occur; however, total fishing effort is not expected to be affected. Overall, the combination of past, present, and future actions is expected to stabilize protected species interactions and lead to low positive, non-significant cumulative impacts to protected species.

Human Communities

As noted in Table 226 and Table 227, the combined impacts of past federal fishery management actions have reduced effort, and therefore have curtailed fishing opportunities. Past and current management measures, including those implemented through Amendment 16 to the FMP and subsequent framework actions, will maintain effort and catch limit controls, which together with non-fishing impacts such as rising fuel costs have had significant negative short-term economic impacts on human communities.

The preferred alternatives proposed in A23 are expected to have substantial socioeconomic impacts. Monitoring coverage of 100 percent, much higher than past and current coverage levels, will be in place, which will result in higher operating costs than under past and current coverage levels. 100% monitoring coverage may be seen as overly burdensome by fishing communities. However, under 100% monitoring coverage enforceability and risk of non-compliance improve, which should improve the fairness and equitability of management measures. In the short term, impacts of 100% monitoring coverage on human communities could be reduced if federal reimbursements for monitoring costs and government subsidies are available. Impacts over the long-term will vary depending on whether federal reimbursements of monitoring costs will continue into the future. Allowing sectors to use additional sector monitoring tools reduces costs of monitoring relative to human at-sea monitors and should improve flexibility in the management system. Initial costs of installing EM may be high which may have negative impacts in the short term, but over the long-term EM may be more cost effective than human at-sea monitors. Distributional impacts of allowing sectors to use EM as a sector monitoring tools are expected, as vessels that participate more, or are more efficient, may have positive impacts as EM is cheaper than human observers for these vessels, and vessels that participate less may have negative impacts, as EM is less cost effective for these vessels.

Establishing a review process for coverage levels and allowing new sector monitoring tools and vessel specific coverage levels to be considered in a framework action are administrative in nature, and may have indirect impacts on human communities but would not be expected to impose additional costs. Allowing waivers from monitoring requirements if NMFS does not have shoreside funding is expected to have positive impacts, to the extent that fishing effort is constrained by the selected coverage level. Eliminating the management uncertainty buffers for sector ACLs for allocated stocks results in higher operating costs since 100% monitoring coverage required for this option; however, revenues are maximized relative to other monitoring options in this action, maximizing operating profits relative to the other 100% monitoring options. Removing monitoring requirements for vessels fishing in a certain geographic area is expected to have positive impacts on fishing communities that fish exclusively in the exemption area as monitoring costs would be reduced; however, low positive impacts for the fleet overall. Overall, the combination of past, present, and future actions is expected to enable a long-term sustainable harvest of groundfish stocks, which should lead to a long-term positive impact on fishing communities and economies. However, the overall combination of impacts thus far has been consistently negative for human communities.

8.0 DATA AND RESEARCH NEEDS

To be completed for FEIS.

9.0 APPLICABLE LAWS/EXECUTIVE ORDERS

9.1 MAGNUSON-STEVENS FISHERY AND CONSERVATION ACT

To be completed for FEIS.

9.1.1 Consistency with National Standards

To be completed for FEIS.

9.1.2 Other MSFCMA Requirements

To be completed for FEIS.

9.1.3 Essential Fish Habitat Assessment

To be completed for FEIS.

9.2 NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) provides a mechanism for identifying and evaluating the full spectrum of environmental issues associated with federal actions, and for considering a reasonable range of alternatives to avoid or minimize adverse environmental impacts. This document is designed to meet the requirements of both the MSFCMA and NEPA. The Council on Environmental Quality (CEQ) has issued regulations specifying the requirements for NEPA documents (40 CFR 1500 – 1508) and NOAA's policy and procedures for NEPA are found in NOAA Administrative Order 216-6. The required elements of an Environmental Impact Statement Assessment (EIS) are specified in 40 CFR 1508.9(b) and NAO 216-6 Section 5.04b.1. They are included in this document as follows:

- The need for this action - Section 3.2
- The alternatives that were considered – Section 4.0
- The environmental impacts of the Proposed Action - Section 6.1
- The agencies and persons consulted on this action - Section 9.2.6
- An executive summary – Section 1.0
- A table of contents – Section 2.0
- Background and purpose - Section 3.0
- A summary of the document – Section 1.0
- A brief description of the affected environment – Section 6.0
- Cumulative effects of the alternatives - Section 1.1
- A list of preparers – Section 9.2.5
- An index - Section 12.0

9.2.1 Public Scoping

The Council announced its intent to prepare Amendment 23 and an Environmental Impact Statement (EIS) on February 17, 2017. The scoping period extended from that date until April 3, 2017. Section 3.4 summarizes the scoping process, comments, and responses to those comments.

9.2.2 Areas of Controversy

To be completed for FEIS.

9.2.3 Document Distribution

This document is available on the Council's web page, www.nefmc.org and has been provided to all Council members. Announcements of document availability will be made in the *Federal Register* and to the interested parties' mailing list. Copies were distributed to:

U.S. EPA, Region 1
1 Congress St., 11th Floor
Boston, MA 02203-0001

U.S. EPA, Region 2
290 Broadway, 25th Floor
New York, NY 10007

U.S. EPA, Region 3
1650 Arch Street
Philadelphia, PA 19106
U.S. EPA, Region 4
61 Forsyth Street
Atlanta, GA 30303

District Commander
First U.S. Coast Guard District
408 Atlantic Avenue
Boston, MA 02210-2209

Director, Office of Marine Conservation
Department of State
2201 "C" Street, NW
Washington, DC 20520

Executive Director
Marine Mammal Commission
4340 East-West Highway
Bethesda, MD 20814

Director, Office of Environmental Policy and Compliance
U.S. Department of Interior
Main Interior Building (MS 2462)
1849 "C" Street, NW
Washington, DC 20520

9.2.4 Point of Contact

Questions concerning this document may be addressed to:

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9.2.5 List of Preparers

The following personnel participated in the preparation of this DEIS.

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National Marine Fisheries Service. Greg Ardini, Dan Caless, Timothy Cardiasmenos, Dr. Matthew Cutler, Chad Demarest, Mark Grant, Anna Henry (NMFS former), Emily Keiley, Dr. Daniel Linden, Katherine McArdle, Paul Nitschke, Danielle Palmer, Liz Sullivan, Aja Szumylo, Maria Vasta

State agencies. Richard Balouskus (RI DEM), Dr. Matthew Cieri (Maine DMR), Dr. Gregory DeCelles (formerly of MADMF), Rebecca Peters (Maine DMR), Kevin Sullivan (NHFG)

Mid-Atlantic Fishery Management Council. Julia Beaty

9.2.6 Agencies Consulted

The following agencies were consulted in the preparation of this document:

- Mid-Atlantic Fishery Management Council
- New England Fishery Management Council, which includes representatives from the following additional organizations:
    - Connecticut Department of Environmental Protection
    - Maine Department of Marine Resources
    - Massachusetts Division of Marine Fisheries
    - New Hampshire Fish and Game
    - Rhode Island Department of Environmental Management
- National Marine Fisheries Service, NOAA, Department of Commerce
- United States Coast Guard, Department of Homeland Security

9.2.7 Opportunity for Public Comment

Amendment 23 was developed from 2016-2020. A public scoping period occurred in 2017. Opportunities for public comment occurred at Advisory Panel, Committee, and Council meetings. There are limited opportunities to comment at PDT meetings and conference calls. Over 80 public meetings related to this action (Table 231). Meeting discussion documents and summaries are available at www.nefmc.org.

To be completed for FEIS, this table is only through the DEIS phase.

Table 231 - Public meetings related to Amendment 23.

Date	Meeting Type	Location
2016		
11/15-17/2016	Council Meeting	Hotel Viking, Newport, RI
2017		
1/18/2017	Advisory Panel	Hilton Garden Inn, Freeport, ME
1/19/2017	Committee	Hilton Garden Inn, Freeport, ME
2/14/2017	PDT	Webinar
3/3/2017	Scoping Hearing	Samoset Resort, Rockport, ME
3/21/2017	Scoping Hearing	Portsmouth Library, Portsmouth, NH
3/21/2017	Scoping Hearing	GARFO, Gloucester, MA
3/22/2017	Scoping Hearing	Hilton Garden Inn, Plymouth, MA
3/23/2017	Scoping Hearing	Hilton Garden Inn, Groton, MA
3/28/2017	Scoping Hearing	Webinar
4/11-12/2017	PDT	GMRI, Portland, ME
5/24/2017	Advisory Panel	Sheraton Harborside, Portland, ME
6/15/2017	Committee	Sheraton Harborside, Portland, ME
6/20-22/2017	Council Meeting	Holiday Inn by the bay, Portland, ME
8/3/2017	PDT	Hilton Garden Inn, Plymouth, MA
8/31/2017	PDT	Webinar
9/21/2017	Committee	Fairfield Inn, New Bedford, MA
9/26-28/2017	Council Meeting	Beauport, Gloucester, MA
11/28/2017	Advisory Panel	Courtyard by Marriott, Boston, MA
11/29/2017	Committee	Courtyard by Marriott, Boston, MA
2018		
1/25/2018	Committee	DoubleTree, Danvers, MA
1/30-31/2018	Council Meeting	Sheraton Harborside, Portsmouth, NH
2/27/2018	PDT	GARFO, Gloucester, MA
3/22/2018	PDT	Webinar
4/3/2018	PDT	SMAST, New Bedford, MA
4/17-19/2018	Council Meeting	Hilton Hotel, Mystic, CT
4/25/2018	PDT	Mariners House, Boston, MA
4/26/2018	Fishery Data for Stock Assessment Working Group	SMAST, New Bedford, MA
5/8/2018	Advisory Panel	Hilton Garden Inn, Boston, MA
5/9/2018	Committee	Hilton Garden Inn, Boston, MA
5/1/2018	PDT	Webinar
5/11/2018	PDT	Webinar
5/22/2018	PDT	NEFSC, Woods Hole, MA
6/1/2018	Committee	Four Points, Wakefield, MA

6/12-14/2018	Council Meeting	Holiday Inn by the Bay, Portland, ME
6/25/2018	Fishery Data for Stock Assessment Working Group	SMAST, New Bedford, MA
7/31/2018	PDT	GARFO, Gloucester, MA
8/6/2018	Fishery Data for Stock Assessment Working Group	SMAST, New Bedford, MA
8/22/2018	PDT	Webinar
9/7/2019	Fishery Data for Stock Assessment Working Group	SMAST New Bedford, MA
9/18/2018	Advisory Panel	Four Points, Wakefield, MA
9/18/2018	Committee	Four Points, Wakefield, MA
9/24-27/2018	Council Meeting	Hotel 1620, Plymouth, MA
10/16/2018	PDT	GARFO, Gloucester, MA
11/8/2018	Advisory Panel	DoubleTree by Hilton, Danvers, MA
11/8/2018	Committee	DoubleTree by Hilton, Danvers, MA
11/30/2018	SSC Sub-Panel Peer Review of Fishery Data for Stock Assessment Working Group Report	Hotel Providence, Providence, RI
12/4-6/2018	Council Meeting	Hotel Viking, Newport, RI
12/19/2018	PDT	Webinar
2019		
1/15/2019	Committee	DoubleTree by Hilton, Danvers, MA
1/29-31/2019	Council Meeting	Portsmouth Harbor Events, Portsmouth, NH
2/7/2019	Fishery Data for Stock Assessment Working Group	Webinar
2/13/2019	PDT	Webinar
2/26/2019	Committee	DoubleTree by Hilton, Danvers, MA
3/19/2019	PDT	GARFO, Gloucester, MA
3/29/2019	PDT	NEFSC, Woods Hole, MA
4/1/2019	Advisory Panel	Hilton Garden Inn, Boston, MA
4/2/2019	Committee	Hilton Garden Inn, Boston, MA
4/3/2019	PDT	Webinar
4/15/2019	PDT	Webinar
4/16-18/2019	Council Meeting	Hilton Hotel, Mystic, CT
4/24-25/2019	SSC Sub-Panel Review of PDT Analysis	Hotel Providence, Providence, RI
5/8/2019	PDT	Hampton Inn, Plymouth, MA
5/14/2019	PDT	Webinar
5/20-21/2019	Joint Committee, PDT, Advisory Panel	DoubleTree, South Portland, ME
5/29/2019	PDT	Webinar
6/11-13/2019	Council Meeting	DoubleTree by Hilton, South Portland, ME
6/27/2019	PDT	Mariners House, Boston, MA
8/6/2019	Joint Committee, Advisory Panel	Hilton Garden Inn, Boston, MA

7/18/2019	PDT	Webinar
8/20/2019	PDT	Webinar
9/16/2019	Advisory Panel	Hilton Garden Inn, Boston, MA
9/17/2019	Committee	Hilton Garden Inn, Boston, MA
9/23-26/2019	Council Meeting	Beauport Hotel, Gloucester, MA
9/30/2019	PDT	Webinar
10/21/2019	PDT	Webinar
10/30/2019	Joint Committee, Advisory Panel	Holiday Inn, Portsmouth, NH
11/25/2019	Joint Committee, Advisory Panel	DoubleTree by Hilton, Danvers, MA
11/5/2019	PDT	GARFO, Gloucester, MA
12/3-5/2019	Council Meeting	Hotel Viking, Newport, RI
2020		
1/8/2020	PDT	Webinar
1/21/2020	Advisory Panel	Four Points, Wakefield, MA
1/23/2020	Committee	Four Points, Wakefield, MA
1/28-30/2020	Council Meeting	Portsmouth Harbor Events, Portsmouth, NH

9.3 Endangered Species Act

To be completed for FEIS.

9.4 Marine Mammal Protection Act

To be completed for FEIS.

9.5 Coastal Zone Management Act

To be completed for FEIS.

9.6 Administrative Procedures Act

To be completed for FEIS.

9.7 Data Quality Act

To be completed for FEIS.

9.8 Executive Order 13132 (Federalism)

To be completed for FEIS.

9.9 Executive Order 13158 (Marine Protected Areas)

To be completed for FEIS.

9.10 Paperwork Reduction Act

9.11 Regulatory Impact Review

To be completed for FEIS.

9.11.1 Regulatory Flexibility Act – Initial Regulatory Flexibility Analysis

To be completed for FEIS.

9.11.2 Executive Order 12866 (Regulatory Planning and Review)

To be completed for FEIS.

10.0 GLOSSARY

Adult stage: One of several marked phases or periods in the development and growth of many animals. In vertebrates, the life history stage where the animal is capable of reproducing, as opposed to the juvenile stage.

Adverse effect: Any impact that reduces quality and/or quantity of EFH. May include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include sites-specific of habitat wide impacts, including individual, cumulative, or synergistic consequences of actions.

Aggregation: A group of animals or plants occurring together in a particular location or region.

Anadromous species: fish that spawn in fresh or estuarine waters and migrate to ocean waters

Amphipods: A small crustacean of the order Amphipoda, such as the beach flea, having a laterally compressed body with no carapace.

Anaerobic sediment: Sediment characterized by the absence of free oxygen.

Anemones: Any of numerous flowerlike marine coelenterates of the class Anthozoa, having a flexible cylindrical body and tentacles surrounding a central mouth.

Annual Catch Entitlement (ACE): Pounds of available catch that can be harvested by a particular sector. Based on the total PSC for the permits that join the sector.

Annual total mortality: Rate of death expressed as the fraction of a cohort dying over a period compared to the number alive at the beginning of the period (# total deaths during year / numbers alive at the beginning of the year). Optimists convert death rates into annual survival rate using the relationship S=1-A.

ASPIC (A Surplus Production Model Incorporating Covariates): A non-equilibrium surplus production model developed by Prager (1995). ASPIC was frequently used by the Overfishing Definition Panel to define BMSY and FMSY reference points. The model output was also used to estimate rebuilding timeframes for the Amendment 9 control rules.

Bay: An inlet of the sea or other body of water usually smaller than a gulf; a small body of water set off from the main body; e.g. Ipswich Bay in the Gulf of Maine.

Benthic community: Benthic means the bottom habitat of the ocean, and can mean anything as shallow as a salt marsh or the intertidal zone, to areas of the bottom that are several miles deep in the ocean. Benthic community refers to those organisms that live in and on the bottom. (In meaning they live within the substrate; e.g., within the sand or mud found on the bottom. See Benthic infauna, below)

Benthic infauna: See Benthic community, above. Those organisms that live in the bottom sediments (sand, mud, gravel, etc.) of the ocean. As opposed to benthic epifauna, that live on the surface of the bottom sediments.

Benthivore: Usually refers to fish that feed on benthic or bottom dwelling organisms.

Berm: A narrow ledge typically at the top or bottom of a slope; e.g. a berm paralleling the shoreline caused by wave action on a sloping beach; also an elongated mound or wall of earth.

Biogenic habitats: Ocean habitats whose physical structure is created or produced by the animals themselves; e.g., coral reefs.

Biomass: The total mass of living matter in a given unit area or the weight of a fish stock or portion thereof. Biomass can be listed for beginning of year (Jan-1), Mid-Year, or mean (average during the entire year). In addition, biomass can be listed by age group (numbers at age * average weight at age) or summarized by groupings (e.g., age 1+, ages 4+ 5, etc.). See also spawning stock biomass, exploitable biomass, and mean biomass.

BMSY: The stock biomass that would produce MSY when fished at a fishing mortality rate equal to FMSY. For most stocks, BMSY is about ½ of the carrying capacity. The proposed overfishing definition control rules call for action when biomass is below ¼ or ½ BMSY, depending on the species.

Bthreshold: 1) A limit reference point for biomass that defines an unacceptably low biomass i.e., puts a stock at high risk (recruitment failure, depensation, collapse, reduced long term yields, etc.).
2) A biomass threshold that the SFA requires for defining when a stock is overfished. A stock is overfished if its biomass is below Bthreshold. A determination of overfished triggers the SFA requirement for a rebuilding plan to achieve Btarget as soon as possible, usually not to exceed 10 years except certain requirements are met. In Amendment 9 control rules, Bthreshold is often defined as either 1/2BMSY or 1/4 BMSY. Bthreshold is also known as Bminimum.

Btarget: A desirable biomass to maintain fishery stocks. This is usually synonymous with BMSY or its proxy.

Biomass weighted F: A measure of fishing mortality that is defined as an average of fishing mortality at age weighted by biomass at age for a ranges of ages within the stock (e.g., ages 1+ biomass weighted F is a weighted average of the mortality for ages 1 and older, age 3+ biomass weighted is a weighted average for ages 3 and older). Biomass weighted F can also be calculated using catch in weight over mean biomass. See also fully-recruited F.

Biota: All the plant and animal life of a particular region.

Bivalve: A class of mollusks having a soft body with platelike gills enclosed within two shells hinged together; e.g., clams, mussels.

Bottom roughness: The inequalities, ridges, or projections on the surface of the seabed that are caused by the presence of bedforms, sedimentary structures, sedimentary particles, excavations, attached and unattached organisms, or other objects; generally small scale features.

Bottom tending mobile gear: All fishing gear that operates on or near the ocean bottom that is actively worked in order to capture fish or other marine species. Some examples of bottom tending mobile gear are otter trawls and dredges.

Bottom tending static gear: All fishing gear that operates on or near the ocean bottom that I snot actively worked; instead, the effectiveness of this gear depends on species moving to the gear which is set in a particular manner by a vessel, and later retrieved. Some examples of bottom tending static gear are gillnets, traps, and pots.

Boulder reef: An elongated feature (a chain) of rocks (generally piled boulders) on the seabed.

Bryozoans: Phylum aquatic organisms, living for the most part in colonies of interconnected individuals. A few to many millions of these individuals may form one colony. Some bryozoans encrust rocky surfaces, shells, or algae others form lacy or fan-like colonies that in some regions may form an abundant component of limestones. Bryozoan colonies range from millimeters to meters in size, but the individuals that make up the colonies are rarely larger than a millimeter. Colonies may be mistaken for hydroids, corals or seaweed.

Burrow: A hole or excavation in the sea floor made by an animal (as a crab, lobster, fish, burrowing anemone) for shelter and habitation.

Bycatch: (v.) the capture of nontarget species in directed fisheries which occurs because fishing gear and methods are not selective enough to catch only target species; (n.) fish which are harvested in a fishery but are not sold or kept for personal use, including economic discards and regulatory discards but not fish released alive under a recreational catch and release fishery management program.

Capacity: the level of output a fishing fleet is able to produce given specified conditions and constraints. Maximum fishing capacity results when all fishing capital is applied over the maximum amount of available (or permitted) fishing time, assuming that all variable inputs are utilized efficiently.

Catch: The sum total of fish killed in a fishery in a given period. Catch is given in either weight or number of fish and may include landings, unreported landings, discards, and incidental deaths.

Closed Area Model: A General Algebraic Modeling System (GAMS) model used to evaluate the effectiveness of effort controls used in the Northeast Multispecies Fishery. Using catch data from vessels in the fishery, the model estimates changes in exploitation that may result from changes in DAS, closed areas, and possession limits. These changes in exploitation are then converted to changes in fishing mortality to evaluate proposed measures.

Coarse sediment: Sediment generally of the sand and gravel classes; not sediment composed primarily of mud; but the meaning depends on the context, e.g. within the mud class, silt is coarser than clay.

Commensalism: See Mutualism. An interactive association of two species where one benefits in some way, while the other species is in no way affected by the association.

Continental shelf waters: The waters overlying the continental shelf, which extends seaward from the shoreline and deepens gradually to the point where the sea floor begins a slightly steeper descent to the deep ocean floor; the depth of the shelf edge varies, but is approximately 200 meters in many regions.

Control rule: A pre-determined method for determining fishing mortality rates based on the relationship of current stock biomass to a biomass target. Amendment 9 overfishing control rules define a target biomass (BMSY or proxy) as a management objective. The biomass threshold (Bthreshold or Bmin) defines a minimum biomass below which a stock is considered overfished.

Cohort: see yearclass.

Crustaceans: Invertebrates characterized by a hard outer shell and jointed appendages and bodies. They usually live in water and breathe through gills. Higher forms of this class include lobsters, shrimp and crawfish; lower forms include barnacles.

Days absent: an estimate by port agents of trip length. This data was collected as part of the NMFS weighout system prior to May 1, 1994.

Days-at-sea (DAS): the total days, including steaming time that a boat spends at sea to fish. Amendment 13 categorized DAS for the multispecies fishery into three categories, based on each individual vessel's fishing history during the period fishing year 1996 through 2001. The three categories are: Category A: can be used to target any groundfish stock; Category B: can only be used to target healthy stocks; Category C: cannot be used until some point in the future. Category B DAS are further divided equally into Category B (regular) and Category B (reserve).

DAS "flip": A practice in the Multispecies FMP that occurs when a vessel fishing on a Category B (regular) DAS must change ("flip") its DAS to a Category A DAS because it has exceeded a catch limit for a stock of concern.

Demersal species: Most often refers to fish that live on or near the ocean bottom. They are often called benthic fish, groundfish, or bottom fish.

Diatoms: Small mobile plants (algæ) with silicified (silica, sand, quartz) skeletons. They are among the most abundant phytoplankton in cold waters, and an important part of the food chain.

Discards: animals returned to sea after being caught; see Bycatch (n.)

Dissolved nutrients: Non-solid nutrients found in a liquid.

Echinoderms: A member of the Phylum Echinodermata. Marine animals usually characterized by a five-fold symmetry, and possessing an internal skeleton of calcite plates, and a complex water vascular system. Includes echinoids (sea urchins), crinoids (sea lillies) and asteroids (starfish).

Ecosystem-based management: a management approach that takes major ecosystem components and services—both structural and functional—into account, often with a multispecies or habitat perspective

Egg stage: One of several marked phases or periods in the development and growth of many animals. The life history stage of an animal that occurs after reproduction and refers to the developing embryo, its food store, and sometimes jelly or albumen, all surrounded by an outer shell or membrane. Occurs before the larval or juvenile stage.

Elasmobranch: Any of numerous fishes of the class Chondrichthyes characterized by a cartilaginous skeleton and placoid scales: sharks; rays; skates.

Embayment: A bay or an indentation in a coastline resembling a bay.

Emergent epifauna: See Epifauna. Animals living upon the bottom that extend a certain distance above the surface.

Epifauna: See Benthic infauna. Epifauna are animals that live on the surface of the substrate, and are often associated with surface structures such as rocks, shells, vegetation, or colonies of other animals.

Essential Fish Habitat (EFH): Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH designation for most managed species in this region is based on a legal text definition and geographical area that are described in the Habitat Omnibus Amendment (1998).

Estuarine area: The area of an estuary and its margins; an area characterized by environments resulting from the mixing of river and sea water.

Estuary: A water passage where the tide meets a river current; especially an arm of the sea at the lower end of a river; characterized by an environment where the mixing of river and seawater causes marked variations in salinity and temperature in a relatively small area.

Eutrophication: A set of physical, chemical, and biological changes brought about when excessive nutrients are released into the water.

Euphotic zone: The zone in the water column where at least 1% of the incident light at the surface penetrates.

Exclusive Economic Zone (EEZ): a zone in which the inner boundary is a line coterminous with the seaward boundary of each of the coastal States and the outer boundary is line 200 miles away and parallel to the inner boundary

Exempt fisheries: Any fishery determined by the Regional Director to have less than 5 percent regulated species as a bycatch (by weight) of total catch according to 50 CFR 648.80(a)(7).

Exploitable biomass: The biomass of fish in the portion of the population that is vulnerable to fishing.

Exploitation pattern: Describes the fishing mortality at age as a proportion of fully recruited F (full vulnerability to the fishery). Ages that are fully vulnerable experience 100% of the fully recruited F and are termed fully recruited. Ages that are only partially vulnerable experience a fraction of the fully recruited F and are termed partially recruited. Ages that are not vulnerable to the fishery (including discards) experience no mortality and are considered pre-recruits. Also known as the partial recruitment pattern, partial recruitment vector or fishery selectivity.

Exploitation rate (u): The fraction of fish in the exploitable population killed during the year by fishing. This is an annual rate compared to F, which is an instantaneous rate. For example, if a population has 1,000,000 fish large enough to be caught and 550,000 are caught (landed and discarded) then the exploitation rate is 55%.

Fathom: A measure of length, containing six feet; the space to which a man can extend his arms; used chiefly in measuring cables, cordage, and the depth of navigable water by soundings.

Fishing mortality (F): A measurement of the rate of removal of fish from a population caused by fishing. This is usually expressed as an instantaneous rate (F) and is the rate at which fish are harvested at any given point in a year. Instantaneous fishing mortality rates can be either fully recruited or biomass weighted. Fishing mortality can also be expressed as an exploitation rate (see exploitation rate) or less commonly, as a conditional rate of fishing mortality (m, fraction of fish removed during the year if no other competing sources of mortality occurred. Lower case m should not be confused with upper case M, the instantaneous rate of natural mortality).

F0.1: a conservative fishing mortality rate calculated as the F associated with 10 percent of the slope at origin of the yield-per-recruit curve.

FMAX: a fishing mortality rate that maximizes yield per recruit. FMAX is less conservative than F0.1.

FMSY: a fishing mortality rate that would produce MSY when the stock biomass is sufficient for producing MSY on a continuing basis.

Fthreshold: 1) The maximum fishing mortality rate allowed on a stock and used to define overfishing for status determination. Amendment 9 frequently uses FMSY or FMSY proxy for Fthreshold. 2) The maximum fishing mortality rate allowed for a given biomass as defined by a control rule.

Fishing effort: the amount of time and fishing power used to harvest fish. Fishing power is a function of gear size, boat size and horsepower.

Framework adjustments: adjustments within a range of measures previously specified in a fishery management plan (FMP). A change usually can be made more quickly and easily by a framework adjustment than through an amendment. For plans developed by the New England Council, the procedure requires at least two Council meetings including at least one public hearing and an evaluation of environmental impacts not already analyzed as part of the FMP.

Furrow: A trench in the earth made by a plow; something that resembles the track of a plow, as a marked narrow depression; a groove with raised edges.

Glacial moraine: A sedimentary feature deposited from glacial ice; characteristically composed of unsorted clay, sand, and gravel. Moraines typically are hummocky or ridge-shaped and are located along the sides and at the fronts of glaciers.

Glacial till: Unsorted sediment (clay, sand, and gravel mixtures) deposited from glacial ice.

Grain size: the size of individual sediment particles that form a sediment deposit; particles are separated into size classes (e.g. very fine sand, fine sand, medium sand, among others); the classes are combined into broader categories of mud, sand, and gravel; a sediment deposit can be composed of few to many different grain sizes.

Growth overfishing: Fishing at an exploitation rate or at an age at entry that reduces potential yields from a cohort but does not reduce reproductive output (see recruitment overfishing).

Halocline: The zone of the ocean in which salinity increases rapidly with depth.

Habitat complexity: Describes or measures a habitat in terms of the variability of its characteristics and its functions, which can be biological, geological, or physical in nature. Refers to how complex the physical structure of the habitat is. A bottom habitat with structure-forming organisms, along with other three dimensional objects such as boulders, is more complex than a flat, featureless, bottom.

Highly migratory species: tuna species, marlin, oceanic sharks, sailfishes, and swordfish

Hydroids: Generally, animals of the Phylum Cnidaria, Class Hydrozoa; most hydroids are bush- like polyps growing on the bottom and feed on plankton, they reproduce asexually and sexually.

Immobile epifaunal species: See epifauna. Animals living on the surface of the bottom substrate that, for the most part, remain in one place.

Individual Fishing Quota (IFQ): federal permit under a limited access system to harvest a quantity of fish, expressed by a unit or units representing a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by an individual person or entity

Juvenile stage: One of several marked phases or periods in the development and growth of many animals. The life history stage of an animal that comes between the egg or larval stage and the adult stage; juveniles are considered immature in the sense that they are not yet capable of reproducing, yet they differ from the larval stage because they look like smaller versions of the adults.

Landings: The portion of the catch that is harvested for personal use or sold.

Land runoff: The part of precipitation, snowmelt, or irrigation water that reaches streams (and thence the sea) by flowing over the ground, or the portion of rain or snow that does not percolate into the ground and is discharged into streams instead.

Larvae stage: One of several marked phases or periods in the development and growth of many animals. The first stage of development after hatching from the egg for many fish and invertebrates. This life stage looks fundamentally different than the juvenile and adult stages, and is incapable of reproduction; it must undergo metamorphosis into the juvenile or adult shape or form.

Lethrinids: Fish of the genus Lethrinus, commonly called emperors or nor'west snapper, are found mainly in Australia's northern tropical waters. Distinctive features of Lethrinids include thick lips, robust canine teeth at the front of the jaws, molar-like teeth at the side of the jaws and cheeks without scales. Lethrinids are carnivorous bottom-feeding fish with large, strong jaws.

Limited-access permits: permits issued to vessels that met certain qualification criteria by a specified date (the "control date").

Lutjanids: Fish of the genus of the Lutjanidae: snappers. Marine; rarely estuarine. Some species do enter freshwater for feeding. Tropical and subtropical: Atlantic, Indian and Pacific Oceans.

Macrobenthos: See Benthic community and Benthic infauna. Benthic organisms whose shortest dimension is greater than or equal to 0.5 mm.

Maturity ogive: A mathematical model used to describe the proportion mature at age for the entire population. A50 is the age where 50% of the fish are mature.

Mean biomass: The average number of fish within an age group alive during a year multiplied by average weight at age of that age group. The average number of fish during the year is a function of starting stock size and mortality rate occurring during the year. Mean biomass can be aggregated over several ages to describe mean biomass for the stock. For example the mean biomass summed for ages 1 and over is the 1+ mean biomass; mean biomass summed across ages 3 and over is 3+ mean biomass.

Megafaunal species: The component of the fauna of a region that comprises the larger animals, sometimes defined as those weighing more than 100 pounds.

Mesh selectivity ogive: A mathematical model used to describe the selectivity of a mesh size (proportion of fish at a specific length retained by mesh) for the entire population. L25 is the length where 25% of the fish encountered are retained by the mesh. L50 is the length where 50% of the fish encountered are retained by the mesh.

Meter: A measure of length, equal to 39.37 English inches, the standard of linear measure in the metric system of weights and measures. It was intended to be, and is very nearly, the ten millionth part of the distance from the equator to the north pole, as ascertained by actual measurement of an arc of a meridian.

Metric ton: A unit of weight equal to a thousand kilograms (1kgs = 2.2 lbs.). A metric ton is equivalent to 2,205 lbs. A thousand metric tons is equivalent to 2.2 million lbs.

Microalgal: Small microscopic types of algae such as the green algae.

Microbial: Microbial means of or relating to microorganisms.

Minimum spawning stock threshold: the minimum spawning stock size (or biomass) below which there is a significantly lower chance that the stock will produce enough new fish to sustain itself over the long term.

Mobile organisms: organisms that are not confined or attached to one area or place, that can move on their own, are capable of movement, or are moved (often passively) by the action of the physical environment (waves, currents, etc.).

Molluscs: Common term for animals of the phylum Mollusca. Includes groups such as the bivalves (mussels, oysters etc.), cephalopods (squid, octopus etc.) and gastropods (abalone, snails). Over 80,000 species in total with fossils back to the Cambrian period.

Mortality: see Annual total mortality (A), Exploitation rate (u), Fishing mortality (F), Natural mortality (M), and instantaneous total mortality (Z).

Motile: Capable of self-propelled movement. A term that is sometimes used to distinguish between certain types of organisms found in water.

Multispecies: the group of species managed under the Northeast Multispecies Fishery Management Plan. This group includes whiting, red hake and ocean pout plus the regulated species (cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, windowpane flounder, white hake and redfish).

Mutualism: See Commensalism. A symbiotic interaction between two species in which both derive some benefit.

Natural disturbance: A change caused by natural processes; e.g. in the case of the seabed, changes can be caused by the removal or deposition of sediment by currents; such natural processes can be common or rare at a particular site.

Natural mortality: A measurement of the rate of death from all causes other than fishing such as predation, disease, starvation, and pollution. Commonly expressed as an instantaneous rate (M). The rate of natural mortality varies from species to species, but is assumed to be M=0.2 for the five critical stocks. The natural mortality rate can also be expressed as a conditional rate (termed n and not additive with competing sources of mortality such as fishing) or as annual expectation of natural death (termed v and additive with other annual expectations of death).

Nearshore area: The area extending outward an indefinite but usually short distance from shore; an area commonly affected by tides and tidal and storm currents, and shoreline processes.

Nematodes: a group of elongated, cylindrical worms belonging to the phylum Nematoidea, also called thread-worms or eel-worms. Some non-marine species attack roots or leaves of plants, others are parasites on animals or insects.

Nemerteans: Proboscis worms belonging to the phylum Nemertea, and are soft unsegmented marine worms that have a threadlike proboscis and the ability to stretch and contract.

Nemipterids: Fishes of the Family Nemipteridae, the threadfin breams or whiptail breams. Distribution: Tropical and sub-tropical Indo-West Pacific.

Northeast Shelf Ecosystem: The Northeast U.S. Shelf Ecosystem has been described as including the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream.

Northwest Atlantic Analysis Area (NAAA): A spatial area developed for analysis purposes only. The boundaries of this the area are within the 500 fathom line to the east, the coastline to the west, the Hague line to the north, and the North Carolina/ South Carolina border to the south. The area is approximately 83,550 square nautical miles, and is used as the denominator in the EFH analysis to determine the percent of sediment, EFH, and biomass contained in an area, as compared to the total NAAA.

Nutrient budgets: An accounting of nutrient inputs to and production by a defined ecosystem (e.g., salt marsh, estuary) versus utilization within and export from the ecosystem.

Observer: any person required or authorized to be carried on a vessel for conservation and management purposes by regulations or permits under this Act

Oligochaetes: See Polychaetes. Oligochaetes are worms in the phylum Annelida having bristles borne singly along the length of the body.

Open access: describes a fishery or permit for which there is no qualification criteria to participate. Open-access permits may be issued with restrictions on fishing (for example, the type of gear that may be used or the amount of fish that may be caught).

Opportunistic species: Species that colonize disturbed or polluted sediments. These species are often small, grow rapidly, have short life spans, and produce many offspring.

Optimum Yield (OY): the amount of fish which A) will provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery

Organic matter: Material of, relating to, or derived from living organisms.

Overfished: A conditioned defined when stock biomass is below minimum biomass threshold and the probability of successful spawning production is low.

Overfishing: A level or rate of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to produce MSY on a continuing basis.

Peat bank: A bank feature composed of partially carbonized, decomposed vegetable tissue formed by partial decomposition of various plants in water; may occur along shorelines.

Pelagic gear: Mobile or static fishing gear that is not fixed, and is used within the water column, not on the ocean bottom. Some examples are mid-water trawls and pelagic longlines.

Phytoplankton: Microscopic marine plants (mostly algae and diatoms) which are responsible for most of the photosynthetic activity in the oceans.

Piscivore: A species feeding preferably on fish.

Planktivore: An animal that feeds on plankton.

Polychaetes: Polychaetes are segmented worms in the phylum Annelida. Polychaetes

(poly-chaetae = many-setae) differ from other annelids in having many setae (small bristles held in tight bundles) on each segment.

Porosity: The amount of free space in a volume of a material; e.g. the space that is filled by water between sediment particles in a cubic centimeter of seabed sediment.

Possession-limit-only permit: an open-access permit (see above) that restricts the amount of multispecies a vessel may retain (currently 500 pounds of "regulated species").

Potential Sector Contribution (PSC): The percentage of the available catch a limited access permit is entitled to after joining a sector. Based on landings history as defined in Amendment 16. The sum of the PSC's in a sector is multiplied by the groundfish sub-ACL to get the ACE for the sector.

Pre-recruits: Fish in size or age groups that are not vulnerable to the fishery (including discards).

Prey availability: The availability or accessibility of prey (food) to a predator. Important for growth and survival.

Primary production: The synthesis of organic materials from inorganic substances by photosynthesis.

Recovery time: The period of time required for something (e.g. a habitat) to achieve its former state after being disturbed.

Recruitment: the amount of fish added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to fishing gear in one year would be the recruitment to the fishery. "Recruitment" also refers to new year classes entering the population (prior to recruiting to the fishery).

Recruitment overfishing: fishing at an exploitation rate that reduces the population biomass to a point where recruitment is substantially reduced.

Regulated groundfish species: cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, windowpane flounder, white hake and redfish. These species are usually targeted with large-mesh net gear.

Relative exploitation: an index of exploitation derived by dividing landings by trawl survey biomass. This measure does not provide an absolute magnitude of exploitation but allows for general statements about trends in exploitation.

Retrospective pattern: A pattern of systematic over-estimation or underestimation of terminal year estimates of stock size, biomass or fishing mortality compared to that estimate for that same year when it occurs in pre-terminal years.

Riverine area: The area of a river and its banks.

Saurids: Fish of the family Scomberesocidae, the sauries or needlefishes. Distribution: tropical and temperate waters.

Scavenging species: An animal that consumes dead organic material.

Sea whips: A coral that forms long flexible structures with few or no branches and is common on Atlantic reefs.

Sea pens: An animal related to corals and sea anemones with a featherlike form.

Sediment: Material deposited by water, wind, or glaciers.

Sediment suspension: The process by which sediments are suspended in water as a result of disturbance.

Sedentary: See Motile and Mobile organisms. Not moving. Organisms that spend the majority of their lives in one place.

Sedimentary bedforms: Wave-like structures of sediment characterized by crests and troughs that are formed on the seabed or land surface by the erosion, transport, and deposition of particles by water and wind currents; e.g. ripples, dunes.

Sedimentary structures: Structures of sediment formed on the seabed or land surface by the erosion, transport, and deposition of particles by water and wind currents; e.g. ripples, dunes, buildups around boulders, among others.

Sediment types: Major combinations of sediment grain sizes that form a sediment deposit, e.g. mud, sand, gravel, sandy gravel, muddy sand, among others.

Spawning adult stage: See adult stage. Adults that are currently producing or depositing eggs.

Spawning stock biomass (SSB): the total weight of fish in a stock that sexually mature, i.e., are old enough to reproduce.

Species assemblage: Several species occurring together in a particular location or region

Species composition: A term relating the relative abundance of one species to another using a common measurement; the proportion (percentage) of various species in relation to the total on a given area.

Species diversity: The number of different species in an area and their relative abundance

Species richness: See Species diversity. A measurement or expression of the number of species present in an area; the more species present, the higher the degree of species richness.

Species with vulnerable EFH: If a species was determined to be "highly" or "moderately" vulnerable to bottom tending gears (otter trawls, scallop dredges, or clam dredges) then it was included in the list of species with vulnerable EFH. Currently there are 23 species and life stages that are considered to have vulnerable EFH for this analysis.

Status Determination: A determination of stock status relative to Bthreshold (defines overfished) and Fthreshold (defines overfishing). A determination of either overfished or overfishing triggers a SFA requirement for rebuilding plan (overfished), ending overfishing (overfishing) or both.

Stock: A grouping of fish usually based on genetic relationship, geographic distribution and movement patterns. A region may have more than one stock of a species (for example, Gulf of Maine cod and Georges Bank cod). A species, subspecies, geographical grouping, or other category of fish capable of management as a unit.

Stock assessment: determining the number (abundance/biomass) and status (life-history characteristics, including age distribution, natural mortality rate, age at maturity, fecundity as a function of age) of individuals in a stock

Stock of concern: a regulated groundfish stock that is overfished, or subject to overfishing.

Structure-forming organisms: Organisms, such as corals, colonial bryozoans, hydroids, sponges, mussel beds, oyster beds, and seagrass that by their presence create a three-dimensional physical structure on the bottom. See biogenic habitats.

Submerged aquatic vegetation: Rooted aquatic vegetation, such as seagrasses, that cannot withstand excessive drying and therefore live with their leaves at or below the water surface in shallow areas of estuaries where light can penetrate to the bottom sediments. SAV provides an important habitat for young fish and other aquatic organisms.

Surficial sediment: Sediment forming the sea floor or land surface; thickness of the surficial layer may vary.

Surplus production: Production of new stock biomass defined by recruitment plus somatic growth minus biomass loss due to natural deaths. The rate of surplus production is directly proportional to stock biomass and its relative distance from the maximum stock size at carrying capacity (K). BMSY is often defined as the biomass that maximizes surplus production rate.

Surplus production models: A family of analytical models used to describe stock dynamics based on catch in weight and CPUE time series (fishery dependent or survey) to construct stock biomass history. These models do not require catch at age information. Model outputs may include stock biomass history, biomass weighted fishing mortality rates, MSY, FMSY, BMSY, K, (maximum population biomass where stock growth and natural deaths are balanced) and r (intrinsic rate of increase).

Survival rate (S): Rate of survival expressed as the fraction of a cohort surviving the a period compared to number alive at the beginning of the period (# survivors at the end of the year / numbers alive at the beginning of the year). Pessimists convert survival rates into annual total mortality rate using the relationship A=1-S.

Survival ratio (R/SSB): an index of the survivability from egg to age-of-recruitment. Declining ratios suggest that the survival rate from egg to age-of-recruitment is declining.

TAC: Total allowable catch. This value is calculated by applying a target fishing mortality rate to exploitable biomass.

Taxa: The plural of taxon. Taxon is a named group or organisms of any rank, such as a particular species, family, or class.

Ten-minute- “squares” of latitude and longitude (TMS): Are a measure of geographic space. The actual size of a ten-minute-square varies depending on where it is on the surface of the earth, but in general each square is approximately 70-80 square nautical miles in this region. This is the spatial area that EFH designations, biomass data, and some of the effort data have been binned into for analysis purposes in various sections of this document.

Topography: The depiction of the shape and elevation of land and sea floor surfaces.

Total Allowable Catch (TAC): The amount (in metric tons) of a stock that is permitted to be caught during a fishing year. In the Multispecies FMP, TACs can either be “hard” (fishing ceases when the TAC is caught) or a “target” (the TAC is merely used as an indicator to monitor effectiveness of management measures, but does not trigger a closure of the fishery).

Total mortality: The rate of mortality from all sources (fishing, natural, pollution) Total mortality can be expressed as an instantaneous rate (called Z and equal to F + M) or Annual rate (called A and calculated as the ratio of total deaths in a year divided by number alive at the beginning of the year)

Trophic guild: Trophic is defined as the feeding level within a system that an organism occupies; e.g., predator, herbivore. A guild is defined as a group of species that exploit the same class of environmental resources in a similar way. The trophic guild is a utilitarian concept covering both structure and organization that exists between the structural categories of trophic groups and species.

Turbidity: Relative water clarity; a measurement of the extent to which light passing through water is reduced due to suspended materials.

Two-bin (displacement) model: a model used to estimate the effects of area closures. This model assumes that effort from the closed areas (first bin) is displaced to the open areas (second bin). The total effort in the system is then applied to the landings-per-unit-effort (LPUE) in open areas to obtain a projected catch. The percent reduction in catch is calculated as a net result.

Vulnerability: In order to evaluate the potential adverse effects of fishing on EFH, the vulnerability of each species EFH was determined. This analysis defines vulnerability as the likelihood that the functional value of EFH would be adversely affected as a result of fishing with different gear types. A number of criteria were considered in the evaluation of the vulnerability of EFH for each life stage including factors like the function of habitat for shelter, food and/or reproduction.

Yield-per-recruit (YPR): the expected yield (weight) of individual fish calculated for a given fishing mortality rate and exploitation pattern and incorporating the growth characteristics and natural mortality.

Yearclass: also called cohort. Fish that were spawned in the same year. By convention, the “birth date” is set to January 1st and a fish must experience a summer before turning 1. For example, winter flounder that were spawned in February-April 1997 are all part of the 1997 cohort (or year-class). They would be considered age 0 in 1997, age 1 in 1998, etc. A summer flounder spawned in October 1997 would have its birth date set to the following January 1 and would be considered age 0 in 1998, age 1 in 1999, etc.

Z: instantaneous rate of total mortality. The components of Z are additive (i.e., Z = F+M)

Zooplankton: See Phytoplankton. Small, often microscopic animals that drift in currents. They feed on detritus, phytoplankton, and other zooplankton. They are preyed upon by fish, shellfish, whales, and other zooplankton.

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