Framework Adjustment 53
To the Northeast Multispecies FMP

Prepared by the
New England Fishery Management Council
In consultation with the
Mid-Atlantic Fishery Management Council
National Marine Fisheries Service

Initial Framework Meeting: June 18, 2014
Final Framework Meeting: November 18-19, 2014
Date Submitted: February 20, 2015

February 20, 2015

Intentionally Blank

1.0 Executive Summary

In New England, the New England Fishery Management Council (NEFMC) is charged with developing management plans that meet the requirements of the Magnuson-Stevens Act (M-S Act). 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, Atlantic wolffish, and ocean pout) off the New England and Mid-Atlantic coasts. The FMPs have been updated through a series of amendments and framework adjustments. Amendment 16, which became effective on May 1, 2010, was the most recent amendment to adopt a broad suite of management measures in order to achieve the fishing mortality targets necessary to rebuild overfished stocks and meet other requirements of the M-S Act. Amendment 17 is the most recent amendment but addresses state-operated permit banks. Eight framework adjustments have updated the measures in Amendment 16.

Amendment 16 made major changes to the FMP. The Amendment adopted a system of Annual Catch Limits (ACLs) and Accountability Measure (AMs) that are designed to ensure catches remain below desired targets for each stock in the management complex. The National Standard Guidelines provide advisory guidance (that does not have the effect or force of law) for the implementation of these requirements (50CFR 600.310(g)). AMs are management controls to prevent ACLs from being exceeded and to correct or mitigate overages of the ACL if they occur. AMs should address and minimize both the frequency and magnitude of overages and correct the problems that caused the overages in as short a time as possible. AMs can be either in season AMs or AMs for when the ACL is exceeded.

NMFS acknowledged in the publication of the guidelines that there is no requirement that AMs and ACLs be implemented as hard TACs or quotas, but conservation and management measures must be implemented so that the ACL is not exceeded and AMs must apply if the ACL is exceeded (74 FR 3184). While many measures in the management program are intended to control fishing mortality and might be interpreted to be AMs since they are "management controls to prevent the ACL from being exceeded," the term AM is usually applied to specific, automatic measures that are implemented either as an ACL is approached or after an ACL is exceeded.

Framework 53 (FW53) is intended to incorporate status changes for groundfish stocks, set specifications for several groundfish stocks, and adjust management measures for commercial and recreational fisheries that catch groundfish stocks. This framework incorporates the results of new stock assessments into the setting of specifications, including catch limits for the U.S./Canada Resource Sharing Understanding and the distribution of ACLs to various components of the fishery. FW 53 would also establish additional management measures designed to protect Gulf of Maine (GOM) cod while allowing commercial and recreational fisheries to prosecute healthy stocks in the multispecies fishery.

The *need* for this action is to prevent overfishing, ensure rebuilding, and help achieve optimum yield in the fishery consistent with the status of stocks and the requirements of MSA of 2006, and to reduce mortality on aggregations of GOM cod and provide spawning protection for GOM cod given current stock status. There are several *purposes* of FW53: to update changes to the status determination criteria, to adopt specifications, to adopt U.S./ Canada Total Allowable Catches (TACs), to establish management measures for GOM cod that revise rolling closures and possession limits to enable GOM cod protection while providing opportunity for the groundfish fishery to prosecute healthy stocks in other times and areas, to address instances when the fishing year may begin without specifications in place for some stocks, and to revise regulations governing Sector Annual Catch Entitlement (ACE) carryover.

Proposed Action

Under the provision of the M-S Act, the Council submits proposed management actions to the Secretary of Commerce for review. The Secretary of Commerce can approve, disapprove, or partially approve the action proposed by the Council. In the following alternative descriptions, measures identified as Preferred Alternatives constitute the Council's preferred management action.

If the Preferred Alternatives identified in this document are adopted, this action would implement a range of measures summarized in Section 4.0.

The Preferred Alternatives include:

- *Stock Status Changes and Annual Catch Limits*
    - *Revised status determination criteria for groundfish stocks.* The preferred alternative would adopt an empirical approach for Georges Bank (GB) yellowtail flounder based on resource survey catches as the basis of catch advice, and update numerical estimates for other stocks for informational purposes. Because a stock assessment model is lacking for this stock, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated.
    - *Revised Annual Catch Limit Specifications.* The preferred alternative would adopt new Overfishing Limits (OFLs), Acceptable Biological Catches (ABCs), and ACLs for pollock, GOM winter flounder, GB winter flounder, GB yellowtail flounder, GOM haddock, and GOM cod. Additionally, US/Canada TACs would be specified for GB yellowtail flounder, Eastern GB (EGB) cod and Eastern GB (EGB) haddock. This alternative would also distribute the ABCs to the various components of the fishery. ACLs for state waters and other sub-components would be modified to reflect recent catches.
- *Commercial and Recreational Fishery Measures.*
    - *GOM Cod Management Measures.* The preferred GOM cod spawning area closure is No Action and would maintain the existing GOM cod spawning closure commonly referred to as "Whaleback" for the commercial and recreational fisheries. The preferred alternative for zero possession of GOM cod if applied to both the commercial and recreational fishery is No Action. However, the Council's preferred alternative for GOM cod protection measures would prohibit the possession of GOM cod for recreational anglers, and modify the suite of existing rolling closures in the GOM for sector and common pool vessels in the commercial fishery. The intent of this measure is to increase protection for GOM cod in winter months by adding the winter closures, and to create more economic opportunities for the commercial fishery in the spring by opening up the April closure.
    - *Default Groundfish Specifications.* The preferred alternative would set catch limits for groundfish stocks at 35% of the prior fishing year's ACL. In the event that the default rollover ACL exceeds the value of the ABC for the upcoming fishing year, then the default rollover would be set equal to the ABC for the upcoming fishing year. Default specifications would be used in the absence of specifications at the start of the fishing year due to a delay in rulemaking, and would be replaced with updated specifications upon rulemaking. Default groundfish specifications would be temporary, and expire on August 1st of the year they would be implemented.

- *Modification to Sector ACE Carryover.* The preferred alternative would modify Amendment 16 carryover provisions. Groundfish sectors would be able to carry forward up to 10% of unused ACE provided that the total unused sector ACE carried forward for all sectors from the previous FY plus the total ACL does not exceed the ABC for the fishing year in which the carryover would be harvested (e.g., from FY 2014 to FY 2015).

Summary of Environmental Consequences

The environmental impacts of all of the alternatives under consideration are described in Section 7.0. Biological impacts are described in Section 7.1; impacts on essential fish habitat are described in Section 7.2; impacts on endangered and other protected species are described in Section 7.3; the economic impacts are described in Section 7.4; and the social impacts are described in Section 7.5. Cumulative effects are described in Section 7.6. Summaries of the most significant impacts are provided in the following paragraphs. As required by NEPA, the Preferred Alternatives are compared to the No Action alternative and other alternatives. Throughout the document, more informative comparisons are also made between the Preferred Alternatives and status quo to enable a more realistic analysis of potential impacts, as appropriate.

Biological Impacts
The Preferred Alternatives are designed to achieve the rebuilding objectives for the Northeast Multispecies (groundfish) fishery. The most important biological impact of the Preferred Alternatives is that they would control fishing mortality on Northeast Multispecies stocks in order to prevent (or end) overfishing and rebuild overfished stocks. In particular, the GOM cod ABC would be significantly revised downward to reflect poor stock condition. The preferred GOM cod protection measures would have mixed (positive, neutral, and negative) biological impacts on the resource, due to increased spawning protection in the winter and loss of some protection in the spring for cod and other groundfish stocks. Mortality changes may be a tradeoff with the closure of one area and the opening of another or protection of cod from a closure may result in a shift in effort into areas that have relatively high cod concentrations. Default specifications and modification to sector ACE carryover are expected to have a low negative to neutral impact when compared to the No Action.

Essential Fish Habitat (EFH) Impacts
The Preferred Alternatives are expected to result in a slight negative increase in habitat impacts when compared to the No Action alternative, but a slight decrease in negative impacts when compared to recent fishing activity. The reduction in expected fishing effort is driven by two factors: the constraining nature of the ACL specifications for key stocks, and the reconfiguration of existing GOM rolling closures as GOM cod protection closures. The development of default specifications would be expected to have a negative impact when compared to the No Action alternative would not provide specifications for several stocks in FY2015, and fishing effort would be dramatically curtailed .When compared with recent fishing activity, the preferred alternatives would be expected to have a neutral impact on EFH. The preferred alternative for sector ACE carryover would be expected to reduce effort and negative EFH impacts relative to the No Action.

Impacts on Endangered and Other Protected Species
When compared to recent fishing activity, the preferred alternatives would likely lead to negligible to low negative impacts on protected species. The ACL specifications of the preferred alternative are not expected to result in an increase in fishing effort or shifts in fishing effort to areas that have not been considered by NMFS in its assessment of fishery effects to protected resources. The GOM cod protection areas are not expected to result in an increased number of interactions with protected species, and would

be expected to have a low negative impact on protected species when compared to the existing GOM rolling closures for the commercial fishery (No Action).

Economic Impacts
The Preferred Alternatives would likely result in an increase in groundfish fishing vessel revenues when compared to No Action for ACLs. This is not informative, however, since No Action would not adopt specifications for several stocks and the majority of groundfish fishing activity would be curtailed. The preferred alternatives would be expected to result in $76.9 million in gross groundfish revenues for FY2015. This represents approximately a $5 million dollar reduction in predicted groundfish revenue for FY2014. The economic impacts of the preferred alternatives are not expected to be uniformly distributed, such that smaller inshore vessels would be most affected. The preferred alternatives for the GOM cod protection measures would lead to low positive economic impacts for the commercial fishery and low negative impacts when compared to the existing rolling closures for the commercial fishery and bag limit for the recreational fishery. Impacts of this preferred alternative on the commercial fishery are expected to be most severe in GOM ports north of Boston, and for smaller vessels with a limited range. Impacts of the preferred alternative for default specifications are expected to be positive relative to the No Action.

Social Impacts
The social impacts of the Preferred Alternatives for annual catch limit specifications would be positive relative to the No Action, but largely negative relative to the fishery compared to FY2014. The GOM cod protection measures would be expected to be low positive for the commercial fishery and negative for the recreational fishery relative to No Action. The impacts of default specifications are expected to be positive relative to the No Action. Impacts related to modify Sector ACE carryover are also expected to be positive.

Alternatives to the Proposed Action

There are a number of alternatives analyzed in the document that are not identified as preferred alternatives. These include some of the No Action alternatives in sections 4.1 (Updates to Status Criteria, Formal Rebuilding Programs and Annual Catch Limits) and 4.2 (Commercial and Recreational Fishery Measures), as well as alternatives for GOM cod spawning protection areas and zero possession of GOM cod, which were not identified as preferred alternatives. These alternatives are briefly described below.

- *Stock Status Changes and Annual Catch Limits*
    - *Revised status determination criteria for groundfish stocks.* The No Action would not update the status determination criteria (SDC) or the numerical estimates for the SDC. Using the old criteria would not be consistent with recently completed assessments and would not comply with M-S Act requirements to use best available science.
    - *Revised Annual Catch Limit Specifications.* The No Action would not adopt new specifications for several stocks, including GOM winter flounder, GB winter flounder, GB yellowtail flounder, and pollock. Without specification of an ACL, a catch would not be allocated to the groundfish fishery and targeted groundfish fishing would not occur for these stocks. In addition, FY 2015 quotas would not be specified for GB yellowtail flounder, EGB cod, EGB haddock, which are managed through the U.S./Canada Resource Sharing Understanding.
- *Commercial and Recreational Fishery Measures.*
    - *GOM Cod Management Measures.* The GOM cod management measures include GOM cod spawning closures areas, zero possession of GOM cod by commercial and

recreational fishermen, and GOM cod protection measures. The GOM cod spawning closure areas would close areas of the western GOM to all commercial and recreational groundfish fishing in times and areas when spawning of GOM cod is known to occur. The prohibition on the possession of GOM cod would apply to all commercial and recreational fishermen. The No Action alternative for GOM cod protection measures would retain the existing GOM rolling closures for sector and common pool vessels, and allow recreational anglers to retain GOM cod.

- *Default Groundfish Specifications.* No Action would not develop default rollover specifications, and therefore in the event of a delay in rulemaking, there would be no fishing for stocks without specifications in place on May 1, nor any fishing for other groundfish stocks that share the same Broad Stock Area (BSA) as stocks with no specifications.
- *Modification to Sector ACE Carryover.* No Action alternative would continue to allow groundfish sectors to carry over up to 10% of their unused sector ACE, as outlined in Amendment 16 to the Northeast multispecies FMP. The No Action would be inconsistent with a ruling from the U.S. District Court for the District of Columbia that invalidated and vacated carryover provisions included in the in Framework Adjustment 50 rulemaking.

Impacts of Alternatives to the Proposed Action

In many cases, the No Action alternative would not address the goals of the M-S Act. Only the most significant impacts are highlighted below.

Biological Impacts
Because the No Action alternatives would not adopt specifications for several stocks, and would not modify the SDC based on best available science, it would lead to a drastic reduction in groundfish fishing activity. This option would be expected to result in reduced fishing mortality rates and faster stock rebuilding than the Preferred Alternatives.

Essential Fish Habitat
Because the No Action alternatives would not adopt specifications for several stocks, and would not modify the status determination criteria based on best available science, it would lead to a drastic reduction in groundfish fishing activity. This option would be expected to result in reduced habitat impacts when compared to the Preferred Alternatives.

Impacts on Endangered and Other Protected Species
Because the No Action alternatives would not adopt specifications for several stocks, and would not modify the status determination criteria based on best available science, it would lead to a drastic reduction in groundfish fishing activity. This option would be expected to result in reduced fishing impacts on endangered and other protected species.

Economic Impacts
Because the No Action alternatives would not adopt specifications for several stocks, and would not modify the status determination criteria based on best available science, it would lead to a drastic reduction in groundfish fishing activity. As a result, fishing vessel revenues on groundfish fishing trips would decline dramatically when compared to the preferred alternative or recent fishing years.

Social Impacts
Because the No Action alternatives would not adopt specifications for several stocks, and would not modify the status determination criteria based on best available science, it would lead to a drastic reduction in groundfish fishing activity and reduced groundfish fishing revenues. Overall, this would likely lead to dramatic changes in the size and demographics of the groundfish fishery, dissatisfaction with the fishing industry and management, and a negative impact on fishermen's attitudes and beliefs.

Intentionally Blank

2.0 Contents

2.1 Table of Contents

1.0 EXECUTIVE SUMMARY **3**

2.0 CONTENTS **10**

2.1 TABLE OF CONTENTS **10**
2.2 LIST OF TABLES **15**
2.3 LIST OF FIGURES **18**
2.4 LIST OF APPENDICES **19**
2.5 LIST OF ACRONYMS **20**

3.0 INTRODUCTION AND BACKGROUND **24**

3.1 BACKGROUND **24**
3.2 PURPOSE AND NEED FOR THE ACTION **25**
3.3 BRIEF HISTORY OF THE NORTHEAST MULTISPECIES MANAGEMENT PLAN **27**
3.4 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) **28**
3.5 FISHERY DATA SOURCES **28**

4.0 ALTERNATIVES UNDER CONSIDERATION **29**

4.1 UPDATES TO STATUS DETERMINATION CRITERIA, FORMAL REBUILDING PROGRAMS AND ANNUAL CATCH LIMITS **29**
4.1.1 Revised Status Determination Criteria *29*
4.1.2 Annual Catch Limits *31*
4.2 COMMERCIAL AND RECREATIONAL FISHERY MEASURES **41**
4.2.1 GOM Cod Management Measures *41*
4.2.1.1 GOM Cod Spawning Area Closures 41
4.2.1.2 Prohibition on the Possession of GOM cod 47
4.2.1.3 GOM Cod Protection Measures 47
4.2.2 Default Groundfish Specifications *61*
4.2.3 Sector ACE Carryover *62*

5.0 ALTERNATIVES CONSIDERED AND REJECTED **64**

5.1 UPDATES TO STATUS DETERMINATION CRITERIA, FORMAL REBUILDING PROGRAMS, AND ANNUAL CATCH LIMITS **64**
5.1.1 ANNUAL CATCH LIMITS **64**
5.1.1.1 PROVISIONAL ANNUAL BIOLOGICAL CATCH FOR GOM COD **64**
5.2 COMMERCIAL AND RECREATIONAL FISHERY MEASURES **64**
5.2.1 SNE/MA Windowpane Flounder Sub-ACLs for Groundfish Sectors and the Common Pool *64*
5.2.2 GOM/GB Windowpane Flounder Sub-ACLs for Groundfish Sectors and the Common Pool *66*
5.2.3 GOM/GB Windowpane Flounder Scallop Fishery Sub-ACL *67*
5.2.4 Observer Requirements in the GOM *68*
5.2.5 Option 2: Additional GOM Cod Spawning Protection Measures (see Section 4.2.1) *71*

6.0 AFFECTED ENVIRONMENT **73**

6.1 PHYSICAL ENVIRONMENT/HABITAT/EFH **73**
6.1.1 Gulf of Maine *73*
6.1.2 Georges Bank *76*
6.1.3 Southern New England/Mid-Atlantic Bight *77*
6.1.4 Habitat requirements of groundfish (focus on demersal life stages) *78*
6.1.5 Essential Fish Habitat (EFH) Designations *82*
6.1.6 Gear Types and Interaction with Habitat *82*

6.1.6.1 Gear Types ... 83
6.1.6.1.1 Trawl Gear ... 83
6.1.6.1.2 Gillnet Gear ... 84
6.1.6.1.3 Fish Traps/Pots ... 85
6.1.6.1.4 Hook and Line Gear ... 85
6.1.6.1.4.1 Hand Lines/Rod and Reel ... 85
6.1.6.1.4.2 Mechanized Line Fishing ... 86
6.1.6.1.4.3 Bottom Longlines ... 86
6.1.6.2 Gear Interaction with Habitat ... 86
6.2 GROUNDFISH SPECIES ... 89
6.2.1 Species and Stock Status Descriptions ... 89
6.2.1.1 Gulf of Maine Cod ... 90
6.2.1.2 Georges Bank Cod ... 90
6.2.1.3 Gulf of Maine Haddock ... 91
6.2.1.4 Georges Bank Haddock ... 91
6.2.1.5 American Plaice ... 91
6.2.1.6 Witch Flounder ... 92
6.2.1.7 Gulf of Maine Winter Flounder ... 92
6.2.1.8 Georges Bank Winter Flounder ... 93
6.2.1.9 Cape Cod/Gulf of Maine Yellowtail Flounder ... 93
6.2.1.10 Georges Bank Yellowtail Flounder ... 93
6.2.1.11 Southern New England/Mid-Atlantic Yellowtail Flounder ... 93
6.2.1.12 Redfish ... 94
6.2.1.13 Pollock ... 94
6.2.1.14 White Hake ... 95
6.2.1.15 SNE/MA Winter Flounder ... 95
6.2.1.16 GOM/GB Windowpane Flounder ... 95
6.2.1.17 SNE/MAB Windowpane Flounder ... 96
6.2.1.18 Ocean Pout ... 96
6.2.1.19 Atlantic Halibut ... 97
6.2.1.20 Atlantic Wolffish ... 97
6.2.2 Assemblages of Fish Species ... 98
6.2.3 Stock Status Trends ... 100
6.2.4 Areas Closed to Fishing ... 101
6.2.5 Interaction between Gear and Allocated Target Species ... 101
6.3 NON-ALLOCATED TARGET SPECIES AND BYCATCH ... 102
6.3.1 Spiny Dogfish ... 102
6.3.2 Skates ... 102
6.3.3 Monkfish ... 103
6.3.4 Summer Flounder ... 104
6.3.5 American Lobster ... 104
6.3.6 Whiting (Silver Hake) ... 105
6.3.7 Longfin Squid ... 106
6.3.8 Atlantic Sea Scallops ... 106
6.3.9 Interaction between Gear and Non-allocated Target Species and Bycatch ... 107
6.4 PROTECTED RESOURCES ... 108
6.4.1 Species Present in the Area ... 108
6.4.2 Species and Critical Habitat Not Likely to be Affected by the Proposed Action ... 110
6.4.3 Species Potentially Affected by the Proposed Action ... 110
6.4.4 Interactions Between Gear and Protected Resources ... 126
6.5 HUMAN COMMUNITIES/SOCIAL-ECONOMIC ENVIRONMENT ... 147
6.5.2 Fleet Characteristics ... 153
6.5.3 Effort ... 155
6.5.4 Landings and Revenue ... 156
6.5.6 Fishing Communities ... 158

6.5.7 Employment ... 163
6.5.8 Consolidation and Redirection ... 164
6.5.9 Regulated Groundfish Stock Catch ... 165
6.5.10 Fishery Sub-Components ... 170
6.5.11 Relevant Analyses ... 180

7.0 ENVIRONMENTAL CONSEQUENCES – ANALYSIS OF IMPACTS ... 186

7.1 BIOLOGICAL IMPACTS ... 186
7.1.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits ... 187
7.1.1.1 Revised Status Determination Criteria ... 187
7.1.1.2 Annual Catch Limits ... 188
7.1.2 Commercial and Recreational Fishery Measures ... 199
7.1.2.1 GOM Cod Management Measures ... 199
7.1.2.1.1 GOM Cod Spawning Area Closures ... 199
7.1.2.1.2 Prohibition on the Possession of GOM cod ... 204
7.1.2.1.3 GOM Cod Protection Measures ... 205
7.1.2.2 Default Groundfish Specifications ... 212
7.1.2.3 Sector ACE Carryover ... 214
7.2 ESSENTIAL FISH HABITAT IMPACTS ... 216
7.2.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits ... 216
7.2.1.1 Revised Status Determination Criteria ... 216
7.2.1.2 Annual Catch Limits ... 217
7.2.2 Commercial and Recreational Fishery Measures ... 219
7.2.2.1 GOM Cod Management Measures ... 219
7.2.2.1.1 GOM Cod Spawning Area Closures ... 219
7.2.2.1.2 Prohibition on the Possession of GOM cod ... 220
7.2.2.1.3 GOM Cod Protection Measures ... 220
7.2.2.2 Default Groundfish Specifications ... 222
7.2.2.3 Sector ACE Carryover ... 222
7.3 IMPACTS ON ENDANGERED AND OTHER PROTECTED SPECIES ... 223
7.3.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits ... 223
7.3.1.1 Revised Status Determination Criteria ... 223
7.3.1.2 Annual Catch Limits ... 223
7.3.2 Commercial and Recreational Fishery Measures ... 226
7.3.2.1 GOM Cod Management Measures ... 226
7.3.2.1.1 GOM Cod Spawning Area Closures ... 226
7.3.2.1.2 Prohibition on the Possession of GOM cod ... 229
7.3.2.1.3 GOM Cod Protection Measures ... 229
7.3.2.2 Default Groundfish Specifications ... 231
7.3.2.3 Sector ACE Carryover ... 232
7.4 ECONOMIC IMPACTS ... 234
7.4.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits ... 257
7.4.1.1 Revised Status Determination Criteria ... 257
Annual Catch Limits ... 257
7.4.1.2 ... 257
7.4.2 Commercial and Recreational Fishery Measures ... 263
7.4.2.1 GOM Cod Management Measures ... 263
7.4.2.1.1 GOM Cod Spawning Area Closures ... 263
7.4.2.1.2 Prohibition on the Possession of GOM Cod ... 267
7.4.2.1.3 GOM Cod Protection Measures ... 269
7.4.2.2 Default Groundfish Specifications ... 270
7.4.2.3 Sector ACE Carryover ... 271
7.5 SOCIAL IMPACTS ... 272
7.5.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits ... 273
7.5.1.1 Revised Status Determination Criteria ... 273
7.5.1.2 Annual Catch Limits ... 274

7.5.2 Commercial and Recreational Fishery Measures 279
7.5.2.1 GOM Cod Management Measures 279
7.5.2.1.1 GOM Cod Spawning Area Closures 280
7.5.2.1.2 Prohibition on the Possession of GOM Cod 282
7.5.2.1.3 GOM Cod Protection Measures 283
7.5.2.2 Default Groundfish Specifications 285
7.5.2.3 Sector ACE Carryover 287
7.6 CUMULATIVE EFFECTS ANALYSIS 288
7.6.1 Introduction 288
7.6.2 Past, Present and Reasonably Foreseeable Future Actions 291
7.6.3 Baseline Conditions for Resources and Human Communities 302
7.6.4 Summary Effects of Framework 53 Actions 305
7.6.5 Cumulative Effects Summary 307

8.0 APPLICABLE LAW 311

8.1 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT 311
8.1.1 Consistency with National Standards 311
8.1.2 Other M-SFCMA requirements 313
8.1.3 EFH Assessment 317
8.1.3.1 Description of Action 317
8.1.3.2 Assessing the Potential Adverse Impacts 317
8.1.3.3 Minimizing or Mitigating Adverse Impacts 318
8.1.3.4 Conclusions 318
8.2 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) 319
8.2.1 Environmental Assessment 319
8.2.2 Finding of No Significant Impact (FONSI) 319
8.2.3 List of Preparers; Point of Contact 325
8.2.4 Agencies Consulted 326
8.2.5 Opportunity for Public Comment 326
8.3 ENDANGERED SPECIES ACT 327
8.4 MARINE MAMMAL PROTECTION ACT 327
8.5 COASTAL ZONE MANAGEMENT ACT 328
8.6 ADMINISTRATIVE PROCEDURE ACT 328
8.7 DATA QUALITY ACT 328
8.7.1 Utility of Information Product 328
8.7.2 Integrity of Information Product 329
8.7.3 Objectivity of Information Product 329
8.8 EXECUTIVE ORDER 13132 (FEDERALISM) 330
8.9 EXECUTIVE ORDER 13158 (MARINE PROTECTED AREAS) 330
8.10 PAPERWORK REDUCTION ACT 331
8.11 REGULATORY IMPACT REVIEW 332
8.11.1 Executive Order 12866 332
8.11.1.1 Objectives 332
8.11.1.2 Description 333
8.11.1.3 Problem Statement 333
8.11.1.4 Analysis of Alternatives 333
8.11.1.5 Determination of Significance 343
8.11.2 Initial Regulatory Flexibility Act 344
8.11.2.1 Introduction 344
8.11.2.2 Description of reasons why action by the Agency is being considered 344
8.11.2.3 Statement of the objectives of, and legal basis for, the proposed rule 344
8.11.2.4 Description and estimate of the number of small entities to which the proposed rule will apply 344

8.11.2.5 Description of the projected reporting, record-keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records 352
8.11.2.6 Identification of all relevant Federal rules, which may duplicate, overlap or conflict with the proposed rule 353
8.11.2.7 Significance of economic impacts on small entities 353
8.11.2.8 Description of impacts on small entities 353

9.0 REFERENCES 356

9.1 GLOSSARY 356
9.2 LITERATURE CITED 370
9.3 INDEX 387

2.2 List of Tables

TABLE 1 - PURPOSE AND NEED FOR FRAMEWORK 53 26
TABLE 2 – NO ACTION STATUS DETERMINATION. 29
TABLE 3 - NO ACTION NUMERICAL ESTIMATES OF SDCS. 29
TABLE 4 - OPTION 2 STATUS DETERMINATION CRITERIA. 30
TABLE 5 - OPTION 2 NUMERICAL ESTIMATES OF SDCS (PROVIDED FOR INFORMATIONAL PURPOSES ONLY). 31
TABLE 6 - NO ACTION/OPTION 1 NORTHEAST MULTISPECIES OFLS, ABCS, ACLS, AND OTHER ACL SUB-COMPONENTS FOR FY2015 (METRIC TONS, LIVE WEIGHT). VALUES ARE ROUNDED TO THE NEAREST METRIC TON. 32
TABLE 7 - PROPOSED FY2015 U.S./CANADA TACS (MT). 35
TABLE 8 - COMPARISON OF THE PROPOSED FY 2015 U.S. TACS AND THE FY 2014 U.S. TACS (MT). 35
TABLE 9 - OPTION 2 NORTHEAST MULTISPECIES OFLS, ABCS, ACLS AND OTHER ACL SUB-COMPONENTS FOR FY 2015 – FY 2017 (METRIC TONS, LIVE WEIGHT). VALUES ARE ROUNDED TO THE NEAREST METRIC TON. SECTOR SHARES BASED ON 2014 PSCS. ONLY STOCKS THAT ARE UNDERLINED **ARE PROPOSED TO BE ADJUSTED. OTHER STOCKS ARE PROVIDED FOR INFORMATIONAL PURPOSES. GRAYED OUT VALUES WILL BE ADJUSTED AS A RESULT OF FUTURE RECOMMENDATIONS OF THE TMGC.** 37
TABLE 10 - OPTION 2 PRELIMINARY COMMON POOL INCIDENTAL CATCH TACS FOR SPECIAL MANAGEMENT PROGRAMS (METRIC TONS, LIVE WEIGHT). THESE VALUES MAY CHANGE AS A RESULT OF CHANGES IN SECTOR MEMBERSHIP. 40
TABLE 11 - FY 2015 CAI HOOK GEAR HADDOCK SAP TACS. 40
TABLE 12 – COMPARISON OF PROPOSED GOM COD PROTECTION CLOSURES (PREFERRED ALTERNATIVES) IN 4.2.1.3 FOR GROUNDFISH SECTORS AND THE COMMON POOL BY 30-MINUTE BLOCKS. 54
TABLE 13 - SNE/MA WINDOWPANE FLOUNDER CATCH (MT & %) BY SECTORS AND THE COMMON POOL. 65
TABLE 14: GOM/GB WINDOWPANE CATCH (MT & %) BY SECTORS AND THE COMMON POOL. 66
TABLE 15 - LIMITED ACCESS SCALLOP FISHERY DISCARDS OF GOM/GB WINDOWPANE FLOUNDER, 2001-2010. LANDINGS WERE LESS THAN 1 METRIC TON IN ALL YEARS. CATCH FROM TABLE I2 IN THE 2012 GF UPDATES PP. 571. LA SCALLOP DREDGE FROM TABLE I5 IN THE 2012 GF UPDATES PP. 573-574. GENERAL CATEGORY ESTIMATED CATCH WAS 4 MT, AN AVERAGE OF 2004-2011 DISCARDS, USING THE SAME METHOD AS THE IN THE 2012 GF UPDATES. 68
TABLE 16 – SUMMARY OF GEOGRAPHIC DISTRIBUTION, FOOD SOURCES, ESSENTIAL FISH HABITAT FEATURES AND COMMERCIAL GEAR USED TO CATCH EACH SPECIES IN THE NORTHEAST MULTISPECIES FISHERY MANAGEMENT UNIT. 80
TABLE 17 - DESCRIPTION OF THE GEAR TYPES USED BY THE MULTISPECIES FISHERY 83
TABLE 18 - COMPARISON OF DEMERSAL FISH ASSEMBLAGES OF GEORGES BANK AND THE GULF OF MAINE. 99
TABLE 19 - STATUS OF THE NORTHEAST GROUNDFISH STOCKS. 100
TABLE 20 – LANDINGS (MT) FOR NON-ALLOCATED TARGET SPECIES AND BYCATCH BY GEAR TYPE[A] 107
TABLE 21 - SPECIES PROTECTED UNDER THE ENDANGERED SPECIES ACT AND/OR MARINE MAMMAL PROTECTION ACT THAT MAY OCCUR IN THE OPERATION AREA FOR THE NORTHEAST MULTISPECIES FISHERY. 108
TABLE 22 - SEA TURTLE SPECIES FOUND IN THE AFFECTED ENVIRONMENT OF THE MULTISPECIES FISHERY. 111
TABLE 23 - LARGE WHALE SPECIES IN THE AFFECTED ENVIRONMENT OF THE MULTISPECIES FISHERY 113
TABLE 24 - LARGE CETACEAN OCCURRENCE IN THE GULF OF MAINE (GOM), GEORGES BANK (GB), SOUTHERN NEW ENGLAND (SNE), AND MID-ATLANTIC SUB-REGIONS OF THE MULTI-SPECIES FISHERIES[1] 114
TABLE 25 - SMALL CETACEAN SPECIES THAT OCCUR IN THE AFFECTED ENVIRONMENT OF THE MULTISPECIES FISHERY 117
TABLE 26 - SMALL CETACEAN OCCURRENCE IN THE GOM, GB, SNE, AND MID-ATLANTIC SUB-REGIONS OF THE MULTI-SPECIES FISHERIES[1] 118
TABLE 27 - PINNIPED SPECIES THAT OCCUR IN THE AFFECTED ENVIRONMENT OF THE MULTISPECIES FISHERY 121
TABLE 28 - PINNIPED OCCURRENCE IN THE GOM, GB, SNE, AND MID-ATLANTIC SUB-REGIONS OF THE MULTI-SPECIES FISHERIES 122
TABLE 29 - ATLANTIC STURGEON DPSS OCCURRING IN THE AFFECTED ENVIRONMENT OF THE MULTISPECIES FISHERY. 122
TABLE 30 - DESCRIPTIONS OF THE TIER 2 FISHERY CLASSIFICATION CATEGORIES (50 CFR 229.2) 127
TABLE 31 - SUMMARY OF CONFIRMED SERIOUS INJURY AND MORTALITY OF FIN, MINKE, HUMPBACK, SEI, AND NORTH ATLANTIC RIGHT WHALES FROM 1997-2011 DUE TO FISHERIES ENTANGLEMENTS. 129
TABLE 32 - SUMMARY OF GEAR MODIFICATION REQUIREMENTS AND RESTRICTIONS FOR THE NORTHEAST AND MID-ATLANTIC TRAP/POT AND GILLNET FISHERIES UNDER THE ATLANTIC LARGE WHALE TAKE REDUCTION PLAN. 131
TABLE 33 - NORTHEAST AND MID-ATLANTIC GILLNET OR TRAP/POT MANAGEMENT AREAS UNDER THE ATLANTIC LARGE WHALE TAKE REDUCTION PLAN 132

TABLE 34 - SMALL CETACEAN AND PINNIPED SPECIES OBSERVED SERIOUSLY INJURED AND/OR KILLED BY CATEGORY I, II, AND III FISHERIES IN THE AFFECTED ENVIRONMENT OF THE MULTISPECIES FISHERY. A (1) INDICATES THOSE SPECIES DRIVING THE FISHERIES CLASSIFICATION....134
TABLE 35 - MID-ATLANTIC TRAWL BYCATCH RATES (WARDEN 2011A).....144
TABLE 36 - SUMMARY OF MAJOR TRENDS IN THE NORTHEAST MULTISPECIES FISHERY....148
TABLE 37 - NUMBER OF VESSELS BY FISHING YEAR....154
TABLE 38 - VESSEL ACTIVITY BY SIZE CLASS....155
TABLE 39 - EFFORT BY ACTIVE VESSELS....156
TABLE 40 – TOTAL LANDINGS AND REVENUE FROM ALL TRIPS BY FISHING YEAR....157
TABLE 41 - TOTAL LANDINGS AND NOMINAL REVENUE FROM GROUNDFISH TRIPS BY FISHING YEAR....157
TABLE 42 - PRIMARY AND SECONDARY MULTISPECIES PORT COMMUNITIES....160
TABLE 43 - FY2013 LANDINGS (LBS.) OF SELECTED GROUNDFISH STOCKS BY HOMEPORTS....161
TABLE 44 - NUMBER OF VESSELS WITH REVENUE FROM ANY SPECIES (ALL TRIPS) BY HOMEPORT AND STATE....162
TABLE 45 - NUMBER OF VESSELS WITH REVENUE FROM AT LEAST ONE GROUNDFISH TRIP BY HOMEPORT AND STATE....162
TABLE 46 - NUMBER OF CREW POSITIONS AND CREW DAYS ON ACTIVE VESSELS BY HOMEPORT AND STATE....163
TABLE 47 – FY 2013 CATCHES OF REGULATED GROUNDFISH STOCKS (METRIC TONS, LIVE WEIGHT)....166
TABLE 48 – FY2013 CATCHES AS PERCENT OF ACL....167
TABLE 49 - FY2013 CATCHES BY NON-GROUNDFISH FMPS (METRIC TONS, LIVE WEIGHT)....168
TABLE 50 - COMMERCIAL GROUNDFISH SUB-ACL (SECTOR AND COMMON POOL), FY 2010 TO FY 2013:....171
TABLE 51 - ANNUAL CATCH ENTITLEMENT AND CATCH (LIVE LBS.)....172
TABLE 52 – COMMON POOL REVENUE AND LANDINGS FY 2010 – FY 2013....175
TABLE 53 - COMMON POOL PERMITS LANDING GROUNDFISH....176
TABLE 54 - COMMON POOL GROUNDFISH LANDINGS BY STATE OF TRIP (LANDED LBS.)....176
TABLE 55 - COMMON POOL GROUNDFISH LANDINGS BY PORT (LANDED LBS.)....176
TABLE 56 - COMMON POOL LANDINGS (LANDED LBS.) BY PERMIT CATEGORY AND STOCK....177
TABLE 57 - RECENT RECREATIONAL FISHING ACTIVITY FOR GOM COD AND GOM HADDOCK[1]....179
TABLE 58 – FOR-HIRE RECREATIONAL VESSELS CATCHING COD OR HADDOCK FROM THE GULF OF MAINE....179
TABLE 59 - COMPARISON OF RECENT ACLS (FY 2010 - FY 2014) AND PROPOSED ACLS FOR FY 2015 (OPTION 1/NO ACTION AND OPTION 2)....180
TABLE 60- FY 2010-2013 NORTHERN WINDOWPANE FLOUNDER CATCH....180
TABLE 61- OTHER SUB-COMPONENT CATCH DETAIL FOR NORTHERN WINDOWPANE FLOUNDER....181
TABLE 62 – DEFAULT SPECIFICATIONS COMPARISON OF FY 2014 AND FY 2015 (OPTION 2)....183
TABLE 63 - DEFAULT SPECIFICATIONS COMPARISON OF FY 2013 AND FY 2014....183
TABLE 64 – DEFAULT SPECIFICATIONS COMPARISON OF FY 2012 AND FY 2013....184
TABLE 65 – PRELIMINARY COMMERCIAL GROUNDFISH CATCH DATA AS A PERCENT OF THE STOCK-SPECIFIC ACLS AND TIME ELAPSED IN THE FISHING YEAR FOR FY 2012, FY 2013, AND FY 2014....185
TABLE 66 – DESCRIPTION OF VALUED ECOSYSTEM COMPONENTS ANALYZED IN ENVIRONMENTAL CONSEQUENCES....186
TABLE 67 - ESTIMATED CATCHES THAT MIGHT OCCUR IN FY2015-FY2017 UNDER OPTION 1/NO ACTION. "NO ACTION ASSUMED CATCH" USED IN THE STOCK PROJECTIONS.....189
TABLE 68- ESTIMATED PROBABILITY OF OVERFISHING IF CATCH IS EQUAL TO ABC.....198
TABLE 69 – COMPARISON BETWEEN 2014 AND PROPOSED NO ACTION 2015 TOTAL ACLS FOR GROUNDFISH STOCKS. ONLY THOSE STOCKS BEING UPDATED VIA THIS FRAMEWORK ARE LISTED.....217
TABLE 70 – COMPARISON OF 2014 AND PROPOSED 2015 TOTAL ACLS FOR GROUNDFISH STOCKS. ONLY THOSE STOCKS BEING UPDATED VIA THIS FRAMEWORK ARE LISTED.....218
TABLE 71 - QCM PREDICTIONS, FY2011 – 2014 (2014 $ MILLIONS)....237
TABLE 72 - SUMMARY OF MEDIAN PREDICTED GROSS REVENUES FOR SEVEN MODELS ($M, MEDIAN VALUES WITH 5TH AND 95TH PERCENTILE CONFIDENCE INTERVALS FROM 500 SIMULATIONS)....242
TABLE 73 - FY 2014 BASELINE, PREDICTED CATCH, UTILIZATION AND REVENUES ($M)....243
TABLE 74 - FW 53 SUB-ACLS (NO CLOSURES), PREDICTED STOCK LEVEL CATCH, UTILIZATION AND REVENUES ($M)....244
TABLE 75 - FW 53 SUB-ACLS WITH CLOSURE A, PREDICTED STOCK LEVEL CATCH, UTILIZATION AND REVENUES ($M)....245
TABLE 76 - FW 53 SUB-ACLS WITH CLOSURE B, PREDICTED STOCK LEVEL CATCH, UTILIZATION AND REVENUES ($M)....246
TABLE 77 - FW 53 SUB-ACLS WITH ZERO GOM COD RETENTION, PREDICTED CATCH, UTILIZATION AND REVENUES ($M)....247

TABLE 78 - FW 53 SUB-ACLS WITH ZERO GOM COD RETENTION AND CLOSURE A, PREDICTED CATCH, UTILIZATION AND REVENUES ($M) 248
TABLE 79 - FW 53 SUB-ACLS WITH ZERO GOM COD RETENTION AND CLOSURE B, PREDICTED CATCH, UTILIZATION AND REVENUES ($M) 249
TABLE 80 - FW 53 SUB-ACLS WITH GOM COD PROTECTION MEASURES, PREDICTED CATCH, UTILIZATION AND REVENUES ($M) 250
TABLE 81 - DISCARDS OF GOM COD IN FY 2014 AND UNDER THE FW 53 ALTERNATIVES FOR FY 2015 251
TABLE 82 - HOMEPORT STATE AND PORT PREDICTED GROSS GROUNDFISH REVENUES ($M, MEDIAN VALUES WITH 5TH AND 95TH PERCENTILE CONFIDENCE INTERVALS, 500 SIMULATIONS) 252
TABLE 83 - HOMEPORT STATE AND PORT LEVEL PREDICTED PERCENT CHANGE IN GROSS REVENUES FROM GROUNDFISH, RELATIVE TO FY 2014 BASELINE 253
TABLE 84 - VESSEL SIZE CLASS PREDICTED GROSS GROUNDFISH REVENUES ($M, MEDIAN VALUES WITH 5TH AND 95TH PERCENTILE CONFIDENCE INTERVALS FROM 500 SIMULATIONS) 254
TABLE 85 - VESSEL SIZE CLASS PREDICTED PERCENT CHANGE IN GROSS REVENUES FROM GROUNDFISH, RELATIVE TO FY 2014 BASELINE.254
TABLE 86 - MEDIAN NOMINAL GROSS REVENUES PER POUND OF GOM COD ACE FOR ALL TRIPS BY VESSELS IN FOUR SIZE CLASSES 255
TABLE 87 - SECTOR-LEVEL ALLOCATIONS OF GOM COD AT AN ABC OF 386MT 256
TABLE 88- GOM AND GB HADDOCK CATCH BY MIDWATER TRAWL VESSELS SUBJECT TO HADDOCK CATCH CAPS (FY2011-2014 YTD) 261
TABLE 89 - IMPACT DEFINITIONS FOR CUMULATIVE EFFECTS ANALYSES. 290
TABLE 90- SUMMARY OF EFFECTS ON VECS FROM PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE FMP AND OTHER FISHERY RELATED ACTIONS. 291
TABLE 91- SUMMARY EFFECTS OF PAST, PRESENT AND REASONABLY FORESEEABLE FUTURE ACTIONS ON THE VECS IDENTIFIED FOR FRAMEWORK 53. 301
TABLE 92- CUMULATIVE EFFECTS ASSESSMENT BASELINE CONDITIONS OF THE VECS. 303
TABLE 93- SUMMARY OF IMPACTS EXPECTED ON THE VECS. 306
TABLE 94- SUMMARY OF POSSIBLE EFFECTS TO EFH AS A RESULT OF THE PREFERRED ALTERNATIVE 318
TABLE 95 – ENTITIES REGULATED BY THE PROPOSED ACTION. 346
TABLE 96 – DESCRIPTION OF REGULATED ENTITIES BY GROSS SALES. 346
TABLE 97 – DESCRIPTION OF IMPACTED REGULATED GROUNDFISH FISHING ENTITIES BY BUSINESS TYPE* AND SIZE. 348
TABLE 98 - DESCRIPTION OF IMPACTED REGULATED COMMERCIAL GROUNDFISH FISHING ENTITIES BY GROSS SALES. 348
TABLE 99- DESCRIPTION OF GROUNDFISH-DEPENDENT IMPACTED REGULATED COMMERCIAL GROUNDFISH ENTITIES BY GROSS SALES. 349
TABLE 100 - PARTY/CHARTER FISHING TRIPS AND PARTICIPATING VESSELS, 2010-2014. 349
TABLE 101 – DESCRIPTION OF IMPACTED REGULATED SCALLOP FISHING ENTITIES BY BUSINESS TYPE AND SIZE. 350
TABLE 102 – DESCRIPTION OF IMPACTED REGULATED SCALLOP FISHING ENTITIES BY GROSS SALES. 350
TABLE 103 – DESCRIPTION OF IMPACTED REGULATED SMALL-MESH MULTISPECIES FISHING ENTITIES BY BUSINESS TYPE AND SIZE. 351
TABLE 104 – DESCRIPTION OF IMPACTED REGULATED SMALL-MESH MULTISPECIES FISHING ENTITIES BY GROSS SALES. 351
TABLE 105 - DESCRIPTION OF IMPACTED REGULATED ACTIVE SMALL-MESH MULTISPECIES FISHING ENTITIES BY BUSINESS TYPE AND SIZE.351
TABLE 106 – DESCRIPTION OF IMPACTED REGULATED ACTIVE SMALL MESH MULTISPECIES FISHING ENTITIES BY GROSS SALES. 352
TABLE 107 – DESCRIPTION OF IMPACTED REGULATED HERRING FISHING ENTITIES BY BUSINESS TYPE AND SIZE. 352
TABLE 108 – DESCRIPTION OF IMPACTED HERRING FISHING ENTITIES BY GROSS SALES. 352

2.3 List of Figures

Figure 1 - Existing GOM Cod Spawning Closure Area (Whaleback) is shown in dark gray located within Block 133. 42
Figure 2 - Sub-Option A proposed GOM cod spawning closure areas in May (top left), June (top right), November-January (bottom left), April (bottom right). 44
Figure 3 - Sub-Option B proposed GOM cod spawning closure areas in May (top left), June (top right), November-January (bottom left), April (bottom right). 46
Figure 4 – Existing GOM Common Pool and Sector Rolling Closures by Month, in order of the Fishing Year. 49
Figure 5 - Proposed GOM Cod Protection Closures in May (Upper Left), June (Upper Right), and November – January (Lower Right). Common Pool rolling closures in October (Lower Left), March (following page, Upper Left), and April as modified (following page, Upper Right). 52
Figure 6 – Charts Comparing existing Common Pool and Sector Rolling Closures (left) with proposed GOM cod protection closures in 4.2.1.3 (right). 55
Figure 7 - Map of Broad Stock Reporting Areas, highlighting the 70° 15' W longitude. 70
Figure 8 - Sub-Option C proposed GOM cod spawning closure areas in May (top left), June (top right), November-January (bottom left), April (bottom right). 72
Figure 9 – Northeast U.S. Shelf Ecosystem. 73
Figure 10 – Gulf of Maine. 74
Figure 11 - Broad stock areas as defined in Amendment 16. 89
Figure 12 - Northeast Multispecies Closed Areas and U.S./Canada 101
Figure 13 - Estimated Range of Atlantic Sturgeon Distinct Population Segments (DPSs) 123
Figure 14 - Capture locations and DPS of origin assignments for Observer Program specimens (n=173). 125
Figure 15. Geographic range of the Gulf of Maine DPS of Atlantic salmon. 126
Figure 16 - Summary of Trap/Pot Management Area under the Atlantic Large Whale Take Reduction Plan. 132
Figure 17 - Summary of Gillnet Management Areas under the Atlantic Large Whale Take Reduction Plan. 133
Figure 18 - 2007-2011 total mean annual mortality of small cetaceans and pinnipeds by Category I and II Fisheries. ...137
Figure 19 - Map of marine mammal bycatch in gillnet gear in the New England region (excluding large whales) observed by traditional fishery observers and at sea monitors between 2007 and 2011. 138
Figure 20 - Map of marine mammal bycatch in trawl gear in the New England region (excluding large whales) observed by traditional fishery observers and at sea monitors between 2007 and 2011. 139
Figure 21. HPTRP Management Areas for New England 140
Figure 22. HPTRP-Waters off New Jersey Management Area. 141
Figure 23 - HPTRP-Southern Mid-Atlantic Management Area 142
Figure 24 - Annual percentage of Gulf of Maine cod landings by ten minutes square, CY 2010-2014 182
Figure 25- Projected GOM cod stock size under Option 1/No Action, using M=0.2 model 191
Figure 26- Projected GOM cod stock size under Option 1/No Action, using M-ramp/M=0.2 model. 191
Figure 27- Projected GOM cod stock size under Option 1/No Action, using M-ramp/M=0.4. 192
Figure 28- Projected GOM haddock stock size under Option 1/No Action. 192
Figure 29- Projected GB winter flounder stock size under Option 1/No Action. 193
Figure 30- Projected pollock stock size under Option 1/No Action. 193
Figure 31- Projected GOM cod stock size under Option 2, using M=0.2 model 195
Figure 32- Projected GOM cod stock size under Option 2, using M-ramp/M=0.2 model. 196
Figure 33- Projected GOM cod stock size under Option 2, using M-ramp/M=0.4. 196
Figure 34- Projected GOM haddock stock size under Option 2. 197
Figure 35- Projected GB winter flounder stock size under Option 2. 197
Figure 36- Projected pollock stock size under Option 2. 198
Figure 37 - Average nominal gross revenues generated per pound of GOM cod ACE for fishing trips by vessels in four size classes, FY 2010-2013 255
Figure 38 - Average nominal gross revenues generated per pound of GOM cod ACE for fishing trips by longitude, FY 2010-2013 256

2.4 List of Appendices

Appendix I: SSC Recommendations for Northeast Multispecies ABCs, FY 2015 – FY 2017
Appendix II: Analytic Techniques: Gulf of Maine Cod and Other Groundfish Analysis
Appendix III: Calculation of Northeast Multispecies Annual Catch Limits, FY 2015- FY 2017
Appendix IV: ABC Projection Output

2.5 List of Acronyms

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
CATT	Closed Area Technical Team- a team established by the Council to look at spatial based management on spawning fish
CAI	Closed Area I
CAII	Closed Area II
CC	Cape Cod
CEQ	Council on Environmental Quality
CPUE	Catch per unit of effort
CZMA	Coastal Zone Management Act
DAH	Domestic Annual Harvest
DAM	Dynamic Area Management
DAP	Domestic Annual Processing
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
ECPA	East Coast Pelagic Association
ECTA	East Coast Tuna Association
EEZ	Exclusive economic zone
EFH	Essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ETA	Elephant Trunk Area
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
IWP	Internal Waters Processing
JVP	Joint Venture Processing
LISA	Local Indicator of Spatial Association
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
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 Introduction and Background

3.1 Background

The primary statute governing the management of fishery resources in the Exclusive Economic Zone (EEZ) of the United States is the Magnuson-Stevens Fishery Conservation and Management Act (M-S Act). In brief, the purposes of the M-S Act are:

(1) To take immediate action to conserve and manage the fishery resources found off the coasts of the United States;

(2) To support and encourage the implementation and enforcement of international fishery agreements for the conservation and management of highly migratory species;

(3) To promote domestic and recreational fishing under sound conservation and management principles;

(4) To provide for the preparation and implementation, in accordance with national standards, of fishery management plans which will achieve and maintain, on a continuing basis, the optimum yield from each fishery;

(5) To establish Regional Fishery Management Councils to exercise sound judgment in the stewardship of fishery resources through the preparation, monitoring, and revisions of such plans under circumstances which enable public participation and which take into account the social and economic needs of the States.

In New England, the New England Fishery Management Council (NEFMC) is charged with developing management plans that meet the requirements of the M-S Act.

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, yellowtail flounder, 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 FMP has been updated through a series of amendments and framework adjustments.

Amendment 16, which became effective on May 1, 2010, was the most recent amendment to adopt a broad suite of management measures in order to achieve the fishing mortality targets necessary to rebuild overfished stocks and meet other requirements of the M-S Act. In 2011, the NEFMC also approved Amendment 17, which allowed for NOAA-sponsored state-operated permit banks to function within the structure of Amendment 16. Amendment 16 greatly expanded the sector management program and adopted a process for setting Annual Catch Limits that requires catch levels to be set in biennial specifications packages. Eight framework adjustments have updated the measures in Amendment 16.

Amendment 16 made major changes to the FMP. The Amendment adopted a system of Annual Catch Limits (ACLs) and Accountability Measure (AMs) that are designed to ensure catches remain below desired targets for each stock in the management complex. The National Standard Guidelines provide advisory guidance (that does not have the effect or force of law) for the implementation of these requirements (50CFR 600.310(g)). AMs are management controls to prevent ACLs from being exceeded and to correct or mitigate overages of the ACL if they occur. AMs should address and minimize both the frequency and magnitude of overages and correct the problems that caused the overages in as short a time as possible. AMs can be either in season AMs or AMs for when the ACL is exceeded.

NMFS acknowledged in the publication of the guidelines that there is no requirement that AMs and ACLs be implemented as hard TACs or quotas, but conservation and management measures must be implemented so that the ACL is not exceeded and AMs must apply if the ACL is exceeded (74 FR 3184). While many measures in the management program are intended to control fishing mortality and might be interpreted to be AMs since they are "management controls to prevent the ACL from being exceeded," the term AM is usually applied to specific, automatic measures that are implemented either as an ACL is approached or after an ACL is exceeded.

This framework (Framework Adjustment 53, FW53) is intended to incorporate any status changes for groundfish stocks, set specifications for several groundfish stocks, and adjust management measures for commercial and recreational fisheries that catch groundfish stocks.

3.2 Purpose and Need for the Action

Periodic frameworks are used to adjust strategies in response to the evaluations that adjust rebuilding plans and overfishing. This framework (FW53) is-intended to incorporate any status changes for groundfish stocks, set specifications for several groundfish stocks, and adjust management measures for commercial and recreational fisheries that catch groundfish stocks. The *need* for this action is to to meet regulatory requirements and adjust management measures that are necessary to prevent overfishing, ensure rebuilding, and help achieve optimum yield in the fishery consistent with the status of stocks and the requirements of MSA of 2006, and to revise cod protection areas and rolling closures in the GOMreduce mortality on aggregations of GOM cod and provide spawning protection for GOM cod given current stock status,. There are several *purposes* of FW53: to update changes to the status determination criteria, to adopt specifications, to adopt U.S./ Canada Total Allowable Catches (TACs), to establish management measures for GOM cod that reduce fishing mortalityrevise cod protection areas and rolling closures and possession limits to enable GOM cod protection while providing opportunity for the groundfish fishery to prosecute healthy stocks in other times and areas, to address instances when the fishing year may begin without specifications in place for some stocks, and to revise regulations governing Sector Annual Catch Entitlement (ACE) carryover.

The measures analyzed in this EA are intended to meet the goals and many of the objectives of the Northeast Multispecies FMP, as modified in Amendment 16.

To better demonstrate the link between the purpose and need for this action, Table 1 summarizes the need for the action and corresponding purposes.

Table 1 - Purpose and Need for Framework 53

Need for Framework 53	***Corresponding Purpose for Framework 53***
Ensure that stock are managed consistent with the status of stocks, the National Standard guidelines, and the requirements of the MSA	• Measures to update status determination criteria
Ensure that levels of catch for Fishing Years 2015-2017 are consistent with best available science, the ABC control rules adopted in Amendment 16 to the Northeast Multispecies FMP, the International Fisheries Agreement Clarification Act, and the most recent relevant law	• Measures to adopt ACLs, including relevant sub-ACLs and incidental catch TACs • Measures to adopt TACs for U.S./Canada area
Ensure that overfishing does not occur consistent with the status of stocks, and the requirements of MSA of 2006 Enhance mortality and spawning protection for GOM cod given the poor status of the stock Minimize the economic impact of current rolling closures by providing access to healthy groundfish stocks	• Measures to establish GOM cod protection • Measures to establish default groundfish specificaions • Measures to revise sector ACE carryover provisions

3.3 Brief History of the Northeast Multispecies Management Plan

Groundfish stocks were managed under the M-S Act beginning with the adoption of a groundfish plan for cod, haddock, and yellowtail flounder in 1977. This plan relied on hard quotas (total allowable catches, or TACs), and proved unworkable. The quota system was terminated in 1982 with the adoption of the Interim Groundfish Plan, which used minimum fish sizes and codend mesh regulations for the Gulf of Maine and Georges Bank to control fishing mortality. The interim plan was replaced by the Northeast Multispecies FMP in 1986, which established biological targets in terms of maximum spawning potential and continued to rely on gear restrictions and minimum mesh size to control fishing mortality. A detailed discussion of the history of the FMP up to 1993 can be found in Amendment 5 (NEFMC 1993).

Amendment 5 was a major revision to the FMP. Adopted in 1994, it implemented a limited access program, reductions in time fished (days-at-sea, or DAS) for some fleet sectors and large seasonal Georges Bank and Southern New England area closures to help control mortality. Amendment 7 (NEFMC 1996), adopted in 1996, expanded the DAS program, accelerated the reduction in DAS first adopted in Amendment 5, and changed the seasonal area closures to year-round closures. After Amendment 7, there was a series of amendments and smaller changes (framework adjustments, FW) that are detailed in Amendment 13 (NEFMC 2003).

Amendment 13 was developed over a four-year period to meet MSA requirements such as adopting rebuilding programs for stocks that are overfished and ending overfishing. Subsequent to the implementation of Amendment 13, FW 40A provided opportunities to target healthy stocks, FW 40B improved the effectiveness of the effort control program, and FW 41 expanded the vessels eligible to participate in a Special Access Program (SAP) that targets GB haddock. FW 42 included measures to implement the biennial adjustment to the FMP as well as a Georges Bank yellowtail rebuilding strategy, several changes to the Category B (regular) DAS Program and two Special Access Programs, an extension of the DAS leasing program, and introduced the differential DAS system. FW 43 adopted haddock catch caps for the herring fishery and was implemented August 15, 2006.

Amendment 16 was adopted in 2009 and had major changes to the FMP. It greatly expanded the sector program and implemented Annual Catch Limits in compliance with 2006 revisions to the M-S Act. There were a host of mortality reduction measures for "common pool" (i.e. non-sector) vessels and the recreational component of the fishery. An appeal of the lawsuit filed by the Cities of Gloucester and New Bedford and several East Coast fishing industry members against Amendment 16 was heard by the U.S. Court of Appeals for the First Circuit in Boston in September, 2012. The court ruled against the plaintiffs and the provisions of Amendment 16 were upheld. Framework 44 was also adopted in 2009, and it set specifications for FY 2010 – 2012 and incorporated the best available information in adjusting effort control measures adopted in Amendment 16. Framework 45 was approved by the Council in 2010 and adopts further modifications to the sector program and fishery specifications; it was implemented May 1, 2011. Framework 46 revised the allocation of haddock to be caught by the herring fishery and was implemented in August 2011. Amendment 17 authorizes NOAA-sponsored state-operated permit banks and was implemented on April 23, 2012. Framework 47, implemented on May 1, 2012, set specifications for some groundfish stocks for FY 2012 – 2014, modified AMs for the groundfish fishery and the administration of the scallop fishery AMs, and revised common pool management measures; modification of the Ruhle trawl definition and clarification of regulations for charter/party and recreational groundfish vessels fishing in groundfish closed areas were proposed under the RA authority. Framework 48 was partially approved for May 1, 2013some measures are still in review.. That action proposes revised status determination criteria for several stocks, modifies the sub-ACL system, adjusts monitoring measures for the groundfish fishery, and changes several accountability measures (AMs). Framework 50 was also implemented on May 1, 2013, and set specifications for many groundfish stocks and modified-the rebuilding program for SNE/MA winter flounder. Framework 49 is a joint Northeast

Multispecies/Atlantic Sea Scallop action that modified the dates for scallop vessel access to the year-round groundfish closed areas; this action was implemented on May 20, 2013. Framework 51 modified rebuilding programs for GOM cod and American plaice, set specifications for FY2014-2016 and modified management measures in order to ensure that overfishing does not occur including, additional management measures related to U.S./Canada shared stocks and yellowtail flounder in the groundfish and scallop fisheries. Framework Adjustment 52 was approved on January 15, 2015. This action made two revisions to the accountability measures (AMs) for the groundfish fishery for the northern (GOM/GB) and southern (SNE/MA) windowpane flounder stocks.

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

3.4 National Environmental Policy Act (NEPA)

NEPA provides a structure 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 includes the required NEPA analyses.

3.5 Fishery Data Sources

This document includes fishery data from FY2009 to FY2013. This approach informs the analysis and provides a baseline for the public to better understand the operation of the fishery. Some differences in totals between this analysis and prior analyses exist.

A “groundfish trip” is defined here as a trip where groundfish is landed, and either applied to a sector Annual Catch Entitlement (ACE) or to the common pool ACL. Unless stated otherwise, NMFS compiled most of the gear and/or location-specific data presented here from VTRs, because it contains effort, gear, and positional data. Some of the data in this document, such as that concerning protected resources, is from the Northeast Fisheries Observer Program data set.

4.0 Alternatives Under Consideration

Under the provision of the M-S Act, the Council submits proposed management actions to the Secretary of Commerce for review. The Secretary of Commerce can approve, disapprove, or partially approve the action proposed by the Council. In the following alternative descriptions, measures identified as Preferred Alternatives constitute the Council's preferred management action.

4.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits

4.1.1 Revised Status Determination Criteria

4.1.1.1 Option 1: No Action

No Action. There would be no revisions to the status determination criteria (SDC) of groundfish stocks (Table 2), and numerical estimates would not change (Table 3).

Table 2 – No Action status determination.

Stock	Biomass Target (SSB_{MSY} or proxy)	Minimum Biomass Threshold	Maximum Fishing Mortality Threshold (F_{MSY} or proxy)
Gulf of Maine Cod	SSB_{MSY}: SSB/R (40% MSP)	½ Btarget	F40% MSP
Gulf of Maine Haddock	SSB_{MSY}: SSB/R (40% MSP)	½ Btarget	F40% MSP
Gulf of Maine Winter Flounder	Unknown	Unknown	F40% MSP
Georges Bank Yellowtail Flounder	SSB_{MSY}: SSB/R (40% MSP)	½ Btarget	F40% MSP
Georges Bank Winter Flounder	SSB_{MSY}	½ Btarget	F_{MSY}
Pollock	SSB_{MSY}: SSB/R (40% MSP)	½ Btarget	F40% MSP

Table 3 - No Action numerical estimates of SDCs.

Stock	Model/ Approach	B_{MSY} or Proxy (mt)	F_{MSY} or Proxy	MSY (mt)
Gulf of Maine Cod	ASAP 0.2	54,743	0.18	9,399
	ASAP M-ramp	80,200	0.18	13,786
Gulf of Maine Haddock	VPA	4,904	0.46	1177
Gulf of Maine Winter Flounder	Area Swept	NA	0.23 exploitation rate	NA
Georges Bank Yellowtail Flounder	VPA	43,200	0.25	9,400
Georges Bank Winter Flounder	VPA	11,800	0.42	4,400
Pollock	ASAP	91,000	0.41	16,200

4.1.1.2 Option 2: Revised Status Determination Criteria

Option 2 would adopt revised status determination criteria for GB yellowtail flounder (Table 4). The M-S Act requires that every fishery management plan specify "objective and measureable 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 TRAC conducted an assessment in 2014 for GB yellowtail flounder. During the 2014 GB yellowtail flounder assessment, the TRAC agreed to no longer use the VPA assessment model, and instead, to use an empirical approach based on resource survey catches as the basis of catch advice. Because a stock assessment model framework is lacking for this stock, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. As well, status determination relative to reference points is not possible because reference points cannot be defined. These are now considered unknown (Table 4).

The NEFSC conducted update assessments in 2014 for the GOM cod, GOM winter flounder, GB winter flounder, and pollock, and a benchmark assessment for GOM haddock. This option updates the numerical estimates of the status determination criteria for these stocks. The 2014 GOM haddock benchmark assessment determined that the stock is not overfished and overfishing is not occurring in 2013. The status of the other stocks, based on the updated assessments, did not change. The 2012 assessment of GOM cod produced two models, M=0.2 and M-ramp. Numerical estimates from both models are provided, based on the updated 2014 assessment. The peer review recommended updated numerical values are provided in Table 5, for information purposes only.

Rationale: This option would update the status determination criteria for GB yellowtail flounder to reflect the best available scientific information.

Table 4 - Option 2 status determination criteria.

Stock	Biomass Target (SSB_{MSY} or proxy)	Minimum Biomass Threshold	Maximum Fishing Mortality Threshold (F_{MSY} or proxy)
Gulf of Maine Cod	SSB_{MSY}: SSB/R (40% MSP)	½ Btarget	F40% MSP
Gulf of Maine Haddock	SSB_{MSY}: SSB/R (40% MSP)	½ Btarget	F40% MSP
Gulf of Maine Winter Flounder	Unknown	Unknown	F40% MSP
Georges Bank Yellowtail Flounder	Unknown	Unknown	Unknown
Georges Bank Winter Flounder	SSB_{MSY}	½ Btarget	F_{MSY}
Pollock	SSB_{MSY}: SSB/R (40% MSP)	½ Btarget	F40% MSP

Table 5 - Option 2 numerical estimates of SDCs (provided for informational purposes only).

Stock	Model/ Approach	B_{MSY} or Proxy (mt)	F_{MSY} or Proxy	MSY (mt)
Gulf of Maine Cod	ASAP 0.2	47,184	0.18	7,753
	ASAP M-ramp	69,621	0.18	11,388
Gulf of Maine Haddock	ASAP	4,108	0.46	955
Gulf of Maine Winter Flounder	Area Swept	NA	0.23 exploitation rate	NA
Georges Bank Yellowtail Flounder	Empirical Area Swept	NA	NA	NA
Georges Bank Winter Flounder	VPA	8,100	0.44	3,200
Pollock	ASAP	76,900	0.42 (equivalent to $F_{5\text{-}7} = 0.27$)	14,800

4.1.2 Annual Catch Limits

4.1.2.1 Option 1: No Action

No Action. There would be no changes to the specifications for FY 2015-FY 2016 that were adopted by FW 51 (Table 6). For GOM winter flounder, GB winter flounder, GB yellowtail flounder, and pollock, there would not be any specifications for these years.

There would be no FY 2015 quotas specified for the transboundary Georges Bank stocks (i.e. GB cod, GB haddock, GB yellowtail flounder), which are managed through the US/CA Resource Sharing Understanding. These quotas are specified annually.

Rationale: Because there would not be any specifications for some stocks, this alternative would not address M-S Act requirements to achieve OY and consider the needs of fishing communities. The No Action alternative would also not be consistent with the best available scientific information.

Table 6 - No Action/Option 1 Northeast Multispecies OFLs, ABCs, ACLs, and other ACL sub-components for FY2015 (metric tons, live weight). Values are rounded to the nearest metric ton.

Stock	Year	OFL	U.S. ABC	State Waters Sub-component	Other Sub-Components	Scallops	Ground-fish Sub-ACL	Comm Ground-fish Sub-ACL	Rec Ground-fish Sub-ACL	Prelim-inary Sectors Sub-ACL	Prelim-inary Non-Sector Ground-fish Sub-ACL	Small Mesh/ MWT Sub-ACL	Total ACL
GB Cod	2015	4,191	2,506	25	100	0	2,262		0	2,219	43	0	2,387
	2016												
	2017												
GOM Cod	2015	2,639	1,550	103	51	0		830	486	810	19	0	1,470
	2016												
	2017												
GB Haddock	2015	56,293	43,606	436	1,744	0	38,940		0	38,671	269	406	41,526
	2016												
	2017												
GOM Haddock	2015	561	435	6	9	0		280	111	278	3	4	412
	2016												
	2017												
GB Yellowtail Flounder	2015												
	2016												
	2017												

Stock	Year	OFL	U.S. ABC	State Waters Sub-component	Other Sub-Components	Scallops	Ground-fish Sub-ACL	Comm Ground-fish Sub-ACL	Rec Ground-fish Sub-ACL	Prelim-inary Sectors Sub-ACL	Prelim-inary Non_ Sector Ground-fish Sub-ACL	Small Mesh/ MWT Sub-ACL	Total ACL
SNE/MA Yellowtail Flounder	2015	1,056	700	7	28	64	566		0	464	102	0	665
	2016												
	2017												
CC/GOM Yellowtail Flounder	2015	1,194	548	33	11	0	479		0	463	16	0	523
	2016												
	2017												
American Plaice	2015	2,021	1,544	31	31	0	1,408		0	1,382	26	0	1,470
	2016												
	2017												
Witch Flounder	2015	1,846	783	23	117	0	610		0	598	12	0	751
	2016												
	2017												
GB Winter Flounder	2015												
	2016												
	2017												
GOM Winter Flounder	2015												
	2016												
	2017												
SNE/MA Winter Flounder	2015	4,439	1,676	235	168	0	1,210		0	1,063	147	0	1,612
	2016												
	2017												
Redfish	2015	16,845	11,974	120	239	0	11,034		0	10,988	46	0	11,393
	2016												
	2017												

Stock	Year	OFL	U.S. ABC	State Waters Sub-component	Other Sub-Components	Scallops	Ground-fish Sub-ACL	Comm Ground-fish Sub-ACL	Rec Ground-fish Sub-ACL	Prelim-inary Sectors Sub-ACL	Prelim-inary Non-Sector Ground fish Sub-ACL	Small Mesh/ MWT Sub-ACL	Total ACL
White Hake	2015	6,237	4,713	47	94	0	4,343		0	4,313	30	0	4,484
	2016	6,314	4,645	46	93	0	4,280		0	4,250	30	0	4,420
	2017												
Pollock	2015												
	2016												
	2017												
N. Window-pane Flounder	2015	202	151	2	44	0	98		0	0	98	0	144
	2016												
	2017												
S. Window-pane Flounder	2015	730	548	55	186	183	102		0	0	102	0	527
	2016												
	2017												
Ocean Pout	2015	313	235	2	21	0	197		0	0	197	0	220
	2016												
	2017												
Atlantic Halibut	2015	198	119	48	6	0	62		0	0	62	0	116
	2016												
	2017												
Atlantic Wolffish	2015	94	70	1	3	0	62		0	0	62	0	65
	2016												
	2017												

4.1.2.2 Option 2: Revised Annual Catch Limit Specifications

Under Option 2, the annual specifications for FY 2015 - FY 2017 for pollock, GOM winter flounder, GB winter flounder, GOM haddock, and GOM cod would be as specified in Table 9. For all other stocks, except the transboundary Georges Bank management units, the specifications included in Table 9 are nearly the same values previously adopted in FW 51 and would be the same as those included in the No Action Alternative, except the US ABC will change for halibut and GB winter flounder to account for Canadian catches, and the groundfish sub-ACL changes slightly given changes to the other sub-component values (See Appendix III for additional information). Table 10 provides the preliminary common pool incidental catch TACs for Special Management Programs, based on the ACLs provided in Table 9, and
Table 11 provides the Closed Area I Hook Gear Haddock SAP.

U.S./Canada TACs

This alternative would specify TACs for the U.S./Canada Management Area for FY 2015 as indicated in Table 7. If NMFS determines that FY 2014 catch of GB cod, haddock, or yellowtail flounder from the U.S./Canada Management Area exceeded the respective 2014 TAC, the U.S./Canada Resource Sharing Understanding and the regulations require that the 2015 TAC be reduced by the amount of the overage. Any overage reduction would be applied to the components of the fishery that caused the overage of the U.S. TAC in 2014. In order to minimize any disruption to the fishing industry, NMFS would attempt to make any necessary TAC adjustment in the first quarter of the fishing year.

Table 7 - Proposed FY2015 U.S./Canada TACs (mt).

TAC	Eastern GB Cod	Eastern GB Haddock	GB Yellowtail Flounder
Total Shared TAC	650 mt	37,000 mt	354 mt (Total ABC)
U.S. TAC	124 mt	17,760 mt	248 mt (US ABC)
Canada TAC	526 mt	19,240 mt	106 mt

A comparison of the proposed FY 2015 U.S. TACs and the FY 2014 U.S. TACs is shown in Table 8. Changes to the U.S. TACs reflect changes to the percentage shares, stock status, and the Transboundary Management Guidance Committee (TMGC) recommendations.

Table 8 - Comparison of the Proposed FY 2015 U.S. TACs and the FY 2014 U.S. TACs (mt).

Stock	U.S. TAC		Percent Change
	FY 2015	FY 2014	
Eastern GB cod	124 mt	154 mt	-19.5 %
Eastern GB haddock	17,760 mt	10,530 mt	+ 68.7 %
GB yellowtail flounder	248 mt	328 mt	-34.5 %

Rationale: This measure would adopt new specifications for groundfish management units that are consistent with the most recent assessment information. For all stocks, only one alternative to No Action is shown. This is because the values in Option 2 represent the best scientific information, as determined

by the Council's Scientific and Statistical Committee, and the M-S Act requires that catches not be set higher than these levels. Any catches below these levels would not mitigate economic impact on fishing communities. This measure would also adjust state waters and other sub-component ACLs to reflect recent sub-component performance.

The U.S. and Canada coordinate management of three management units that overlap the boundary between the two countries on Georges Bank. Agreement on the amount to be caught is reached each year by the TMGC. This framework includes the recommendations of the TMGC, which are consistent with the most recent TRAC assessments.

Table 9 - Option 2 Northeast Multispecies OFLs, ABCs, ACLs and other ACL sub-components for FY 2015 – FY 2017 (metric tons, live weight). Values are rounded to the nearest metric ton. Sector shares based on 2014 PSCs. Only stocks that are underlined are proposed to be adjusted. Other stocks are provided for informational purposes. Grayed out values will be adjusted as a result of future recommendations of the TMGC.

Stock	Year	OFL	U.S. ABC	State Waters Sub-component	Other Sub-Components	Scallops	Ground-fish Sub-ACL	Comm Ground-fish Sub-ACL	Rec Ground-fish Sub-ACL	Prelim-inary Sectors Sub-ACL	Prelim-inary Non-Sector Ground-fish Sub-ACL	Small Mesh/ MWT Sub-ACL	Total ACL
GB Cod	2015	4,191	1,980	20	79	0	1,787		0	1,753	34	0	1,886
	2016												
	2017												
GOM Cod	2015	514	386	26	13	0	328	207	121	202	5	0	366
	2016	514	386	26	13	0	328	207	121	202	5	0	366
	2017	514	386	26	13	0	328	207	121	202	5	0	366
GB Haddock	2015	56,293	24,366	244	975	0	21,759	21,759		21,608	150	227	23,204
	2016												
	2017												
GOM Haddock	2015	1,871	1,454	11	21	0	1,329	958	372	948	9	14	1,375
	2016	2,270	1,772	13	26	0	1,620	1,167	453	1,155	12	16	1,675
	2017	2,707	2,125	15	31	0	1,943	1,399	543	1,386	14	20	2,009
GB Yellowtail Flounder	2015		248		2	38	195	195		192	3	5	240
	2016		354		4	55	278	278		274	4	7	343
	2017												

Stock	Year	OFL	U.S. ABC	State Waters Sub-component	Other Sub-Components	Scallops	Ground-fish Sub-ACL	Comm Ground-fish Sub-ACL	Rec Ground-fish Sub-ACL	Prelim-inary Sectors Sub-ACL	Prelim-inary Non_ Sector Ground-fish Sub-ACL	Small Mesh/ MWT Sub-ACL	Total ACL
SNE/MA Yellowtail Flounder	2015	1,056	700	14	28	66	557		0	457	101	0	666
	2016												
	2017												
CC/GOM Yellowtail Flounder	2015	1,194	548	38	27	0	458		0	443	16	0	524
	2016												
	2017												
American Plaice	2015	2,021	1,544	31	31	0	1,408		0	1,382	26	0	1,470
	2016												
	2017												
Witch Flounder	2015	1,846	783	23	117	0	610		0	598	12	0	751
	2016												
	2017												
GB Winter Flounder	2015	3,242	2,010	0	60	0	1,891		0	1,875	16	0	1,952
	2016	3,383	2,107	0	67	0	2,090		0	2,072	18	0	2,156
	2017	3,511	2,180	0	69	0	2,158		0	2,140	19	0	2,227
GOM Winter Flounder	2015	688	510	87	10	0	392		0	374	18	0	489
	2016	688	510	87	10	0	392		0	374	18	0	489
	2017	688	510	87	10	0	392		0	374	18	0	489
SNE/MA Winter Flounder	2015	4,439	1,676	117	184	0	1,306		0	1,147	159	0	1,607
	2016												
	2017												
Redfish	2015	16,845	11,974	120	239	0	11,034		0	10,988	46	0	11,393
	2016												
	2017												

Stock	Year	OFL	U.S. ABC	State Waters Sub-component	Other Sub-Components	Scallops	Ground-fish Sub-ACL	Comm Ground-fish Sub-ACL	Rec Ground-fish Sub-ACL	Prelim-inary Sectors Sub-ACL	Prelim-inary Non_ Sector Ground fish Sub-ACL	Small Mesh/ MWT Sub-ACL	Total ACL
White Hake	2015	6,237	4,713	47	94	0	4,343		0	4,313	30	0	4,484
	2016	6,314	4,645	46	93	0	4,280		0	4,250	30	0	4,420
	2017												
Pollock	2015	21,538	16,600	996	1,162	0	13,720		0	13,632	88	0	15,878
	2016	21,864	16,600	996	1,162	0	13,720		0	13,632	88	0	15,878
	2017	24,598	16,600	996	1,162	0	13,720		0	13,632	88	0	15,878
N. Window-pane Flounder	2015	202	151	2	44	0	98		0	0	98	0	144
	2016												
	2017												
S. Window-pane Flounder	2015	730	548	55	186	183	102		0	0	102	0	527
	2016												
	2017												
Ocean Pout	2015	313	235	2	24	0	195		0	0	195	0	220
	2016												
	2017												
Atlantic Halibut	2015	198	100	30	3	0	64		0	0	64	0	97
	2016												
	2017												
Atlantic Wolffish	2015	94	70	1	3	0	62		0	0	62	0	65
	2016												
	2017												

Table 10 - Option 2 Preliminary Common Pool Incidental Catch TACs for Special Management Programs (metric tons, live weight). These values may change as a result of changes in sector membership.

Stock	Regular B DAS Program		Closed Area I Hook Gear Haddock SAP		Eastern U.S./Canada Haddock SAP	
	2015	2016	2015	2016	2015	2016
GB cod	0.3	0.0	0.1	0.0	0.2	-
GOM cod	0.0	0.0	-	-	-	-
GB yellowtail flounder	0.03	0.04	-	-	0.03	0.04
CC/GOM yellowtail flounder	0.2	0.0	-	-	-	-
American Plaice	1.3	0.0	-	-	-	-
Witch Flounder	0.6	0.0	-	-	-	-
SNE/MA winter flounder	1.6	0.0	-	-	-	-

Table 11 - FY 2015 CAI Hook Gear Haddock SAP TACs.

Year	Exploitable Biomass (thousand mt)	WGB Exploitable Biomass	B(year)/B2004	TAC (mt, live weight)
2015	169,027	59,159	2.166	2,448

4.2 Commercial and Recreational Fishery Measures

4.2.1 GOM Cod Management Measures

4.2.1.1 GOM Cod Spawning Area Closures

4.2.1.1.1 Option 1: No Action (*Preferred Alternative*)

The No Action alternative maintains the current GOM cod spawning protection area for commercial and recreational vessels from April 1st to June 30th.

GOM Cod Spawning Closure Area (Whaleback)
The GOM cod spawning closure area is defined by the following coordinates and illustrated in Figure 1.

42-50.95 N	70-32.22 W
42-47.65 N	70-35.64 W
42-54.91 N	70-41.88 W
42-58.27 N	70-38.64 W

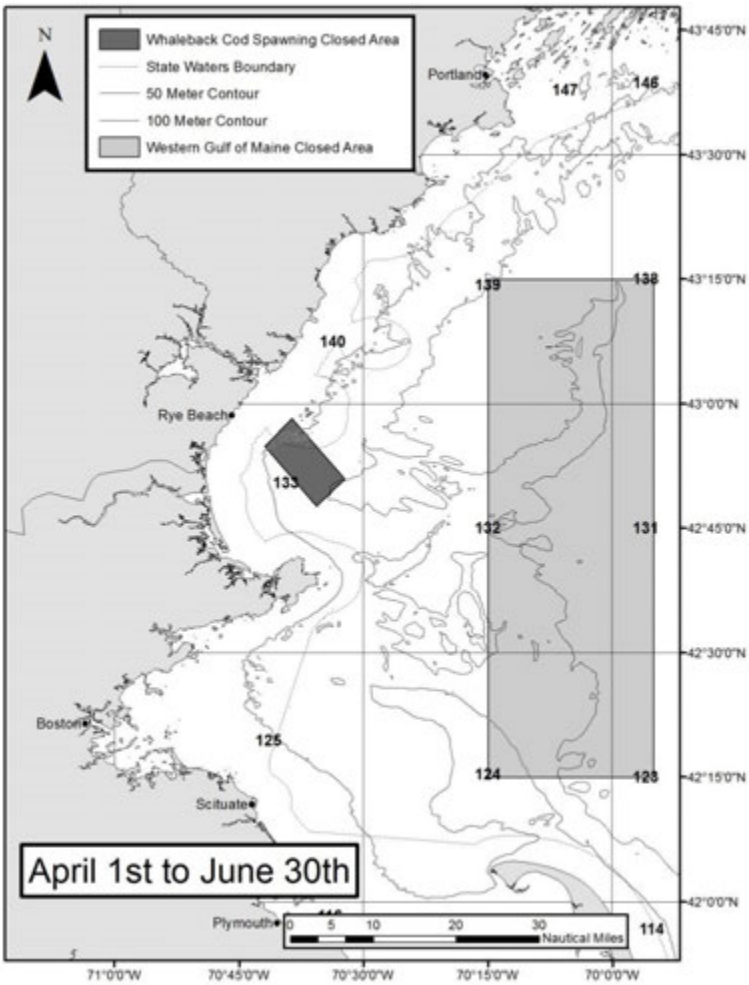
Provisions that apply to the area:

- All commercial fishing vessels using gear capable of catching groundfish are prohibited from fishing in the area from June 1 through June 30. Only fishing with exempted gear (that is, gear deemed not capable of catching groundfish as defined by 50 CFR 648.2[1].) is allowed in the area
- Recreational fishing vessels (including party-charter vessels) are subject to the following restrictions:
    - All recreational fishing vessels using gear capable of catching groundfish are prohibited from fishing in the area from April through June. Only pelagic hook and line gear, as defined in the commercial fishing exempted gear regulations, is allowed for use in the area.
- A fishing vessel (commercial or recreational) may transit the area as long as gear is properly stowed in accordance with regulations promulgated by the Regional Administrator.
- The take or possession of any groundfish species by vessels using exempted gear in this area from April through June is prohibited.

Rationale: This measure maintains the existing GOM cod spawning closure area, and continues to restrict commercial and recreational fishing in an inshore area in the GOM that has been identified as being important for cod spawning in the spring. This closure would continue to reduce fishing impacts on spring spawners, and thus contribute to rebuilding of the GOM cod stock. The area would continue to provide protection to spawning cod by limiting fishing at times and in an area in the spring when cod return to this discrete area to spawn.

[1] 50 CFR 648.2: "Exempted gear, with respect to the NE multispecies fishery, means gear that is deemed to be not capable of catching NE multispecies, and includes: Pelagic hook and line, pelagic longline, spears, rakes, diving gear, cast nets, tongs, harpoons, weirs, dipnets, stop nets, pound nets, pelagic gillnets, pots and traps, shrimp trawls (with a properly configured grate as defined under this part), and surfclam and ocean quahog dredges." The list of exempted gears is subject to change.

Figure 1 - Existing GOM Cod Spawning Closure Area (Whaleback) is shown in dark gray located within Block 133.



4.2.1.1.2 Option 2: Additional GOM Cod Spawning Protection Measures

The Council considered selecting Sub-Option A or Sub-Option B.

Additional GOM cod spawning closures for commercial and recreational groundfish fisheries would be created in the Gulf of Maine. The proposed GOM cod spawning closure areas coincide with other management measures in time and space (e.g. Gulf of Maine Rolling Closures & the Western Gulf of Maine Closed Area), but are not considered replacements to these other management areas.

Rationale: This option would restrict commercial and recreational fishing in inshore areas in the GOM that have been identified as being important for cod spawning by the Closed Area Technical Team (CATT) and other information related to cod spawning. This alternative is designed to reduce fishing impacts on spawning cod during times of year when cod are known to be spawning (e.g. winter and spring), and thus contribute to rebuilding the GOM cod stock. Fishing can interfere with spawning success and therefore productivity in a number of ways including: removal of spawning fish before they

have the opportunity to spawn, dispersal of spawning fish, and disruption of spawning behavior. The closure areas are intended to provide protection to spawning cod by limiting fishing at times and areas when cod are in spawning condition, and by preventing fishing from interfering with spawning activity.

Sub-Option A: If selected, this option would create seasonal GOM cod spawning closure areas in 30-minute blocks (Figure 2). Portions of blocks 124, 132, and 139 that overlap the Western GOM Closed Area would not be considered as GOM cod spawning closures.

All commercial and recreational groundfish fishing would be prohibited seasonally in the following 30-minute blocks during these months:

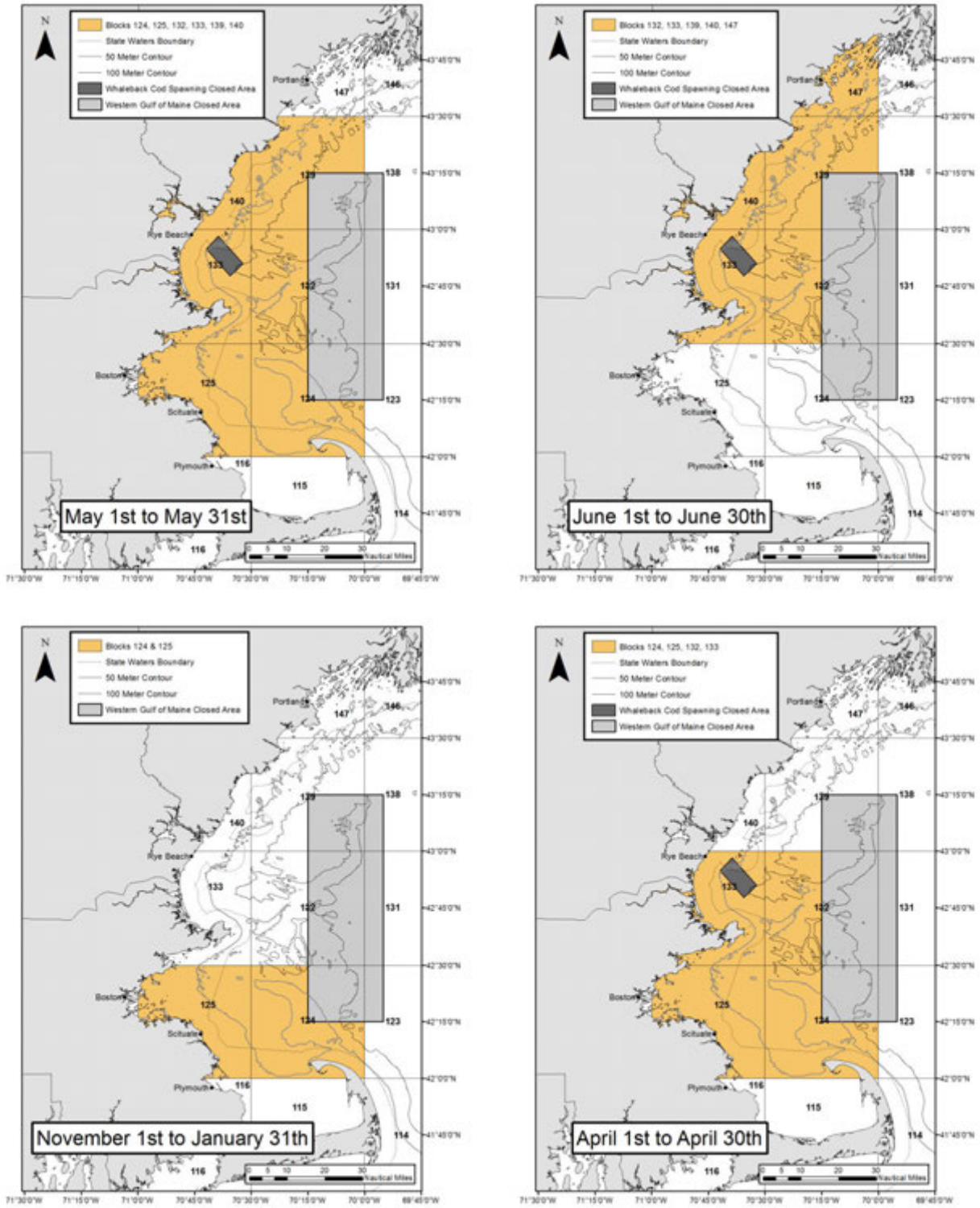
- May: 124, 125, 132, 133, 139, 140
- June: 132, 133, 139, 140, 147
- November – January: 124-125
- April: 124, 125, 132, 133

Provisions that apply to Sub-Option A:

- All commercial fishing vessels using gear capable of catching groundfish are prohibited from fishing in the areas during the dates specified. Only fishing with exempted gear (that is, gear deemed not capable of catching groundfish as defined by 50 CFR 648.2) is allowed in the area.
- Recreational fishing vessels (including party-charter vessels) are subject to the following restrictions:
    - All recreational fishing vessels using gear capable of catching groundfish are prohibited from fishing in the areas during the dates specified. Only pelagic hook and line gear, as defined in the commercial fishing exempted gear regulations, is allowed for use in the area.
- A fishing vessel (commercial or recreational) may transit the area as long as gear is properly stowed in accordance with regulations promulgated by the Regional Administrator.
- The take or possession of any groundfish species by vessels using exempted gear would be prohibited in the areas described above.

Rationale: This measure would restrict commercial and recreational fishing in areas in the GOM that have been identified as being important for winter and spring cod spawning. This alternative is designed to reduce fishing impacts on seasonal spawners during the winter and spring for all groundfish fishing, and thus contribute to rebuilding the GOM cod stock. Sub-Option A is more conservative than Sub-Option B as it captures more of the GOM cod spawning activity. The configuration of the GOM rolling closures are shown in the left hand column of Figure 6 in Section 4.2.1.3. Sub-Option A overlaps with and expands upon the existing GOM rolling closures. These additional closures would predominately impact fishing activity in the western GOM in blocks 124, 125, 132, and 133 in the winter and spring.

Figure 2 - Sub-Option A proposed GOM cod spawning closure areas in May (top left), June (top right), November-January (bottom left), April (bottom right).



Sub-Option B: If selected, this option would create seasonal GOM cod spawning closure areas in 30-minute blocks. All commercial and recreational groundfish fishing would be prohibited in the following 30-minute blocks (Figure 3):

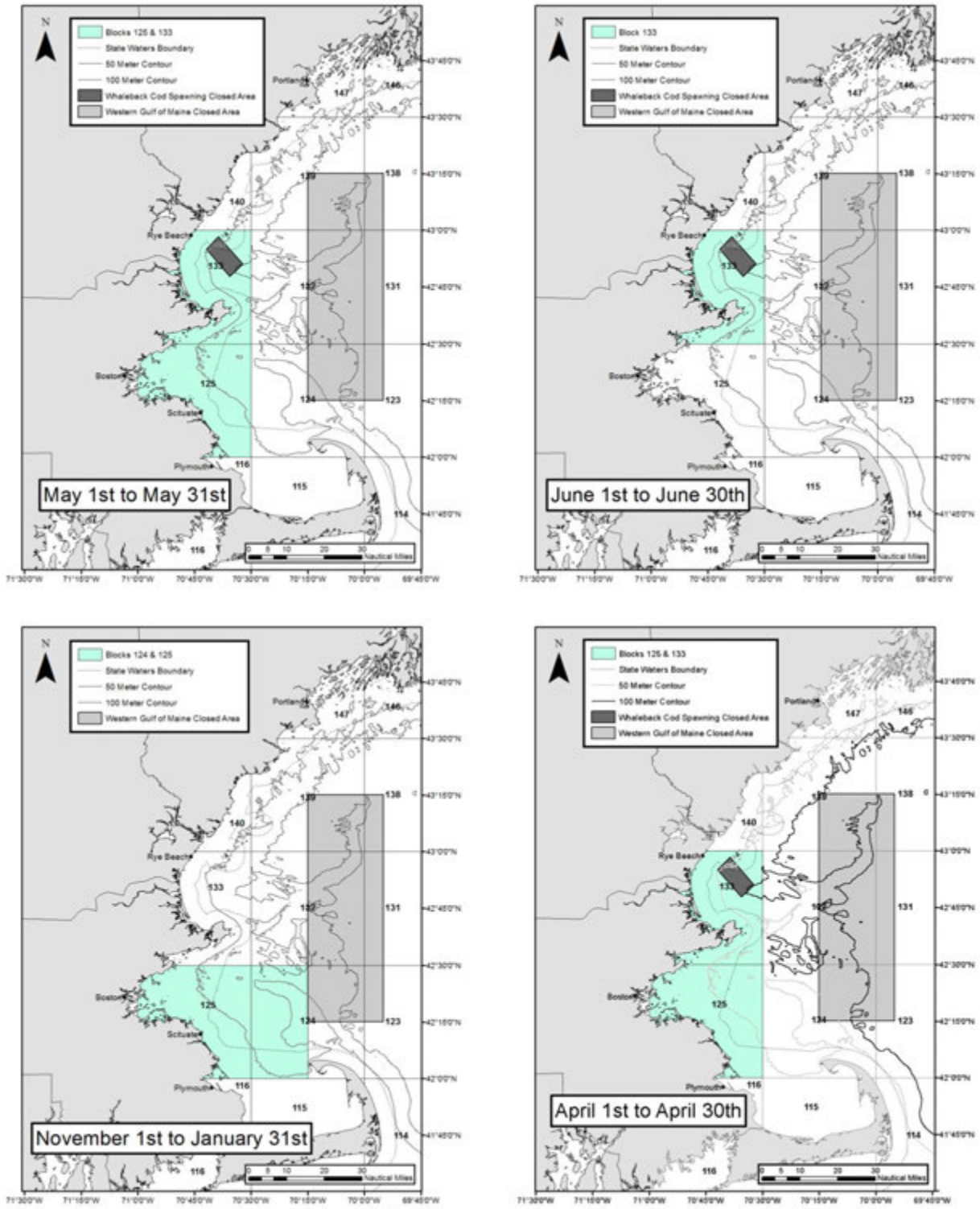
- May: 125, 133
- June: 133
- November – January: 125 and 124 with an eastern boundary defined at 70° 15'W
- April: 125, 133

Provisions that apply to Sub-Option B:

- All commercial fishing vessels using gear capable of catching groundfish are prohibited from fishing in the areas during the dates specified. Only fishing with exempted gear (that is, gear deemed not capable of catching groundfish as defined by 50 CFR 648.2) is allowed in the area.
- Recreational fishing vessels (including party-charter vessels) are subject to the following restrictions:
    - All recreational fishing vessels using gear capable of catching groundfish are prohibited from fishing in the areas during the dates specified. Only pelagic hook and line gear, as defined in the commercial fishing exempted gear regulations, is allowed for use in the area.
- A fishing vessel (commercial or recreational) may transit the area as long as gear is properly stowed in accordance with regulations promulgated by the Regional Administrator.
- The take or possession of any groundfish species by vessels using exempted gear would be prohibited in the areas described above.

Rationale: This measure would restrict commercial and recreational fishing in areas in the GOM that have been identified as being important for seasonal cod spawning. This alternative is designed using smaller closure areas to protect spawning cod and is less conservative than Sub-Option A as it captures some GOM cod spawning activity. The configuration of the GOM rolling closures are shown in the left hand column of Figure 6 in Section 4.2.1.3. Sub-Option B expands on the existing rolling closures in the GOM for commercial vessels in the winter and spring, particularly in Massachusetts Bay and Stellwagen Bank.

Figure 3 - Sub-Option B proposed GOM cod spawning closure areas in May (top left), June (top right), November-January (bottom left), April (bottom right).



4.2.1.2 Prohibition on the Possession of GOM cod

4.2.1.2.1 Option 1: No Action (*Preferred Alternative*)

No Action. There would be no revision to the retention regulations of GOM cod.

Rationale: This option would maintain accountability for catches of this stock and would address concerns about discarding of GOM cod. This measure would continue to allow possession and landing of GOM cod in order to promote achieving OY and minimize bycatch consistent with National Standard 9. Landing GOM cod would also allow continued collection of biological samples from landed fish.

However, the Council's preferred alternative for GOM cod protection measures would prohibit the possession of GOM cod for recreational anglers, and modify the suite of existing rolling closures in the GOM for commercial sector and common pool vessels (see Section 4.2.1.3).

4.2.1.2.2 Option 2: Prohibition on the Possession of GOM cod

Commercial and recreational vessels would be required to discard all catch of GOM cod (i.e., zero possession). There would be no change in how GOM cod is allocated, and there would be no changes made to catch accounting or accountability measures.

Rationale: Fishing mortality on GOM cod needs to be substantially reduced based on recent assessment findings. Prohibiting the possession of GOM cod while retaining ACLs and AMs for the recreational and commercial fisheries would discourage targeted fishing on this stock. However, this measure increases the uncertainty of catch estimates because all catch would be discards.

4.2.1.3 GOM Cod Protection Measures

4.2.1.3.1 Option 1: No Action

If the No Action is selected, there would be no revision to existing regulations currently in place, which include:

- Recreational fishery possession of GOM cod, and
- GOM rolling closures for sectors and the common pool

<u>Recreational Fishery Possession of GOM cod:</u>

With respect to the recreational fishery, the measures adopted by Amendment 16 include a a bag limit, and a seasonal prohibition on possession of GOM cod (November 1 – April 15). In Framework 48, the Council granted authority to the Regional Administrator to adjust proactive recreational measures – including possession – so that the recreational fishery will achieve, but will not exceed, the specific sub-ACLs that are allocated to the fishery.

<u>Gulf of Maine Rolling Closures:</u>

Selecting No Action would retain existing sector rolling closures, common pool rolling closures, and year-round closures for the commercial fleet. Vessels enrolled in northeast groundfish sectors would continue to be subject to a sub-set of the common-pool rolling closures, and all vessels would be

prohibited from conducting fishing activity in the Western Gulf of Maine and Cashes Ledge year round closed areas (Figure 4).

Sector Rolling Closures (30-Minute Blocks):

- May: 132, 133, 138, 139, 140
- June: 139, 140, 145, 146, 147, 152
- April: 124, 125, 132, 133

Common Pool Rolling Closures (30-Minute Blocks):

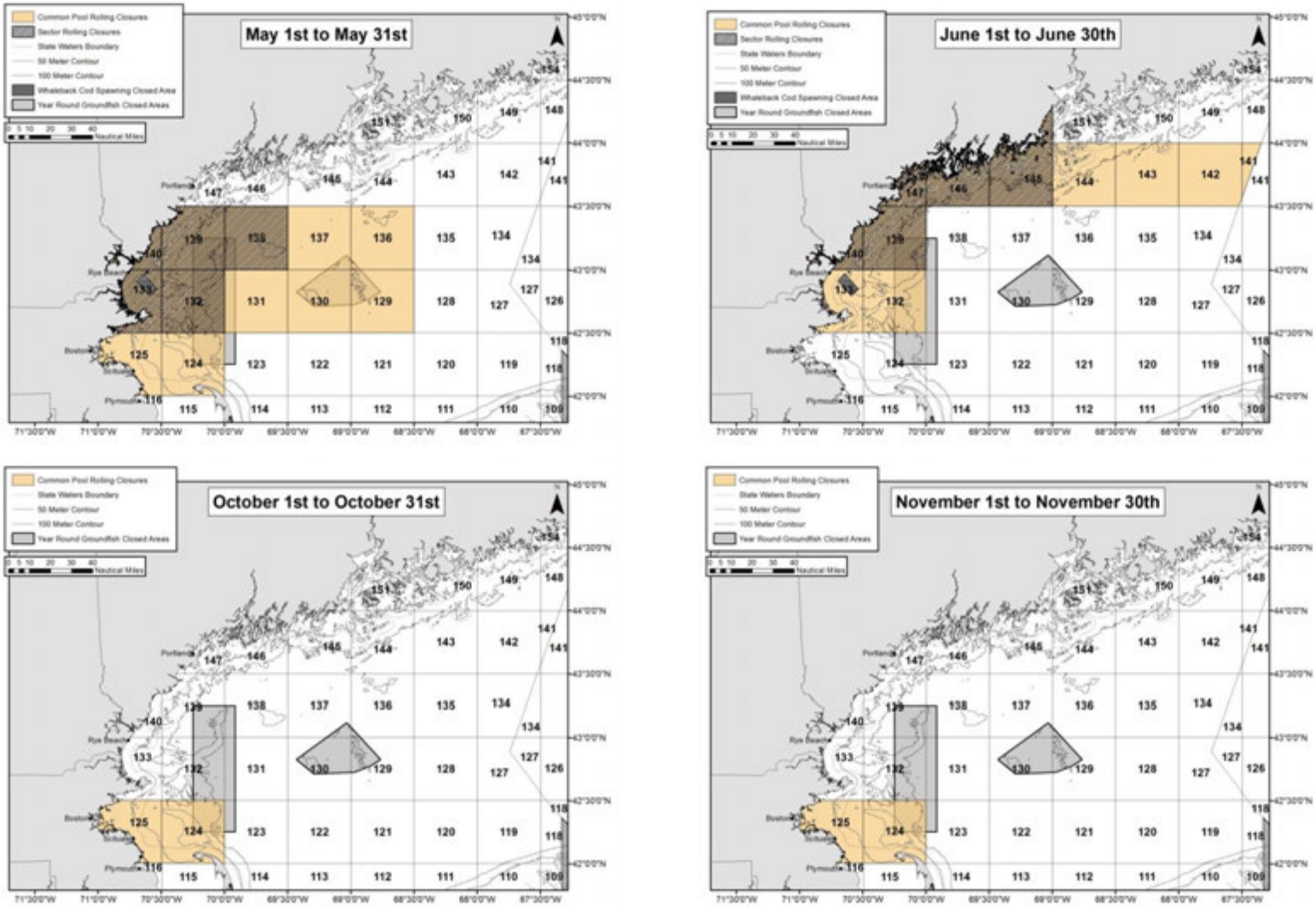
- May: 124, 125, 129, 130, 131, 132, 133, 136, 137, 138, 139, 140
- June: 132, 133, 139, 140, 142, 143, 144, 145, 146, 147, 152
- October – November: 124, 125
- March: 121, 122, 123
- April: 121, 122, 123, 124, 125, 129, 130, 131, 132, 133

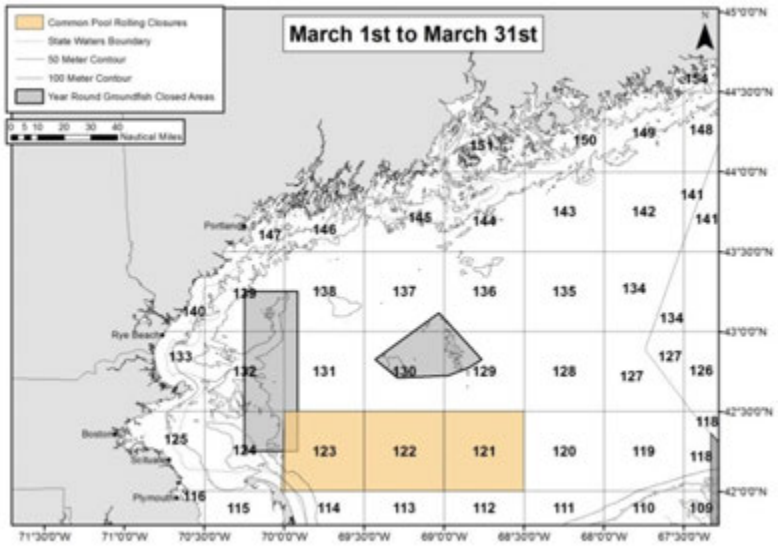
Rationale: The rationale for each measure in the No Action is described below.

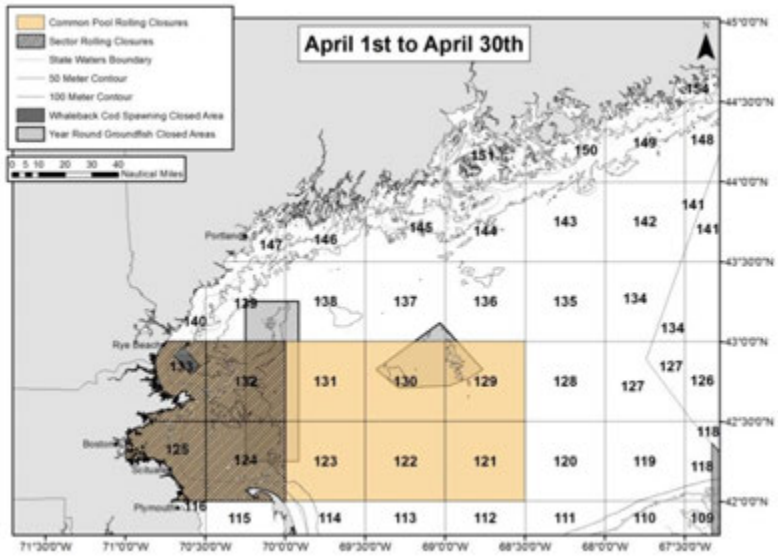
Recreational Management Measures: Bag limits and seasons are tools that may allow harvests by the recreational fishery to achieve, but not exceed the sub-ACL for GOM cod and other groundfish. Existing regulations adopted in FW48 allow NMFS to make in-season adjustments to recreational proactive AMs after consultation with the Council for the upcoming FY.

Rolling Closures (Commercial fishery): This measure would retain rolling closures developed by the Council through a series of actions beginning in 1996 (Amendment 7). These time/area closures have been used to reduce fishing mortality of GOM cod and reduce impacts on other regulated species.

Figure 4 – Existing GOM Common Pool and Sector Rolling Closures by Month, in order of the Fishing Year.




March 1st to March 31st
Common Pool Rolling Closures
State Waters Boundary
50 Meter Contour
100 Meter Contour
Year Round Groundfish Closed Areas
Nautical Miles
Portland
Rye Beach
Boston
Scituate
Plymouth


April 1st to April 30th
Common Pool Rolling Closures
Sector Rolling Closures
State Waters Boundary
50 Meter Contour
100 Meter Contour
Whaleback Cod Spawning Closed Area
Year Round Groundfish Closed Areas
Nautical Miles
Portland
Rye Beach
Boston
Scituate
Plymouth

4.2.1.3.2 Option 2: Gulf of Maine Cod Protection Measures (*Preferred Alternative*)

If implemented, Option 2 would prohibit the possession of GOM cod by the recreational groundfish fishery. This alternative would also modify existing GOM rolling closures (sector and common pool) for the commercial groundfish fishery during the months of May, June, and November, and implement new closures in December and January. Option 2 would also remove all sector and common pool GOM rolling closures during the month of April, and would retain existing common pool GOM rolling closures as GOM cod protection closures in October and March. The GOM cod protection closure areas would not apply to the recreational fishery. The GOM cod protection closures would be subject to review when the GOM cod stock biomass reaches 50% of $SSB_{MSY.}$ Commercial vessels would still not be allowed in Whaleback in April through June.

GOM Cod Protection Closures:

GOM Cod Protection Closures would apply to all commercial groundfish vessels fishing on a common-pool or sector trip in the following 30-Minute Blocks (Figure 5, see also Figure 6 and Table 12):

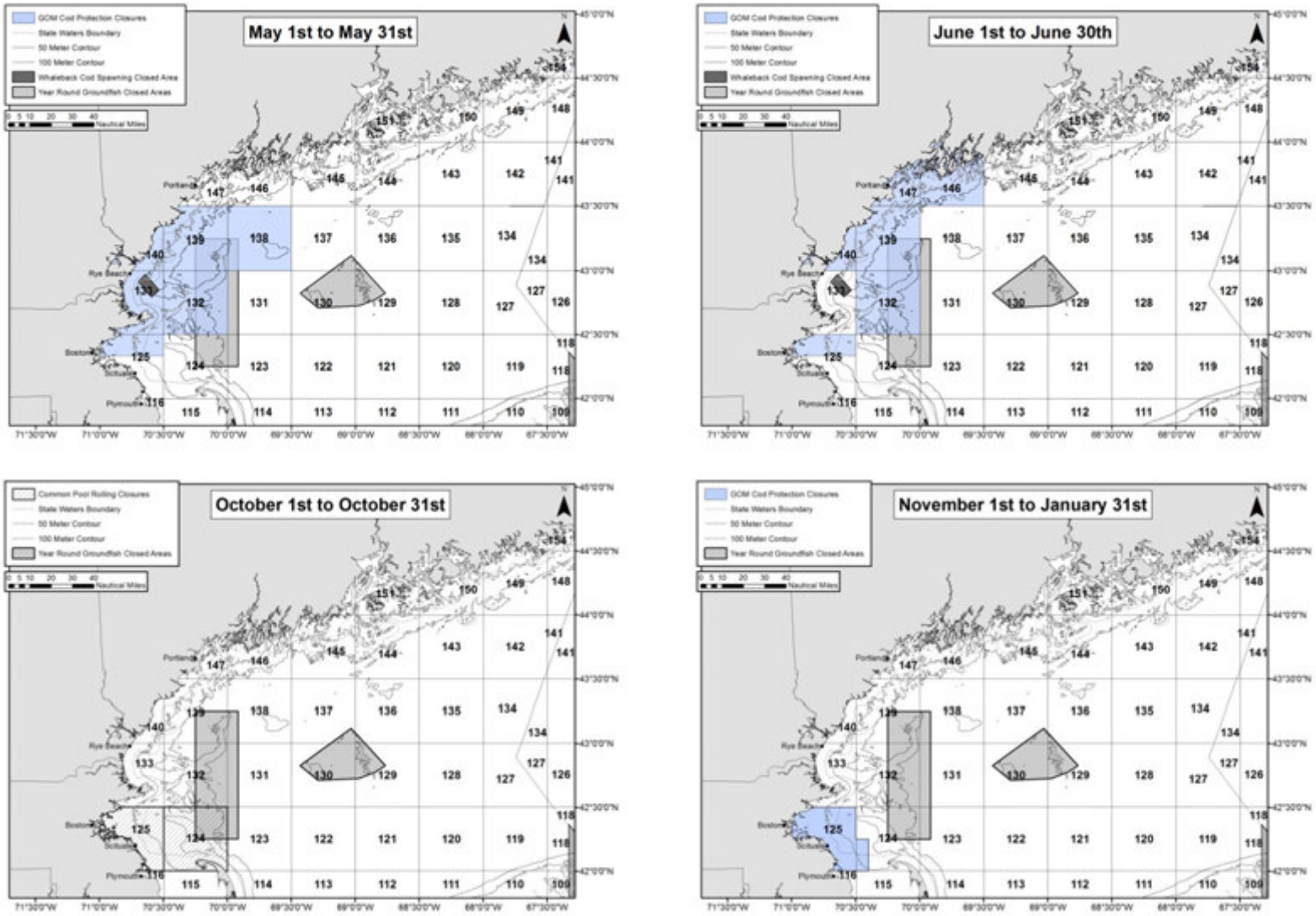
- May: 132, 133, 138, 139, 140, and 125 north of 42° 20’
- June: 132, 139, 140, 146, 147, and 125 north of 42° 20’
- November – January: 125, and an area of 124 defined by the following coordinates:
    - 42° 00’ N…70° 30’ W
    - 42° 00’ N…70° 24’ W
    - 42° 15’ N…70° 24’ W
    - 42° 15’ N…70° 30° W, and

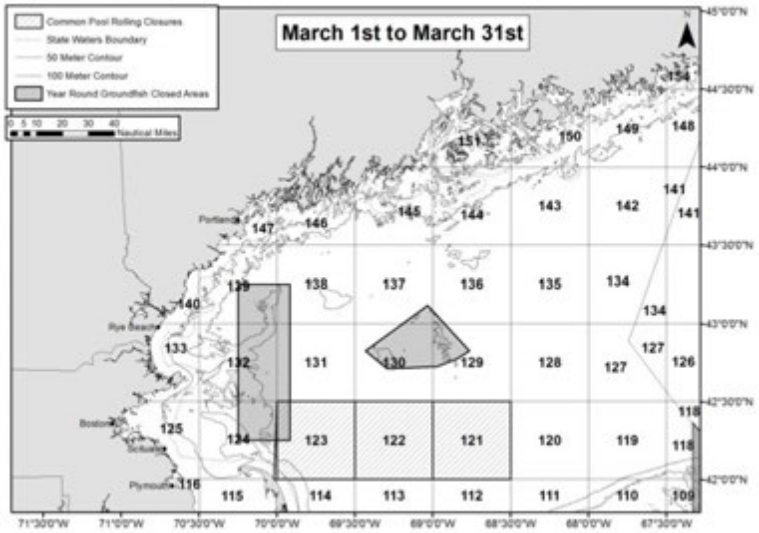
Rolling closures would continue to apply to common pool vessels in the following 30-Minute Blocks:

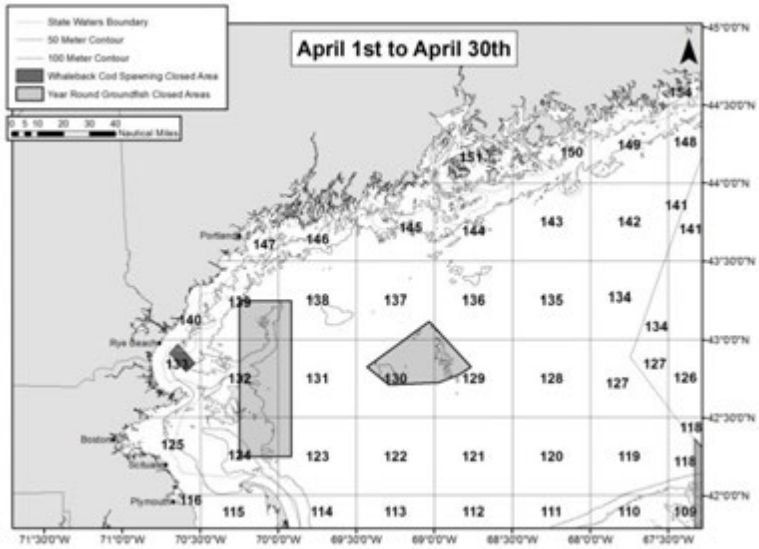
- October: 124 and 125
- March: 121, 122, 123

This option would not change the existing Whaleback GOM cod spawning closure, the year-round groundfish mortality closed areas, and the ability of NMFS to make adjustments to recreational management measures.

Figure 5 - Proposed GOM Cod Protection Closures in May (Upper Left), June (Upper Right), and November – January (Lower Right). Common Pool rolling closures in October (Lower Left), March (following page, Upper Left), and April as modified (following page, Upper Right).




March 1st to March 31st
Common Pool Rolling Closures
State Waters Boundary
50 Meter Contour
100 Meter Contour
Year Round Groundfish Closed Areas
Nautical Miles
Portland
Rye Beach
Boston
Scituate
Plymouth
154
151
150
149
148
147
146
145
144
143
142
141
141
140
139
138
137
136
135
134
134
133
132
131
130
129
128
127
127
126
125
124
123
122
121
120
119
118
118
116
115
114
113
112
111
110
109
45°0'0"N
44°30'0"N
44°0'0"N
43°30'0"N
43°0'0"N
42°30'0"N
42°0'0"N
71°30'0"W
71°0'0"W
70°30'0"W
70°0'0"W
69°30'0"W
69°0'0"W
68°30'0"W
68°0'0"W
67°30'0"W


April 1st to April 30th
State Waters Boundary
50 Meter Contour
100 Meter Contour
Whaleback Cod Spawning Closed Area
Year Round Groundfish Closed Areas
Nautical Miles
Portland
Rye Beach
Boston
Scituate
Plymouth
154
151
150
149
148
147
146
145
144
143
142
141
141
140
139
138
137
136
135
134
134
133
132
131
130
129
128
127
127
126
125
124
123
122
121
120
119
118
118
116
115
114
113
112
111
110
109
45°0'0"N
44°30'0"N
44°0'0"N
43°30'0"N
43°0'0"N
42°30'0"N
42°0'0"N
71°30'0"W
71°0'0"W
70°30'0"W
70°0'0"W
69°30'0"W
69°0'0"W
68°30'0"W
68°0'0"W
67°30'0"W

Rationale: Zero possession of GOM cod in the recreational fishery would reduce incentives to target GOM cod, and would be expected to reduce fishing mortality on the stock, while allowing for continued access to other groundfish stocks (e.g. haddock and pollock). Zero possession may increase the uncertainty of catch estimates, but data collection would remain unchanged.

This measure would modify the existing rolling closure to use seasonal closures in the commercial groundfish fishery to protect GOM cod at times and in areas where spawning is known to occur in the winter and spring, and reduce fishing mortality in these times and areas on the stock while providing opportunity for the groundfish fishery to prosecute healthy stocks in other times and areas. The intent of this measure is to increase protection for GOM cod in the winter months by adding the winter closures, and to create more economic opportunities in the spring by opening up the April closure. The 2014 GOM cod assessment indicated that SSB_{MSY} is at 2-3% of the target biomass for the stock. The provision to revisit the GOM cod protection area when the stock reaches 50% of SSB_{MSY} would establish an incentive for commercial groundfish fisheries to reach that conservation goal. The review of these measures would be based on the need to balance protecting the GOM cod stock while allowing continued access or closure of these areas to commercial groundfish fisheries. Exempted gears[1] and exempted fisheries would be permitted in these areas.

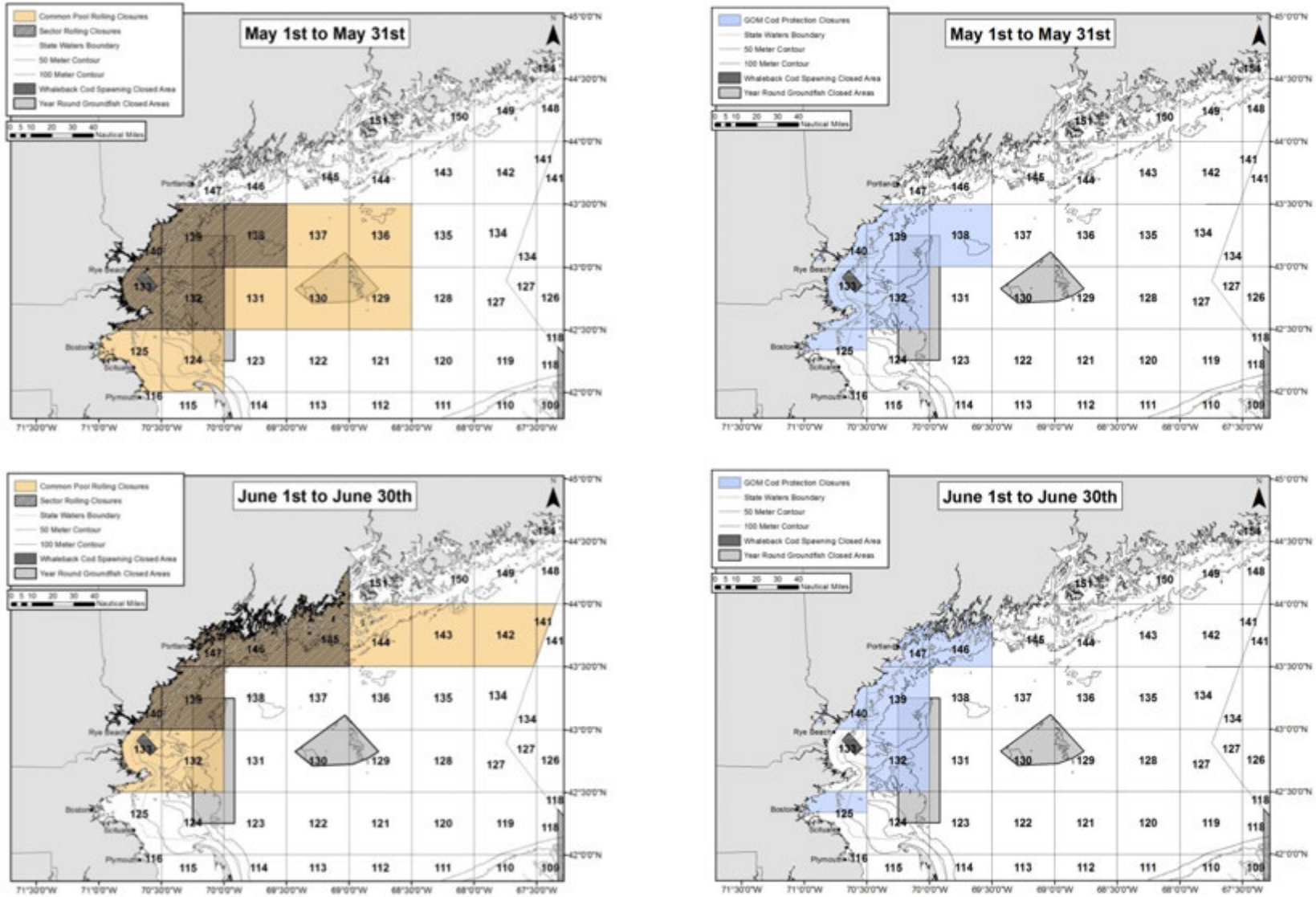
Table 12 – Comparison of proposed GOM Cod Protection Closures (Preferred Alternatives) in 4.2.1.3 for groundfish sectors and the common pool by 30-minute blocks.

Gulf of Maine Cod Protection Closures		
Month	***Revised Sector Rolling Closures***	***Revised Common Pool Rolling Closures***
May	132, 133, 138, 139, 140 and 125 north of 42° 20’	
June	132, 139, 140, 146, 147, and 125 north of 42° 20’	
July	*None*	*None*
August	*None*	*None*
September	*None*	*None*
October	*None*	124 and 125
November	125 and a portion of 124 defined by the following coordinates: 42° 00’ N…70° 30’ W 42° 00’ N…70° 24’ W 42° 15’ N…70° 24’ W 42° 15’ N…70° 30° W	
December		
January		
February	*None*	*None*
March	*None*	121, 122, and 123
April	*None*	*None*

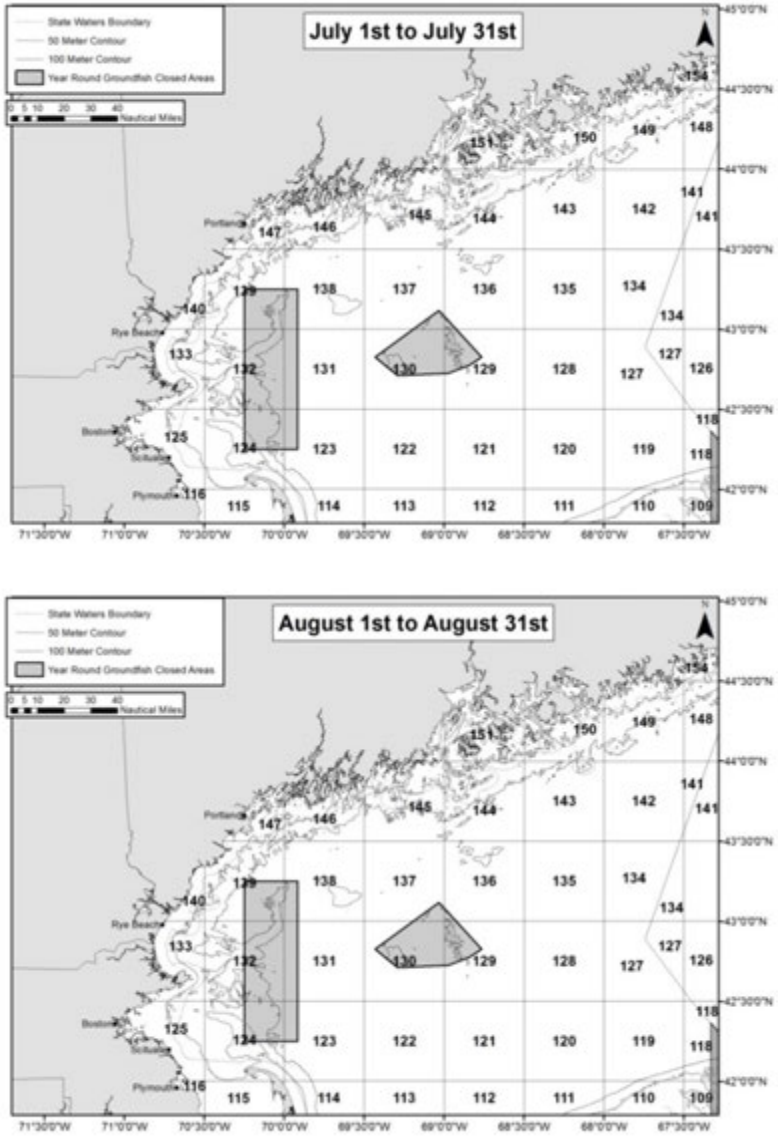
Figure 6 – Charts Comparing existing Common Pool and Sector Rolling Closures (left) with proposed GOM cod protection closures in 4.2.1.3 (right).

Common Pool and Sector Rolling Closures

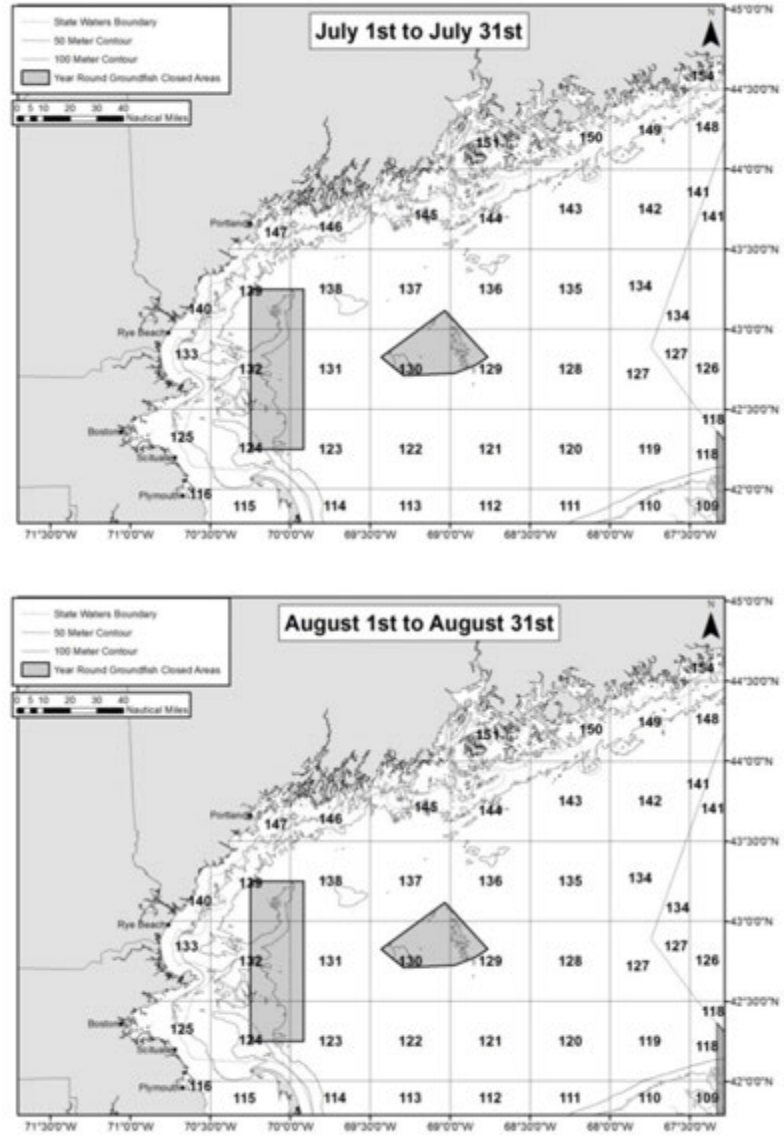
Proposed GOM Cod Protection Closures



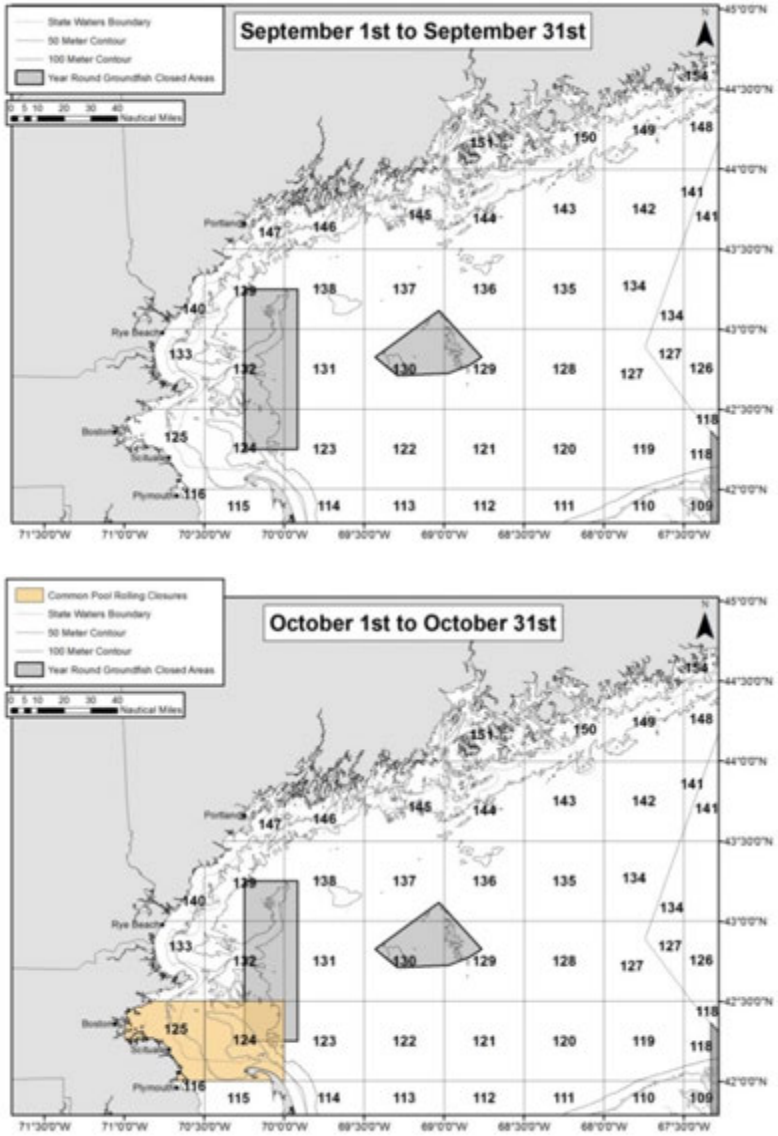
Common Pool and Sector Rolling Closures



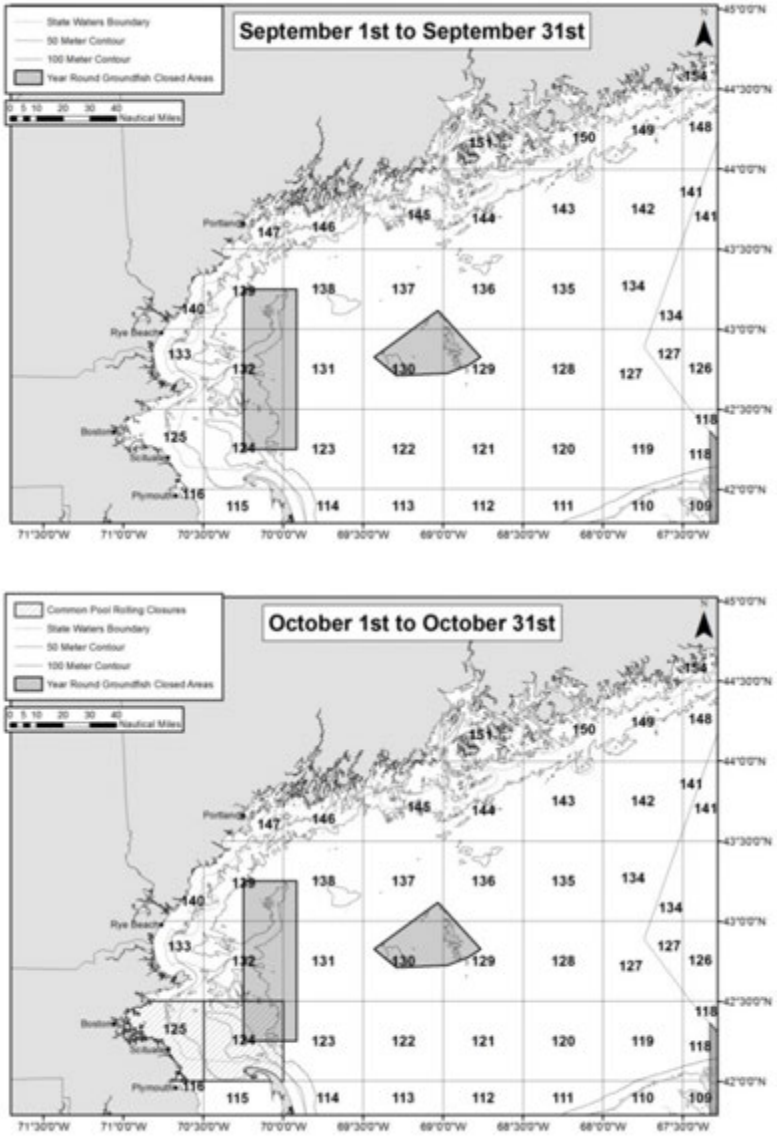
Proposed GOM Cod Protection Closures



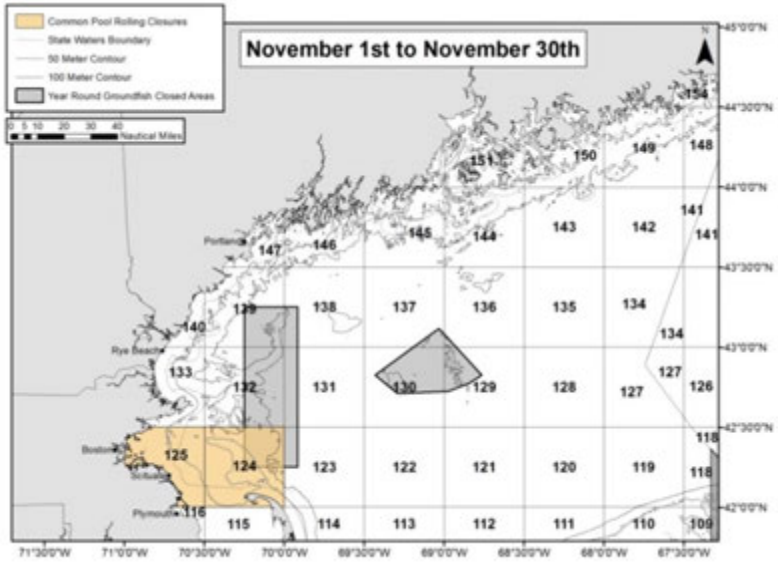
Common Pool and Sector Rolling Closures (No Action)

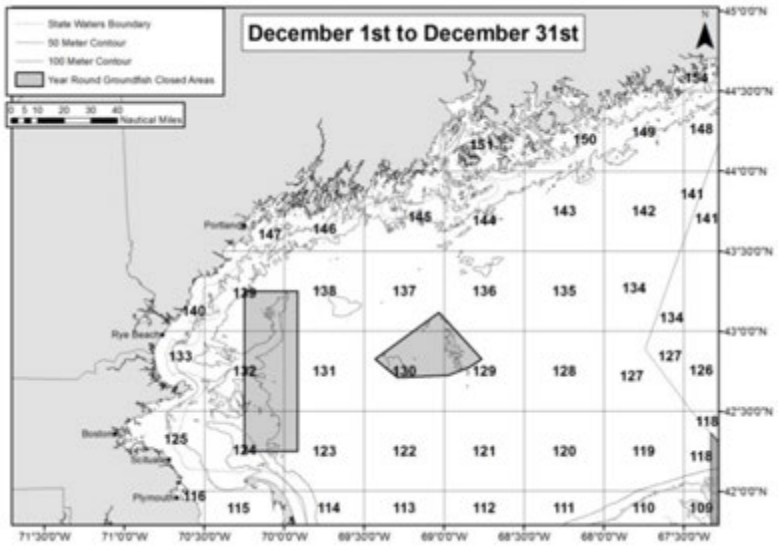


Proposed GOM Cod Protection Closures

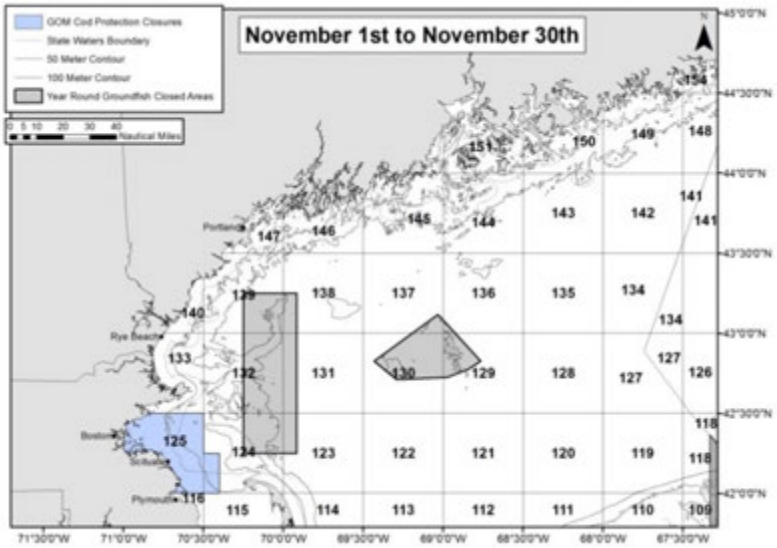


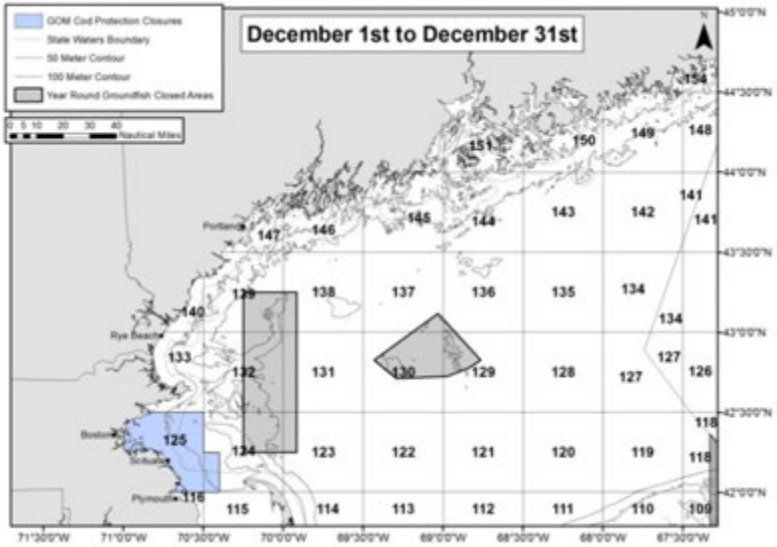
Common Pool and Sector Rolling Closures



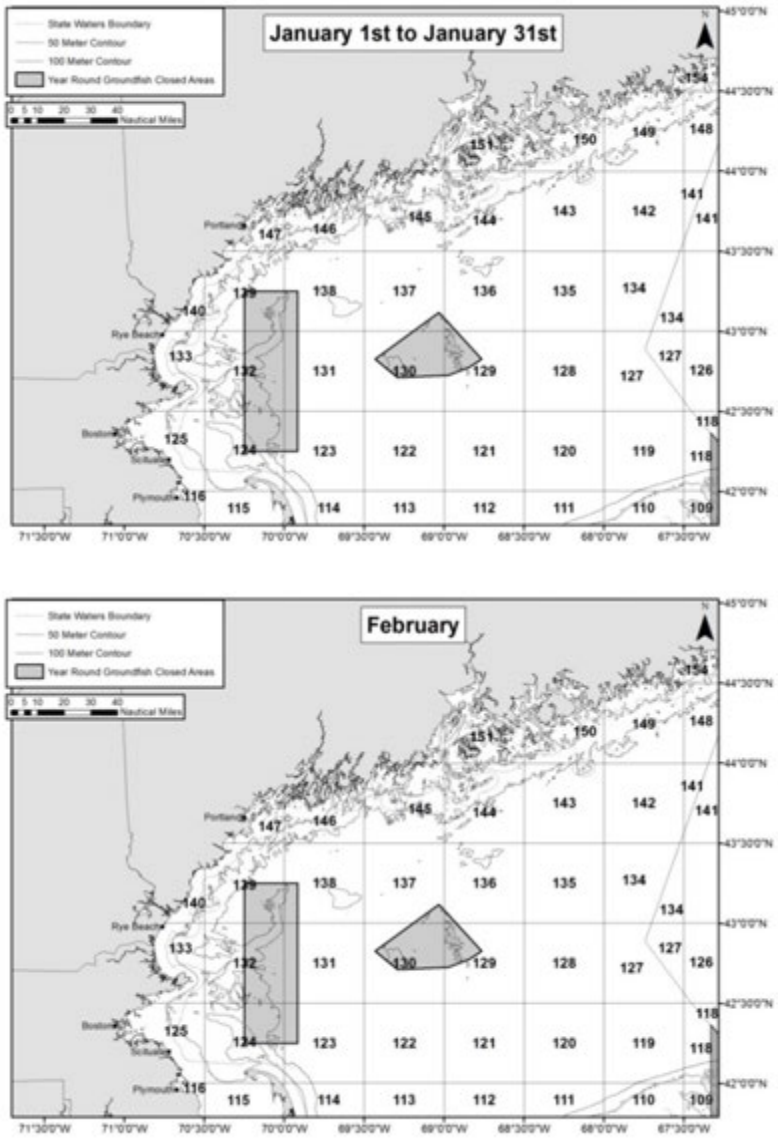


Proposed GOM Cod Protection Closures

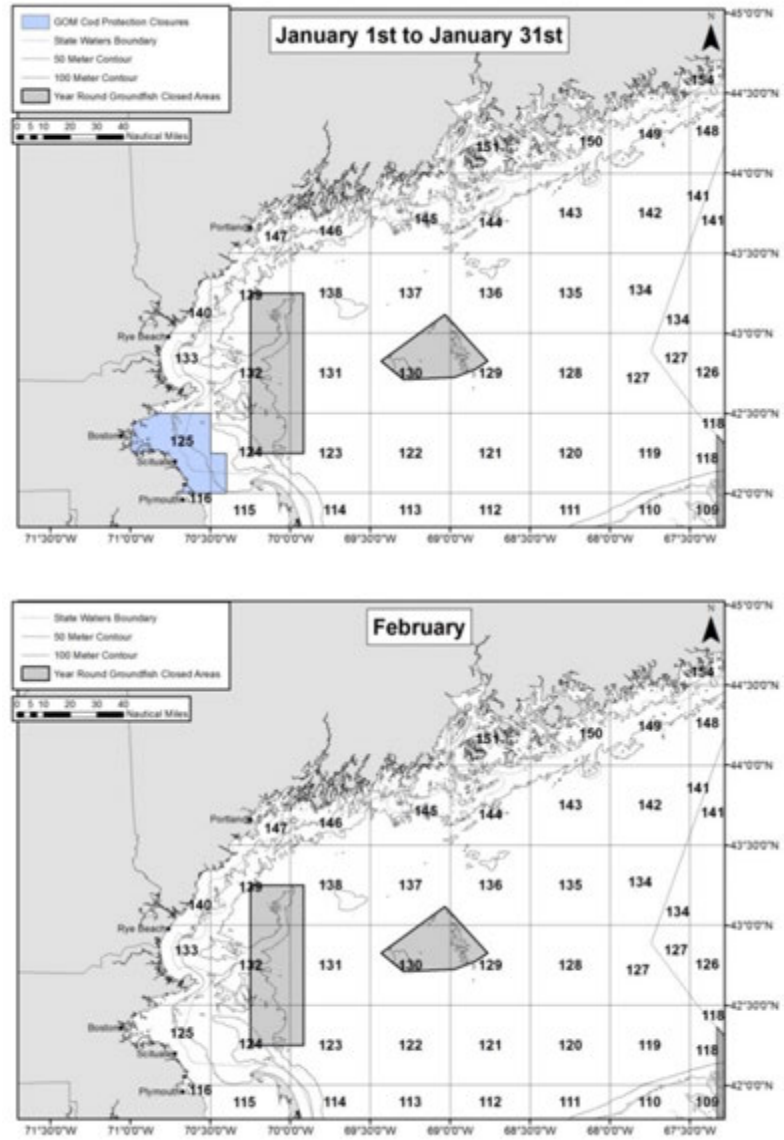




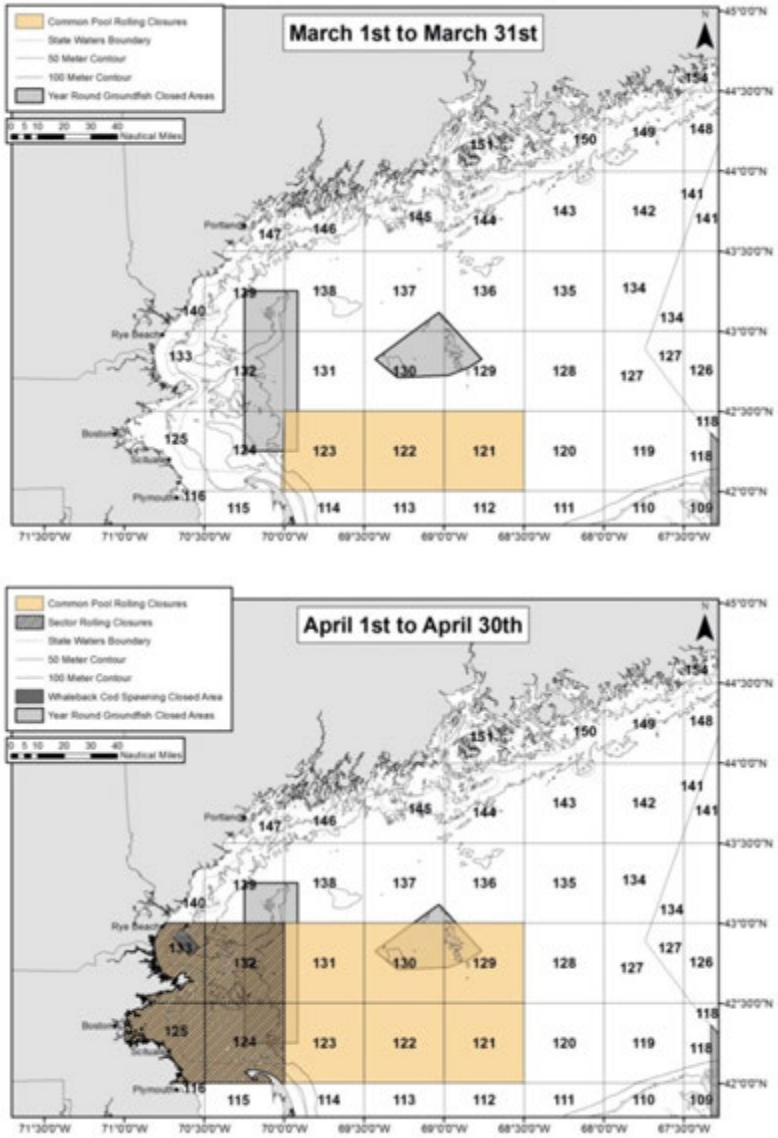
Common Pool and Sector Rolling Closures



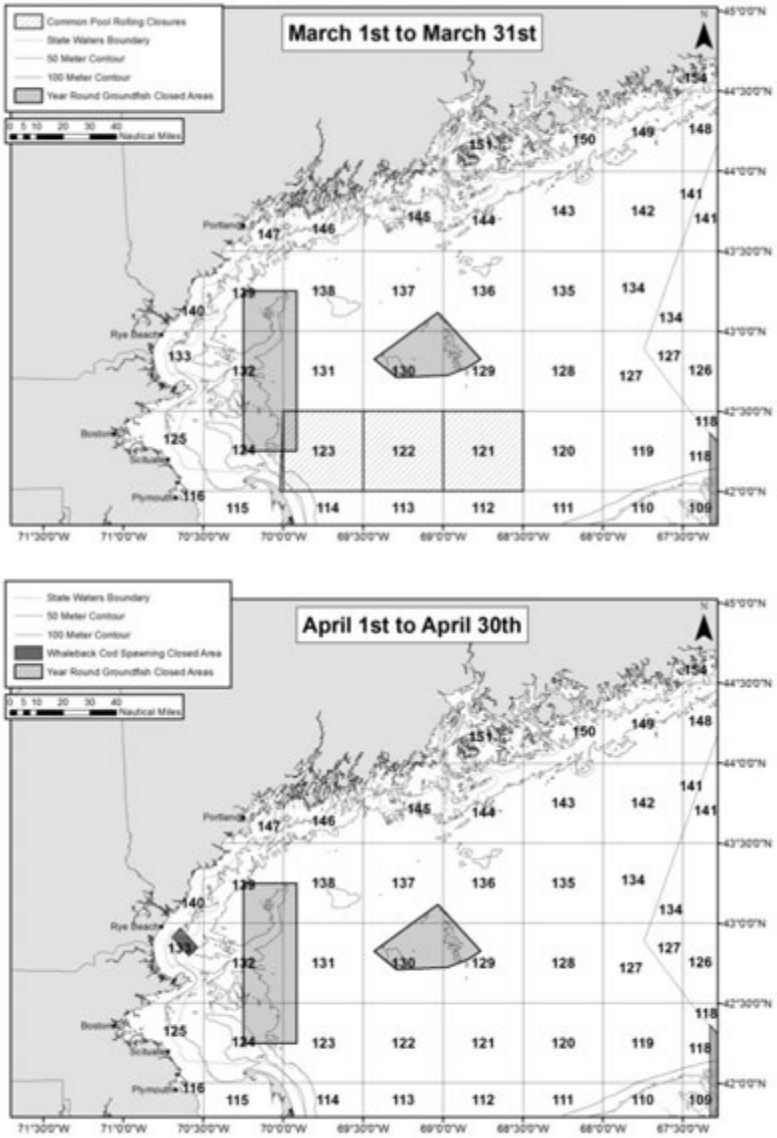
Proposed GOM Cod Protection Closures



Common Pool and Sector Rolling Closures



Proposed GOM Cod Protection Closures



4.2.2 Default Groundfish Specifications

4.2.2.1 Option 1: No Action

In the event of a delay in rulemaking, there would be no fishing for stocks without specifications in place on May 1, nor any fishing for other groundfish stocks that share the same Broad Stock Area (BSA) as stocks with no specifications.

Rationale: Because the fishing year would begin without specifications in place, the No Action alternative would not address M-S Act requirements to achieve OY and consider the needs of fishing communities.

4.2.2.2 Option 2: Percentage Rollover Provisions for Default Specifications *(Preferred Alternative)*

If this option is implemented, a default percentage of the prior year's ACL, as identified in the sub-options below, would be rolled over in the absence of specifications due to a delay in rulemaking. The default specifications would expire on August 1st, and may not exceed the anticipated ABC for the upcoming FY. In the event that the default rollover ACL exceeds the value of the ABC for the upcoming fishing year, then the default rollover would be set equalt to the ABC for the upcoming fishing year. Default specifications would be replaced by approved OFL, ABC, and ACL values upon rulemaking. All catches occurring while default specifications are in place (after May 1st through final rulemaking) would be counted against each component's allocation and the updated ACL for the FY. Northeast groundfish sectors would not be subject to a 20% holdback of the prior year's Sector Annual Catch Entitlement while default specifications are in place.

Rationale: This measure would allow the directed groundfish fishery to begin on-time in the event that specifications were not in place in time for the start of the fishing year. A percentage less than 100% of the prior year's OFL, ABC, and ACL, not to exceed the next year's ABC, reflects a more precautionary approach to rollover provisions than carrying forward 100% of the prior year's specifications (as done in other FMPs) because of the variation in stock statuses within the multispecies complex. Delays in final rulemaking for specifications actions are anticipated to be minor, and the limited duration of the "rollover period" (August 1st end date) retains a timeline for rulemaking while allowing the fishing year to begin on time. In the event that there was a continued delay in rulemaking (beyond August 1st), there would be no fishing for stocks without specifications in place, nor any fishing for other groundfish stocks that share the same BSA as stocks with no specifications. Nothing in this measure would change the distribution or conditions of the commercial and recreational fishery allocations (e.g. trimester TACs).

The Council considered either sub-option A, B, or C.

<u>Sub-Option A:</u> Default Rollover 35% of all groundfish stocks to the following FY. *(Preferred Alternative)*

If implemented, this option would allow for an 35% default rollover of the prior year's OFL, ABC, and ACL for all groundfish stocks for implementation at the start of the following FY unless the rollover value of the specifications exceed ABC recommendations, in which case the default specification would be set equal to the ABC for the upcoming FY.

Rationale: Reducing the allowable catch in the fishery by 65% builds in precaution to protect stocks whose status may have changed while allowing the fishing year to begin on time. This option is the least

precautionary of the three sub-options, and most accommodating to fishing businesses that prosecute the fishery early on the fishing year.

Sub-Option B: Default Rollover 20% of all groundfish stocks to the following FY.

If selected, this option would allow for a 20% default rollover of the prior year's ACL for all groundfish stocks for implementation at the start of the following FY unless the rollover value of the specifications exceed ABC recommendations, in which case the default specification would be set equal to the ABC for the upcoming FY.

Rationale: Reducing the allowable catch in the fishery by 80% builds in precaution to protect stocks whose status may have changed while allowing the fishing year to begin on time. More precautionary than sub-Option A, Option B would constrain catches to prevent overfishing, and likely fishing businesses that prosecute the fishery predominately during summer months.

Sub-Option C: Default Rollover 10% of all groundfish stocks to the following FY.

If selected, this approach would allow for an 10% default rollover of the prior year's OFL, ABC, and ACL for all groundfish stocks for implementation at the start of the following FY unless the rollover value of the specifications exceed ABC recommendations, in which case the default specification would be set equal to the ABC for the upcoming FY.

Rationale: Reducing the allowable catch in the fishery by 90% builds in precaution to protect stocks whose status may have changed while allowing the fishing year to begin on time. As the most precautionary of the three sub-options, Option C would likely constrain for fishing businesses that prosecute the fishery predominately during summer months.

4.2.3 Sector ACE Carryover

4.2.3.1 Option 1: No Action

The No Action alternative would continue to allow groundfish sectors to carry over up to 10% of their unused sector ACE, as outline in Amendment 16 to the Northeast Multispecies FMP.

Note: The No Action would be inconsistent with a ruling from the U.S. District Court for the District of Columbia that invalidated and vacated carryover provisions included in the Framework Adjustment 50 rulemaking. The ruling specified that the value of the stock-specific ACL plus the carryover of unused ACE may not exceed the following year's ABC. While the Court's ruling invalidated the carryover provision included in the Framework Adjustment 50 rulemaking, it did not change carryover rules adopted in Amendment 16.

4.2.3.2 Option 2: Modification to Sector ACE carryover *(Preferred Alternative)*

This option would modify Amendment 16 carryover provisions. Groundfish sectors would be able to carry forward up to 10% of unused ACE provided that the total unused sector ACE carried forward for all sectors from the previous FY plus the total ACL does not exceed the ABC for the fishing year in which the carryover would be harvested (e.g., from FY 2014 to FY 2015). If the total exceeds the ABC, NMFS would adjust the maximum amount of unused carryover (down from 10%) to an amount equal to or less than the ABC of the following fishing year. This alternative does not change the accountability measure

criteria previously adopted by NMFS' May 2014 carryover action. Sectors would continue to be required to pay back carried over catch used only when both the sector sub-ACL and total ACL are exceeded.

Rationale: This option addresses the U.S. District Court for the District of Columbia's April 4, 2014 ruling on NMFS' carryover-related measures included in the Framework Adjustment 50 rulemaking, which invalidated and vacated the FY 2013 carryover measures. The ruling also specified that a 'total potential catch' (the total ACL plus 10% unused ACE carryover) cannot exceed the ABC for any stock. This revision is necessary to cap the amount of carryover that can be harvested to ensure that the 'total potential catch' (i.e., total ACL + max. carryover) does not exceed the ABC for the fishing year in which the carried over ACE may be harvested.

5.0 Alternatives Considered and Rejected

5.1 Updates to Status Determination Criteria, Formal Rebuilding Programs, and Annual Catch Limits

5.1.1 Annual Catch Limits

5.1.1.1 Provisional Annual Biological Catch for GOM Cod

At its September 2014 meeting, the Council considered the SSC's *provisional* 200 mt ABC recommendation for GOM cod. The SSC reported at the Council meeting that it intended to revisit its ABC recommendation pending further information vetted through the PDT on non-target incidental catch of GOM cod. The SSC requested this information because it felt that it had insufficient information to adequately address Part C of the ABC default control rule.[2] However, the SSC did feel that it had sufficient information to recommend an OFL at 514 mt. The Council moved to provisionally accept the ABC at 200 mt for analysis purposes with the understanding that the SSC may recommend a different (higher or lower) ABC, and that this value – by definition – would be less than the recommended OFL of 514 mt. After reviewing additional information vetted through the PDT, the SSC recommended an ABC of 386 mt for GOM cod. The Council endorsed the SSC's updated ABC value, which is included in Section 4.1.2.2 (see Appendix I for a summary of SSC discussion and recommendations).

Rationale for not including 5.1.1.1: The GOM cod specification included in Option 2 in Section 4.1.2.2 was determined by the SSC to prevent overfishing, as required by the MSA. This value represents the best scientific information, as determined by the Council's SSC, and the M-S Act requires that catches not be set higher than these levels. After the SSC updated the 200 mt provisional ABC to a 386mt based on new, incidental catch information, the Council rejected using the lower ABC value for analysis because it would not mitigate economic impacts on fishing communities.

5.2 Commercial and Recreational Fishery Measures

5.2.1 SNE/MA Windowpane Flounder Sub-ACLs for Groundfish Sectors and the Common Pool

5.2.1.1 Option 2: Create SNE/MA Windowpane Flounder sub-ACLs for Groundfish Sectors and the Common Pool

If selected, Option 2 would split the SNE/MA windowpane flounder stocks into sub-ACLs for groundfish sectors and the common pool based on a specified percentage. The Council would select a percentage for this measure that would apply to all future allocations (Table 13).

Rationale: NMFS began tracking fleet-specific catches of SNE/MA windowpane flounder by sectors and the common-pool in FY 2010 after the adoption and implementation of Amendment 16. This measure would split the commercial sub-ACL between sectors and the common pool based on each fleet's catch

[2] Part C of the Northeast Multispecies ABC Control Rule adopted in Amendment 16: "For stocks that cannot rebuild to B_{MSY} in the specified rebuilding period, even with no fishing, the ABC should be based on incidental bycatch, including a reduction in bycatch rate (i.e., the proportion of the stock caught as bycatch)."

history from FY 2010 – FY 2013. However, this measure alone does not necessarily make groundfish sectors and the common pool accountable for their own catches of SNE/MA windowpane flounder because it does not change the AM. The AM is triggered for all commercial groundfish vessels (common pool and sectors) if the groundfish sub-ACL is exceeded and the total ACL is also exceeded by the greater than the management uncertainty buffer.

Table 13 - SNE/MA Windowpane Flounder Catch (mt & %) by Sectors and the Common Pool.

	Groundfish ACL (mt)	Sector (mt)	Common-Pool (mt)	Total GF catch (mt)
2010	**154**	52.7	20.9	73.6
2011	**154**	83	28.5	111.5
2012	**72**	95.9	10.6	106.5
2013	**102**	86	30	116
Median		84.5	20.9	109
Mean		79.4	20.9	101.9

	Total Catch of Groundfish ACL (%)	Sector Catch(%)	Common-Pool (%)
2010	**47.8%**	71.6%	28.4%
2011	**72.4%**	74.4%	25.6%
2012	**147.9%**	90.0%	10.0%
2013	**113.7%**	74.1%	25.9%

Rationale for not including section 5.1.1: The Council considered distributing the commercial SNE/MA windowpane flounder sub-ACL between Northeast groundfish sectors and the common pool as a way to add catch accountability for both fleets. However, the options proposed for SNE/MA windowpane flounder would not have created new AMs for either fleet, and the entire groundfish fishery would continue to be subject to the existing AMs if ACLs are exceeded. The Council discussed splitting the commercial sub-ACL as a percentage between the fleets, but ultimately did not specify how the sub-ACLs would be calculated. Windowpane flounder is a non-allocated stock that is predominately discarded at-sea, and total catch estimates in the groundfish fishery are extrapolated based on observer data (NEFOP and ASM). This option was not pursued further because the measure would not sufficiently address the original intent of adding catch accountability and AMs for sectors and the common pool. Furthermore, this measure was not pursued in favor of a holistic examination of management options for windowpane flounder in the future.

5.2.2 GOM/GB Windowpane Flounder Sub-ACLs for Groundfish Sectors and the Common Pool

5.2.2.1 Option 2: Create GOM/GB Windowpane Flounder sub-ACLs for Groundfish Sectors and the common pool

If selected, Option 2 would split the GOM/GB windowpane flounder stock into sub-ACLs for groundfish sectors and the common pool based on a specified percentage. The Council would select a percentage for this measure that would apply to all future allocations (Table 14).

Rationale: NMFS began tracking fleet-specific catches of GOM/GB windowpane flounder by sectors and the common-pool in FY 2010 after the adoption and implementation of Amendment 16. This measure would split the commercial sub-ACL between sectors and the common pool based on each fleet's catch history from FY 2010 – FY 2013. However, this measure alone does not necessarily make groundfish sectors and the common pool accountable for their own catches of GOM/GB windowpane flounder because it does not change the AM. The AM is triggered for all commercial groundfish vessels (common pool and sectors) if the groundfish sub-ACL is exceeded and the total ACL is also exceeded by the greater than the management uncertainty buffer.

Table 14: GOM/GB Windowpane Catch (mt & %) by Sectors and the Common Pool.

	Groundfish ACL (mt)	**Sector catch (mt)**	**Common-Pool catch (mt)**	**Total GF catch (mt)**
2010	**110**	151.7	1.8	153.5
2011	**110**	156.2	0.3	156.5
2012	**129**	129.5	0.1	129.6
2013	**98**	237.3	0.2	237.5
Median		154	0.25	155
Mean		168.7	0.6	169.3

	Catch of Groundfish ACL (%)	Sector catch (%)	Common-Pool catch (%)
2010	**139.5%**	98.83%	1.17%
2011	**142.3%**	99.81%	0.19%
2012	**100.5%**	99.92%	0.08%
2013	**242.3%**	99.92%	0.08%

Rational for not including section 5.1.2: The Council considered distributing the commercial GOM/GB windowpane flounder sub-ACL between Northeast groundfish sectors and the common pool as a way to add catch accountability for both fleets. However, the options proposed for GOM/GB windowpane flounder sub-ACL would not have created new AMs for either fleet, and the entire groundfish fishery would continue to be subject to AMs if ACLs were exceeded. The Council sought to split the commercial sub-ACL as a percentage between the fleets, but ultimately did not specify how the sub-ACLs would be calculated. Commercial catch data indicates that over 99% of the GOM/GB windowpane flounder catch comes from vessels enrolled in sectors. Windowpane flounder is a non-allocated stock that is

predominately discarded at-sea, and total catch estimates in the groundfish fishery are extrapolated based on observer data (NEFOP and ASM). This option was not pursued further because nearly all windowpane catch in the commercial groundfish fishery is attributable to sectors, and this measure would not address original intent of adding catch accountability and AMs for sectors and the common pool. Furthermore, this measure was not pursued in favor of a holistic examination of management options for windowpane flounder in the future.

5.2.3 GOM/GB Windowpane Flounder Scallop Fishery Sub-ACL

5.2.3.1 Option 2: Create a Scallop Fishery GOM/GB Windowpane Flounder Sub-ACL

If this option is adopted, a sub-ACL of GOM/GB (northern) windowpane flounder would be allocated to the scallop fishery based on a percentage of recent catches (2%-14%) as shown in Table 15. Catches of this stock by scallop vessels would no longer be counted as part of the "other sub-components" category. The scallop sub-ACL would be based on recent scallop fishery catches (as a percent of the total) for the period calendar year 2001 through 2010. The selected percentage of the ABC would be used to determine the scallop fishery sub-ABC, and then adjusted downwards for management uncertainty to calculate the scallop fishery sub-ACL. Catches of this stock by scallop vessels would no longer be counted as part of the "other sub-components" category of the ACL, and the amount set-aside for the other sub-components would be reduced (Table 9).

To identify the scallop fishery catch history of GOM/GB windowpane flounder, it is important to note that prior to 2004, there was limited observer coverage of the General Category scallop dredge fleet, and discards from this fleet were not included in the 2012 Assessment Update for GOM/GB windowpane flounder. From 2004 to 2011, the average General Category catch of this stock was 4 mt, and this catch assumption was added to the scallop fishery catch values for each year from 2001 through 2010.

Based on these updated catches for calendar year 2001-2010 (see Table 15):

- The 90th percentile would be 14 % (rounded up from 13.7%) of all catches for this stock.
- The median would be 8% (rounded up from 7.6%) of all catches for this stock.
- The mean would be 8% (rounded up from 7.8%) of all catches for this stock.
- The range would be 2 % (rounded down from 2.2%) to 14% (rounded up from 13.9%) of all catches for this stock.

Specific scallop fishery AMs would be adopted by the scallop FMP within one year of the implementation of this sub-ACL. Any scallop fishery overage in FY 2015 would be subject to the AMs that are adopted through the scallop FMP. Consistent with the approach adopted in Framework 47 to the multispecies FMP, any scallop fishery AMs for this sub-ACL would only be triggered if: 1) the scallop fishery sub-ACL is exceeded and the total ACL is also exceeded; or 2) the scallop fishery sub-ACL is exceeded by more than 50 percent.

Rationale: The scallop fishery catches of this stock are large enough that the effectiveness of the AM system could be undermined if those catches are not subject to a scallop specific AM. In addition, adopting an allocation for the scallop fishery would also ensure the groundfish fishery is not negatively affected by any overage caused by the scallop fishery. The scallop fishery is virtually the sole contributor of the other sub-component catches. For these reasons, only this component was pursued for development of an allocation at this time.

Rational for not including section 5.1.3: The Council considered creating a scallop fishery sub-ACL for GOM/GB windowpane flounder as a way to add catch accountability for the scallop fishery, and decouple

the groundfish fishery from impacts of ACL overages caused in part by scallop fishery catches (e.g., FY 2012). However, this measure was not pursued in favor of a holistic examination of management options for windowpane flounder in the future.

Table 15 - Limited access scallop fishery discards of GOM/GB windowpane flounder, 2001-2010. Landings were less than 1 metric ton in all years. Catch from Table I2 in the 2012 GF Updates pp. 571. LA Scallop Dredge from Table I5 in the 2012 GF Updates pp. 573-574. General Category estimated catch was 4 mt, an average of 2004-2011 discards, using the same method as the in the 2012 GF Updates.

Calendar Year	Catch (mt)	Limited Access Scallop Dredge (mt)	Limited Access Scallop Fishery Catches as Percent of Total	General Category Scallop Fishery Catch Assumption (mt)	Total Scallop Fishery Catch As Percent of Total
	A	B	B/A	C	(B+C)/(A+C)
2001	229	22	9.6%	4	11.2%
2002	176	21	11.9%	4	13.9%
2003	377	13	3.4%	4	4.5%
2004	328	7	2.1%	4	3.3%
2005	968	17	1.8%	4	2.2%
2006	683	73	10.7%	4	11.2%
2007	1091	98	9.0%	4	9.3%
2008	376	43	11.4%	4	12.4%
2009	440	15	3.4%	4	4.3%
2010	236	9	3.8%	4	5.4%
		Mean (average), 2001-2010	6.7%		7.8%
		Median, 2001-2010	6.4%		7.6%
		90th percentile, 2001-2010	11.9%		13.7%

5.2.4 Observer Requirements in the GOM

5.2.4.1 Option 2: Revised Observer Requirements on trips in the GOM and GB cod broad stock areas

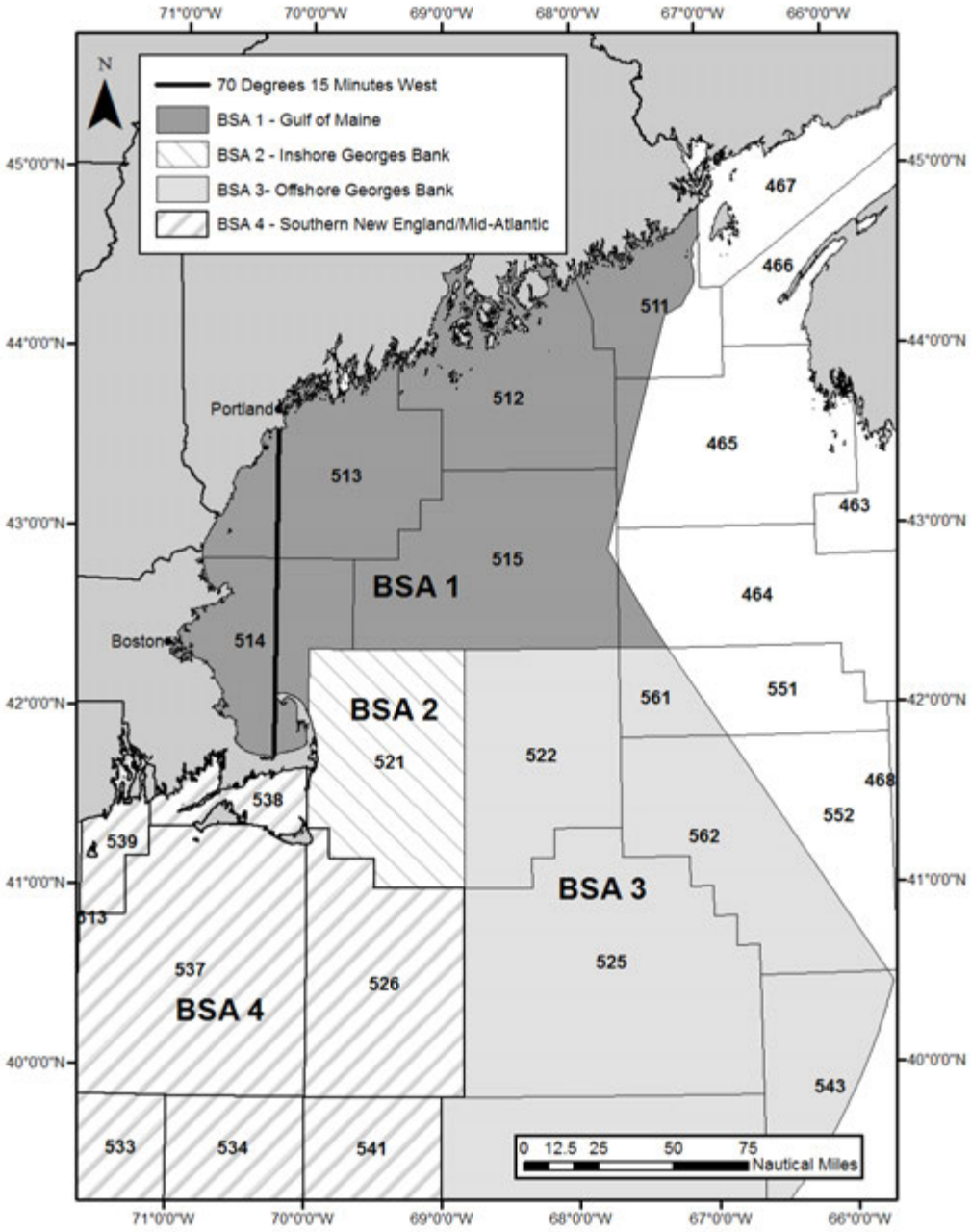
If selected, Option 2 would prohibit commercial vessels from fishing in the GOM west of 70° 15' W longitude and any other broad stock area (e.g., BSA2, BSA3, BSA4) on the same trip, unless carrying an observer (Figure 7). However, vessels fishing only in the GOM cod stock area (BSA1) would not be restricted by this measure. As an example, a vessel fishing only in the BSA1/GOM cod stock area on a given trip could fish on either side of the 70° 15' W longitude line, even if an observer was not on board. A vessel carrying an observer would not be restricted in where they could fish on a given trip (i.e., these

vessels could fish in all BSAs). Trip declarations of the area that would be fished would be made to NMFS and via the Trip Start Hail report through a vessel's VMS system.

Rationale: This option aims to improve catch accounting of GOM and GB cod by restricting where commercial vessels can fish when not carrying an observer. Vessels carrying an observer would not be restricted by this measure. Option 2 is designed in a similar manner to measures adopted in Northeast Groundfish Sector operations plans. For observed trips, this option would provide flexibility to be able to fish in both cod broad stock areas on a single trip.

Rationale for not including Section 5.1.4: The Council did not pursue this option any further because a similar voluntary measure is currently place for all groundfish sectors, and over concern that the measure would create observer bias for discard estimates.

Figure 7 - Map of Broad Stock Reporting Areas, highlighting the 70° 15' W longitude.



5.2.5 Option 2: Additional GOM Cod Spawning Protection Measures (see Section 4.2.1)

Sub-Option C: If selected, this option would create seasonal GOM cod spawning closure areas in the GOM. All commercial and recreational groundfish fishing would be prohibited in the following 30-minute blocks (Figure 8):

- May: 125, 133
- June: 133
- November – January: 125, rectangle within Block 124 defined by the following coordinates:
    - 42° 00'……70° 30'
    - 42° 00'……70° 24'
    - 42° 15'……70° 24'
    - 42° 15'……70° 30'
- April: 125, 133

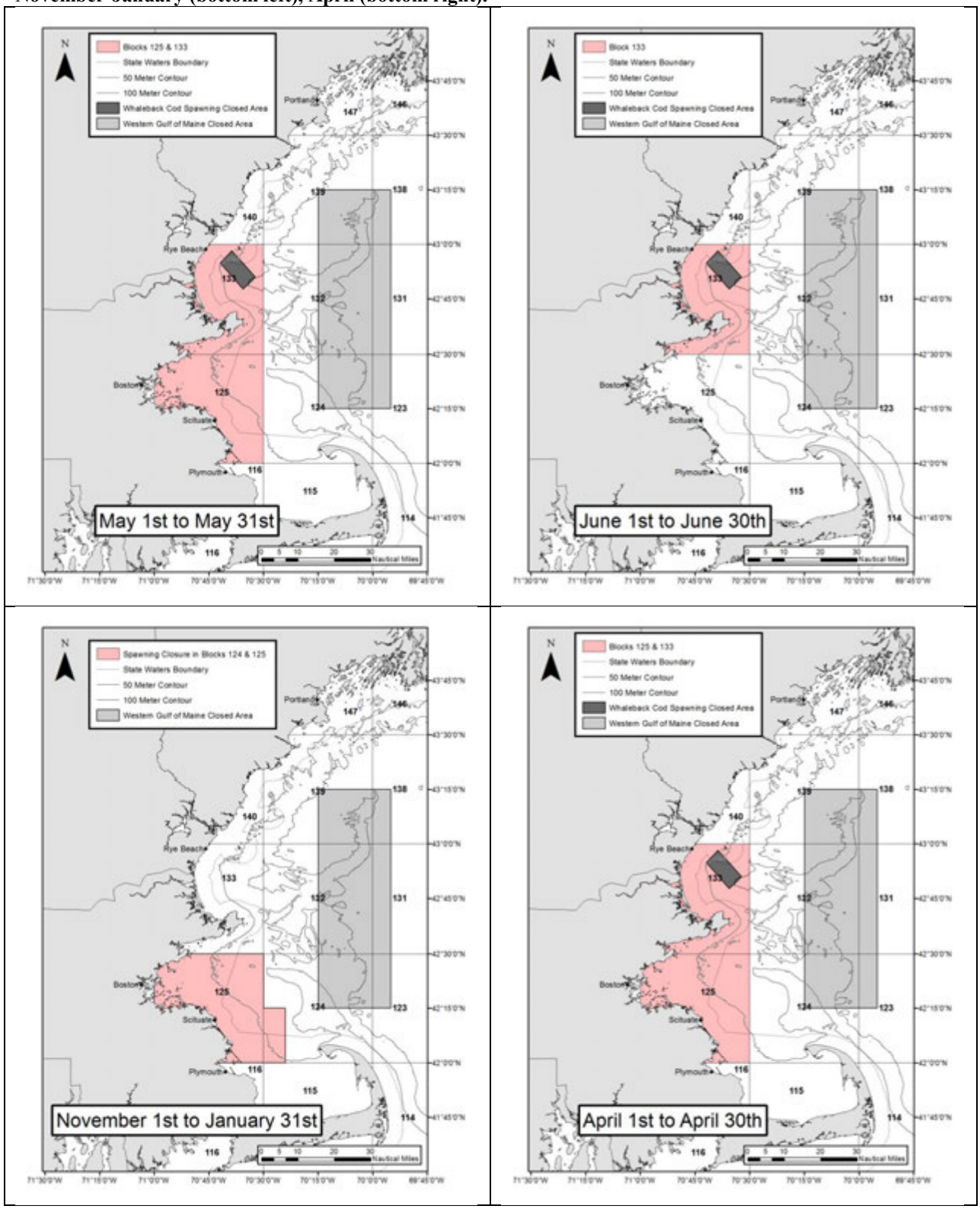
Provisions that apply to Sub-Option C:

- All commercial fishing vessels using gear capable of catching groundfish are prohibited from fishing in the areas during the dates specified. Only fishing with exempted gear (that is, gear deemed not capable of catching groundfish as defined by 50 CFR 648.2) is allowed in the area.
- Recreational fishing vessels (including party-charter vessels) are subject to the following restrictions:
    - All recreational fishing vessels using gear capable of catching groundfish are prohibited from fishing in the areas during the dates specified. Only pelagic hook and line gear, as defined in the commercial fishing exempted gear regulations, is allowed for use in the area.
- A fishing vessel (commercial or recreational) may transit the area as long as gear is properly stowed in accordance with regulations promulgated by the Regional Administrator.
- The take or possession of any groundfish species by vessels using exempted gear would be prohibited in the areas described above.

Rationale: This measure would restrict commercial and recreational fishing in areas in the GOM that have been identified as being important for seasonal cod spawning. This alternative is designed using smaller closure areas to protect spawning cod and is less conservative than Sub-Option A and Sub-Option B, and captures some GOM cod spawning activity.

Rational for not including Section 5.1.5: This option is the least restrictive of the three proposed GOM cod spawning closures (see Section 4.2.1.1), and the November – January closures mirror those proposed in the GOM cod protection closure measures (in Section 4.2.1.3). Sub-Option C was first introduced, and added into FW53, by the Council at its November meeting prior to selecting preferred alternatives for GOM cod spawning closure areas. Later in the meeting, after selecting the No Action Alternative as the preferred alternative for GOM cod spawning closures, the Council moved Sub-Option C to considered but rejected because the Council did not request any additional analysis of this option.

Figure 8 - Sub-Option C proposed GOM cod spawning closure areas in May (top left), June (top right), November-January (bottom left), April (bottom right).



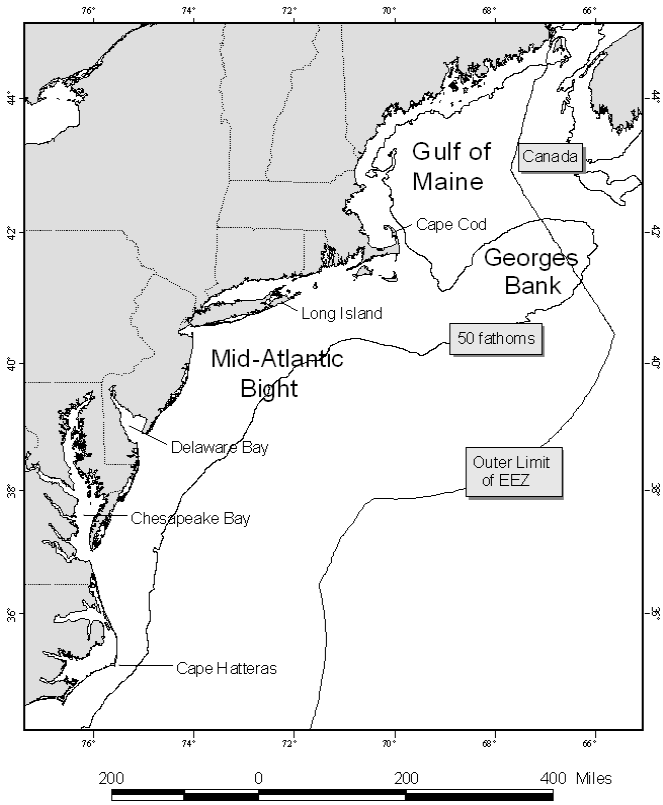
6.0 Affected Environment

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

6.1 Physical Environment/Habitat/EFH

The Northeast U.S. Shelf Ecosystem (Figure 9) includes the area from the Gulf of Maine south to Cape Hatteras, North Carolina. It extends from the coast seaward to the edge of the continental shelf and offshore to the Gulf Stream (Sherman et al. 1996). The continental slope includes the area seaward of the shelf, out to a depth of 6,562 feet (ft.) [2,000 meters (m)]. Four distinct sub-regions comprise the NMFS Northeast Region: the Gulf of Maine, Georges Bank, the southern New England/Mid-Atlantic region, and the continental slope. Sectors primarily fish 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 and biological environment focuses on these sub-regions. Information in this section was extracted from Stevenson et al. (2004).

Figure 9 – Northeast U.S. Shelf Ecosystem.

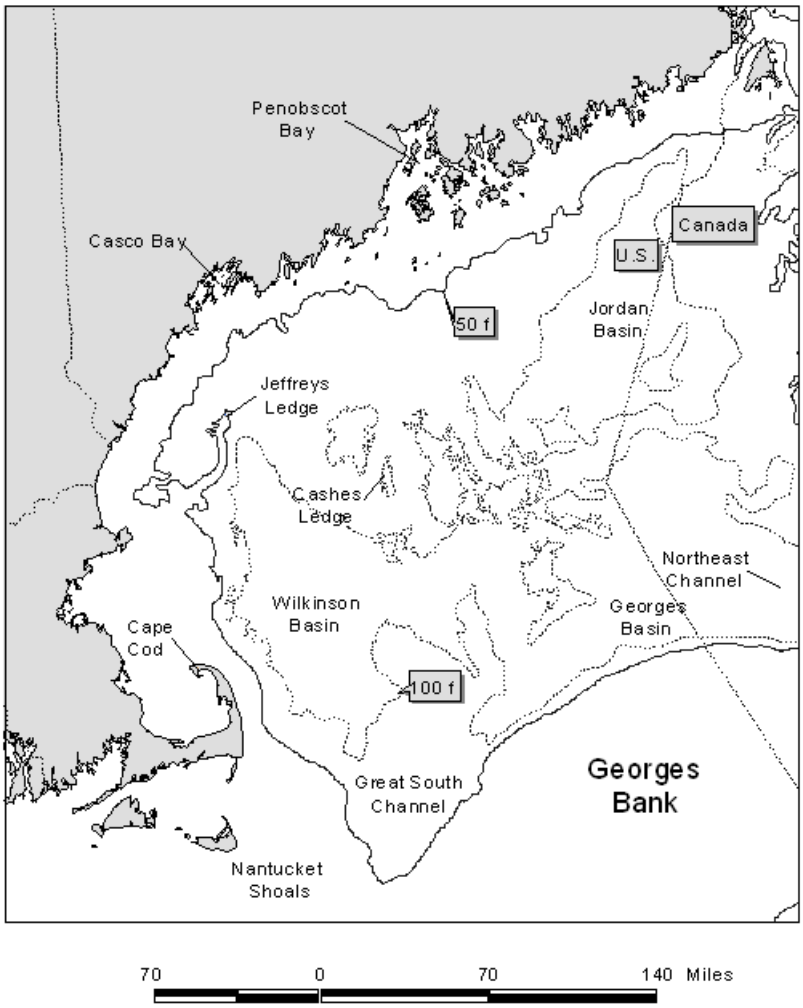


6.1.1 Gulf of Maine

The Gulf of Maine is 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 (Figure 10). The Gulf of Maine is a boreal environment characterized by relatively cold waters and deep basins,

with a patchwork of various sediment types. 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.

Figure 10 – Gulf of Maine.



The Gulf of Maine is an enclosed coastal sea that was glacially derived and is characterized by a system of deep basins, moraines, and rocky protrusions. The Gulf of Maine is topographically diverse from the rest of the continental border of the U.S. Atlantic coast (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. These mud deposits blanket and obscure the irregularities of the underlying bedrock, forming topographically smooth terrains. 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,[3] 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 to 131 ft. (20 to 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.

The geologic features of the Gulf of Maine coupled with the vertical variation in water properties (e.g., salinity, depth, temperature) combine to provide a great diversity of habitat types that support a rich biological community. To illustrate this, 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 to 459 ft. (60 to 140 m) within cold Gulf of Maine Intermediate Water:[4] 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 to 46 °F (7 to 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 greater than 46 °F (8°C): upper slope fauna extending into the Northeast Channel.

Two studies (Gabriel 1992; Overholtz & Tyler 1985) reported common[5] demersal fish species by assemblages in the Gulf of Maine and Georges Bank:

- Deepwater/Slope and Canyon: offshore hake, blackbelly rosefish, Gulf stream flounder;

[3] 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.
[4] 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 Gulf of Maine.
[5] Other species were listed as found in these assemblages, but only the species common to both studies are listed.

- 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.

6.1.2 Georges Bank

Georges Bank is a shallow (10 to 492 ft. [3 to 150 m depth]), elongated ((100 miles [mi] (161 kilometer [km] wide) by 20 mi (322 km long)) extension of the continental shelf that was formed during the Wisconsinian glacial episode (Figure 2). 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 primary productivity and fish production. The most common groups of benthic invertebrates on Georges Bank in terms of numbers collected were amphipod crustaceans and annelid worms, while sand dollars and bivalves dominated the overall biomass (Theroux and Wigley 1998). Using the same 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 to 656 ft. [150 to 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 less than 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 to 656 ft. (80 to 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.

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.

6.1.3 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 (Figure 2). 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 between 62 to 124 ft. (100 and 200 km) offshore where it transforms to the slope (328 to 656 ft. [100 to 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 to 31 mi (10 to 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 to 10 with heights of about 7 ft. (2 m), lengths of 164 to 328 ft. (50 to 100 m), and 0.6 to 1 mi (1 to 2 km) between patches. Sand waves are temporary features that form and re-form in different locations. They usually occur on the inner shelf, especially in areas like Nantucket Shoals where there are strong bottom currents. 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. Artificial reefs formed much more recently on the geologic time scale than other regional habitat types. These localized areas of hard structure have been formed 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 either 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.

In terms of numbers, amphipod crustaceans and bivalve mollusks dominate the benthic inhabitants of this primarily sandy environment. Mollusks (70%) dominate the biomass (Theroux and Wigley 1998). 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 percent or less 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."

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.

Colvocoresses and Musick (1984) identified the following assemblages in the Mid-Atlantic sub region during spring and fall.[6]

- 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 searobin;
- 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.

6.1.4 Habitat requirements of groundfish (focus on demersal life stages)

Habitats provide living things with the basic life requirements of nourishment and shelter. This ultimately provides for both individual and population growth. The quantity and quality of available habitat influences the fishery resources of a region. Depth, temperature, substrate, circulation, salinity, light, dissolved oxygen, and nutrient supply are important parameters of a given habitat. These parameters determine the type and level of resource population that the habitat supports. Table 16 briefly summarizes the habitat requirements for each of the large-mesh groundfish species/stocks managed by the Northeast Multispecies FMP. Information for this table was extracted from the original Northeast

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

Multispecies FMP and profiles available from NMFS. EFH information for egg, juvenile, and adult life stages for these species was compiled from Stevenson et al. 2004 (Table 16). Note that EFH for the egg stage was included for species that have a demersal egg stage (winter flounder and ocean pout); all other species' eggs are found either in the surface waters, throughout the water column, or are retained inside the parent until larvae hatch. The egg habitats of these species are therefore not generally subject to interaction with gear and are not listed in Table 16.

Table 16 – Summary of Geographic Distribution, Food Sources, Essential Fish Habitat Features and Commercial Gear used to Catch Each Species in the Northeast Multispecies Fishery Management Unit.

Species	Geographic Region of the Northwest Atlantic	Food Source	Essential Fish Habitat		Commercial Fishing Gear Used
			Water Depth	Substrate	
Atlantic Cod	Gulf of Maine, Georges Bank and southward	Omnivorous (invertebrates and fish)	(J): 82-245 ft. (25-75 m) (A): 33-492 ft. (10-150 m)	(J): Cobble or gravel bottom substrates (A): Rocks, pebbles, or gravel bottom substrate	Otter trawl, bottom longlines, gillnets
Haddock	Southwestern Gulf of Maine and shallow waters of Georges Bank	Benthic feeders (amphipods, polychaetes, echinoderms), bivalves, and some fish	(J): 115-328 ft. (35-100 m) (A): 131-492 ft. (40-150 m)	(J): Pebble and gravel bottom substrates (A): Broken ground, pebbles, smooth hard sand, smooth areas between rocky patches	Otter trawl, bottom longlines, gillnets
Acadian redfish	Gulf of Maine, deep portions of Georges Bank and Great South Channel	Crustaceans	(J): 82-1,312 ft. (25-400 m) (A): 164-1,148 ft. (50-350 m)	(J): Bottom habitats with a substrate of silt, mud or hard bottom (A): Same as for (J)	Otter trawl
Pollock	Gulf of Maine, extends to Georges Bank, and the northern part of Mid-Atlantic Bight	Juvenile feed on crustaceans, adults also feed on fish and mollusks	(J): 0-820 ft. (0-250 m) (A): 49-1,198 ft. (5-365 m)	(J): Bottom habitats with aquatic vegetation or substrate of sand, mud or rocks (A): Hard bottom habitats including artificial reefs	Otter trawl, gillnets
Atlantic Halibut	Gulf of Maine, Georges Bank	Juveniles feed on annelid worms and crustaceans, adults mostly feed on fish	(J): 66-197 ft. (20-60 m) (A): 328-2,297 ft. (100-700 m)	(J): Bottom habitat with a substrate of sand, gravel or clay (A): Same as for (J)	Otter trawl bottom longlines
Ocean Pout	Gulf of Maine, Cape Cod Bay, Georges Bank, Southern New England, Middle Atlantic south to Delaware Bay	Juveniles feed on amphipods and polychaetes. Adults feed mostly on echinoderms, mollusks &	(E): <164 ft. (<50 m)	(E): Bottom habitats, generally hard bottom sheltered nests, holes or crevices where juveniles are	Otter trawl

		crustaceans		guarded	
			(L): <164 ft. (<50 m)	(L): Hard bottom nesting areas	
			(J): 262 ft. (<80 m)	(J): Bottom habitat, often smooth areas near rocks or algae	
			(A): 361 ft. (<110 m)	(A): Bottom habitats; dig depressions in soft sediments	
White hake	Gulf of Maine, Georges Bank, Southern New England	Juveniles feed mostly on polychaetes and crustaceans; adults feed mostly on crustaceans, squids and fish	(J): 16-738 ft. (5-225 m)	(J): Bottom habitat with seagrass beds or substrate of mud or fine-grained sand	Otter trawl, gillnets
			(A): 16-1,066 ft. (5-325 m)	(A): Bottom habitats with substrate of mud or find grained sand	
Yellowtail flounder	Gulf of Maine, Southern New England, Georges Bank	Amphipods and polychaetes	(J): 66-164 ft. (20-50 m)	(J): Bottom habitats with substrate of sand or sand and mud	Otter trawl
			(A): 66-164 ft. (20-50 m)	(A): Same as for (J)	
American plaice	Gulf of Maine, Georges Bank	Polychaetes, crustaceans, mollusks, echinoderms	(J): 148-492 ft. (45-150 m)	(J): Bottom habitats with fine grained sediments or a substrate of sand or gravel	Otter trawl
			(A): 148-574 ft. (45-175 m)	(A): Same as for (J)	
Witch flounder	Gulf of Maine, Georges Bank, Mid-Atlantic Bight/Southern New England	Mostly polychaetes (worms), echinoderms	(J): 164-1,476 ft. (50-450 m)	(J): Bottom habitats with fine grained substrate	Otter trawl
			(A): 82-984 ft. (25-300 m)	(A): Same as for (J)	
Winter flounder	Gulf of Maine, Georges Bank, Mid-Atlantic Bight/Southern New England	Polychaetes, crustaceans	(E): 16 ft. (<5 m) (J): 0.3-32 ft. (0.1-10 m) (3-164 age 1+) (1-50 m) (A): 3.2-328 ft. (1-100 m)	(J): Bottom habitats with a substrate of mud or fine grained sand (A): Bottom habitats including estuaries with substrates of mud, sand, gravel	Otter trawl, gillnets

Atlantic wolffish	Gulf of Maine & Georges Bank	Mollusks, brittle stars, crabs, and sea urchins	(J): 131, 2-787.4 ft. (40-240 m) (A): 131.2-787.4 ft. (40-240 m)	(J): Rocky bottom and coarse sediments (A): Same as for (J)	Otter trawl, bottom longlines, and gillnets
Windowpane flounder	Gulf of Maine, Georges Bank, Mid-Atlantic Bight/Southern New England	Juveniles mostly crustaceans; adults feed on crustaceans and fish	(J): 3.2-328 ft. (1-100 m) (A): 3.2-574 ft. (1-75 m)	(J): Bottom habitats with substrate of mud or fine grained sand (A): Same as for (J)	Otter trawl

6.1.5 Essential Fish Habitat (EFH) 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; Atlantic sea scallop; monkfish; deep-sea red crab; northeast skate complex; Atlantic herring; summer flounder, scup, and black sea bass; tilefish; squid, Atlantic mackerel, and butterfish; Atlantic surf clam and ocean quahog FMPs. 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 16 summarizes the EFH descriptions of the general substrate or bottom types for all the benthic life stages of the species managed under these FMPs. Full descriptions and maps of EFH for each species and life stage are available on the NMFS Northeast Region website at http://www.nero.noaa.gov/hcd/index2a.htm. 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.

6.1.6 Gear Types and Interaction with Habitat

A variety of gears are used to prosecute the multispecies fishery (Table 17) Groundfish vessels fish for target species with a number of gear types: trawl, gillnet, fish pots/traps, and hook and line gear (including jigs, handline, and non-automated demersal longlines). This section discusses the characteristics of each of the proposed gear types as well as the typical impacts to the physical habitat associated with each of these gear types.

6.1.6.1 Gear Types

Table 17 - 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 inches (38 cm) long, 3 to 6 inches (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 inches [16.5 cm])	No nets, but 12/0 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 trending 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

6.1.6.1.1 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.

Fishermen use the mid-water trawl to capture pelagic species throughout the water column. The mouth of the net typically ranges from 361 to 558 ft. (110 m to 170 m) and requires the use of large vessels (Sainsbury 1996). Successful mid-water trawling requires the effective use of various electronic aids to find the fish and maneuver the vessel while fishing (Sainsbury 1996). Tows typically last for several hours and catches are large. Fishermen usually remove the fish from the net while it remains in the water alongside the vessel by means of a suction pump. Some fishermen remove the fish in the net by repeatedly lifting the codend aboard the vessel until the entire catch is in the hold.

Bottom otter trawls account for nearly all commercial bottom trawling activity. There is a wide range of otter trawl types used in the Northeast due to the diversity of fisheries and bottom types encountered in the region (Northeast Region Essential Fish Habitat Steering Committee 2002). The specific gear design used 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). A number of different types of bottom otter trawl used in the Northeast are specifically designed to catch certain species of fish, on specific bottom types, and at particular times of year. 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 swinning up off the bottom where they can be entrained intonet. Flatfish trawls are used on smooth mud and sand bottoms. 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 (Northeast Region Essential Fish Habitat Steering Committee 2002).

Bottom otter trawls can be rigged with rockhopper gear for use on "hard" bottom (i.e., gravel or rocky bottom), 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 to 2.0 ft. (0.5 to 0.6 m) above the bottom (Carr and Milliken 1998). 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 and 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 2009a).

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 (NOAA 2009).

6.1.6.1.2 Gillnet Gear

Individual sink/anchor gillnets are about 295 ft. (90 m) long, and are usually fished as a series of 5 to 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 kilogram (kg)/net). Webs are usually 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 New England groundfish, frequency of tending gillnets ranges from daily to semiweekly (Northeast Region Essential Fish Habitat Steering Committee 2002).

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. Gillnets are highly selective because the species and sizes of fish caught are dependent on the mesh size of the net. The meshes of individual gillnets are uniform in size and shape, hence 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 to 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.

6.1.6.1.3 Fish Traps/Pots

Fish traps, pots, and lobster pots are similar. To help differentiate, the following descriptions are given. 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 were constructed of 2 cm diam. PVC electrical conduit, with 13 cm radius corners, glued with cement. The frame sizes were 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 were anchored with >5 kg links of chain. The PVC pipes were then perforated and 11 deep-water gillnet floats were added along the upper frame to achieve proper orientation. During the tank investigation, 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.

6.1.6.1.4 Hook and Line Gear

6.1.6.1.4.1 Hand Lines/Rod and Reel

The simplest form of hook and line fishing is the hand line. 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). Fishermen use hand lines as well as rods and reels in the Northeast Region to catch a variety of demersal species.

6.1.6.1.4.2 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.

6.1.6.1.4.3 Bottom Longlines

A bottom longline consists of a long length of line to which short lengths of line ("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 to 24 lbs (9 to 11 kg) anchors. The mainline is a parachute cord. Gangions are typically 16 in (40 cm) long and 3 to 6 in (1 to 1.8 m) apart and are made of shrimp twine. These bottom longlines are usually set for a few hours at a time (Northeast Region Essential Fish Habitat Steering Committee 2002).

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

6.1.6.2 Gear Interaction with Habitat

Commercial fishing in the region has historically used trawls, gillnets, and bottom longline gear. Fishermen have intensively used trawls throughout the region for decades and currently account for the majority of commercial fishing activity in the multispecies fishery off New England.

The most recent Multispecies FMP action to include a comprehensive evaluation of gear effects on habitat was Amendment 13 (NEFMC 2003). Amendment 13 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). This report identified a number of possible effects of bottom otter trawls on benthic habitats and is based on scientific findings summarized in Lindeboom and de Groot (1998). The report focuses on the Irish Sea and North Sea, but assesses effects in other areas. 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 report also concluded the following about direct habitat effects:

- Loss or dispersal of physical features such as peat banks or boulder reefs results in <u>changes that are always permanent</u> and lead to an overall change in habitat diversity. This in turn leads to the local loss of species and species assemblages dependent on such features;
- Loss of structure-forming organisms such as bryozoans, tube-dwelling polychaetes, hydroids, seapens, sponges, mussel beds, and oyster beds results in <u>changes that may be permanent</u> leading to an overall change in habitat diversity. This in turn leads to the local loss of species and species assemblages dependent on such biogenic features;

- Changes are not likely to be permanent due to a reduction in complexity caused by redistributing and mixing of surface sediments and the degradation of habitat and biogenic features, leading to a decrease in the physical patchiness of the seafloor; and
- Changes are not likely to be permanent due to alteration of the detailed physical features of the seafloor by reshaping seabed features such as sand ripples or damaging burrows and associated structures that provide important habitats for smaller animals and can be used by fish to reduce their energy requirements.

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

The report from a "Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern U.S." sponsored by the NEFMC and MAFMC (NEFSC 2002) provides additional information for various Northeast region gear types. A panel of fishing industry members and experts in the fields of benthic ecology, fishery ecology, geology, and fishing gear technology convened for the purpose of assisting the NEFMC, MAFMC, and NMFS with:

- Evaluating the existing scientific research on the effects of fishing gear on benthic habitats;
- Determining the degree of impact from various gear types on benthic habitats in the Northeast;
- Specifying the type of evidence that is available to support the conclusions made about the degree of impact;
- Ranking the relative importance of gear impacts to various habitat types; and
- Providing recommendations on measures to minimize those adverse impacts.

The panel was provided with a summary of available research studies that summarized information 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.

The panel's report provides additional information on the recovery times for each type of impact for each gear type in mud, sand, and gravel habitats ("gravel" includes other hard-bottom habitats). This information made it possible for the panel to rank these three substrates in terms of their vulnerability to the effects of bottom trawling. The report also notes that other factors such as frequency of disturbance from fishing and from natural events are also important. 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 of shorter duration (days to months) given the exposure of most continental shelf sand habitats to strong bottom currents and/or frequent storms.

According to the panel, impacts of sink gillnets and bottom longlines on sand and gravel habitats would result in low degree impacts (NEFSC 2002). 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.

Amendment 13 also summarized the contents of a second expert panel report, produced by the Pew Charitable Trusts and entitled "Shifting Gears: Addressing the Collateral Impacts of Fishing Methods in U.S. Waters" (Morgan & Chuenpagdee 2003). This group evaluated the habitat effects of ten different commercial fishing gears used in U.S. waters. The report concluded that bottom trawls have relatively high habitat impacts; bottom gillnets and pots and traps have low to medium impacts; and bottom longlines have low impacts. As in the International Council for the Exploration of the Seas and National Research Council reports, the panel did not evaluate individual types of trawls and dredges. The impacts of bottom gillnets, traps, and bottom longlines were limited to warm or shallow water environments with rooted aquatic vegetation or "live bottom" environments (e.g., coral reefs).

Going beyond Amendment 13 analyses, one purpose of the ongoing Omnibus Essential Fish Habitat Amendment 2 (OA2) is to evaluate existing habitat management areas and develop new habitat management areas. To assist with this effort, the Habitat PDT 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 detailed in this document, available on the Council webpage: http://www.nefmc.org/habitat/sasi_info/110121_SASI_Document.pdf.

The spatial domain of the SASI model is US Federal waters (between 3-200 nm offshore) from Cape Hatteras to the US-Canada border. Within this region, habitats were defined based on natural disturbance regime and dominant substrate. Understanding natural disturbance regime is important because it 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 areas of 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 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. For this reason, additional data sources were used during habitat management area development.

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. Structurally complex and/or long-lived epifaunal species are more susceptible to gear damage and slower to recover. Recovery rates were assumed to be retarded in low energy areas, such that overall vulnerability (susceptibility + recovery) of low energy areas is greater than high energy areas, other factors being equal. When combined with the underlying substrate and energy distribution, the susceptibility and recovery scores assigned to the inferred mix of epifaunal and geological features generated a highly patchy vulnerability map. Locations where high proportions by area map out as cobble-dominated or cobble- and boulder-dominated tended to show higher vulnerability scores. 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, so mobile gear vulnerability scores are the focus here in the exemption area analyses below.

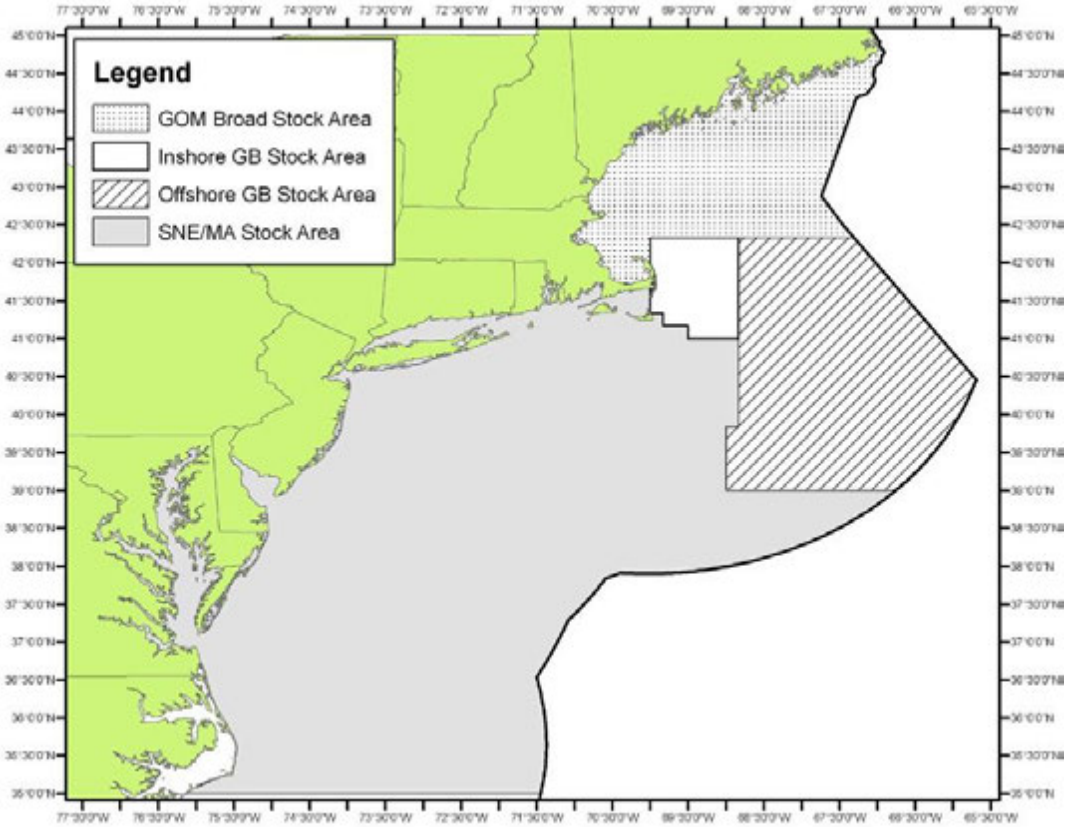
6.2 Groundfish Species

This section describes the life history and stock population status for groundfish species managed under the Northeast Multispecies FMP. Figure 16 identifies the four broad stock areas used in the fishery (Figure 11)Figure 11 - Broad stock areas as defined in Amendment 16. Please refer to the species habitat associations described in Section 6.1.6 for information on the interactions between gear and species. Section 6.1 also provides a comparison of depth-related demersal fish assemblages of Georges Bank and the Gulf of Maine. This section concludes with an analysis of the interaction between the gear types used to prosecute the Northeast multispecies fishery(as described in Section 6.1.6.1) and allocated target species. The following discussions have been adapted from the GARM III report (NEFSC 2008) and the EFH Source Documents: Life History and Habitat Characteristics are assessable via the NEFSC website at http://www.nefsc.noaa.gov/nefsc/habitat/efh/.

6.2.1 Species and Stock Status Descriptions

Target stocks for the groundfish fishery are GOM Cod, GB Cod, GOM Haddock, GB Haddock, American Plaice, Witch Flounder, GOM Winter Flounder, GB Winter Flounder, Cape Cod/GOM Yellowtail Flounder, GB Yellowtail Flounder, SNE/MA Yellowtail Flounder, Redfish, Pollock and White Hake.

Figure 11 - Broad stock areas as defined in Amendment 16.



The Northeast Multispecies FMP also manages Atlantic halibut, ocean pout, windowpane flounder, and SNE/MA winter flounder. These species are not targeted in the groundfish fishery . Possession of wolffish, ocean pout, and windowpane flounder is prohibited. Commercial vessels can retain one halibut

per trip, and recreational vessels are limited to 1 fish per vessel per trips. Wolffish are provisionally managed under the Northeast Multispecies FMP Amendment 16 to the Northeast Multispecies FMP (NEFMC 2009) addresses these species. These species are discussed in Section 6.2

Spiny dogfish, skates, and monkfish are considered in this EA as "non-allocated target species and bycatch" in Sections 6.3. The Northeast Multispecies FMP does not allocate these species. They and are managed under their own FMPs.

6.2.1.1 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 and Georges Bank. GOM cod attain sexual maturity at a later age than GB cod due to differences in growth rates between the two stocks. The greatest concentrations of cod off the Northeast coast of the U.S. are on rough bottoms in waters between 33 and 492 ft. (10 and 150 m) and at temperatures between 32 and 50°F (0 and 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 and 7°C). It is delayed until spring when winters are severe and peaks in winter when mild. Eggs are pelagic, buoyant, spherical, and transparent. They drift for 2 to 3 weeks before hatching. The larvae are pelagic for about three months until reaching 1.6 to 2.3 in (4 to 6 cm), at which point they descend to the seafloor. Most remain on the bottom after this descent, 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.

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=.2 and M-ramp) in the last two assessments yield two estimates for SSB in recent years, though both indicate a shape decline in SSB since 2010. The stock remains low relative to historic levels and is subject to a formal stock rebuilding plan. The 2013 biomass estimate, the most recent estimate available, was 3-4% percent of the biomass rebuilding target. Currently, the GOM cod stock is overfished and overfishing is occurring.

6.2.1.2 Georges Bank Cod

Life History: The GB cod stock, *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 and 150 m) and at temperatures between 32 and 50° F (0 and 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 and 7°C). It is delayed until spring when winters are severe and peaks in winter when 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 to 6 cm), at which point they descend to the seafloor. Most remain on the bottom after this descent, 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.

Population Status: GB cod are a transboundary stock harvested by both the U.S. and Canadian fishing fleets. The GB cod stock underwent a benchmark assessment in 2012, which indicated that the stock is overfished and overfishing is occurring.

6.2.1.3 Gulf of Maine Haddock

Life History: The GOM haddock, *Melanogrammus aeglefinus*, is a commercially-exploited groundfish found in the North Atlantic Ocean. This demersal gadoid species occurs from Cape May, New Jersey to the Strait of Belle Isle, Newfoundland in the western North Atlantic. A total of six distinct haddock stocks have been identified. Two of these haddock stocks occur in U.S. waters associated with Georges Bank and the Gulf of Maine.

Haddock are highly fecund broadcast spawners. They spawn over various substrates including rocks, gravel, smooth sand, and mud. Haddock release their eggs near the ocean bottom in batches where a courting male then fertilizes them. After fertilization, haddock eggs become buoyant and rise to the surface water layer. In the Gulf of Maine, spawning occurs from early February to May, usually peaking in February to April. Jeffreys Ledge and Stellwagen Bank are the two primary spawning sites in the Gulf of Maine. Fertilized eggs are buoyant and remain in the water column where subsequent development occurs. Larvae metamorphose into juveniles in roughly 30 to 42 days at lengths of 0.8 to 1.1 in (2 to 3 cm). Small juveniles initially live and feed in the epipelagic zone. Juveniles remain in the upper part of the water column for 3 to 5 months. Juveniles visit the ocean bottom in search of food. Juveniles settle into a demersal existence once they locate suitable bottom habitat. Haddock do not make extensive seasonal migrations. Haddock prefer deeper waters in the winter and tend to move shoreward in summer.

Population Status: The GOM haddock stock is not overfished and overfishing is not occurring.

6.2.1.4 Georges Bank Haddock

Life History: The general life history of GB haddock, *Melanogrammus aeglefinus*, is comparable to the GOM haddock as described above. On Georges Bank, spawning occurs from January to June, usually peaking from February to early-April. Georges Bank is the principal haddock spawning area in the Northeast U.S. Shelf Ecosystem. GB haddock spawning concentrates on the northeast peak of Georges Bank.

Median age and size of maturity differ slightly between the GB and GOM haddock stocks. GARM III found that the GOM fishery does not target haddock. The fleet targets mostly flatfish using large square (6.5 inch [16.5 cm]) mesh gear. This leads to reduced selectivity on haddock. The GOM haddock have lower weights at age than the GB stock and the age at 50 percent maturity was also lower for GOM haddock than GB haddock.

Population Status: The GB haddock stock is a transboundary resource co-managed with Canada. Substantial declines have recently occurred in the weights at age due to slower than average growth. This was particularly true of the 2003 year-class. This decline is affecting productivity in the short-term. The growth of subsequent year-classes remains at the recent slower rate. The stock is not overfished and overfishing is not occurring. The fishing mortality rate for this stock has been low in recent years.

6.2.1.5 American Plaice

Life History: The American plaice, *Hippoglossoides platessoides*, is an arctic-boreal to temperate-marine pleuronectid (righteye) flounder that inhabits both sides of the North Atlantic on the continental shelves of northeastern North America and northern Europe. Off the U.S. coast, American plaice are

managed as a single stock in the Gulf of Maine-Georges Bank region. American plaice are batch spawners. They release 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 will drift into the upper water column after release. Eggs hatch at the surface and the amount of time between fertilization and hatching varies with the water temperature. Transformation of the larvae and migration of the left eye begins when the larvae are approximately 0.8 in (20 millimeters (mm)). Dramatic physiological transformations occur during the juvenile stage. The body shape continues to change, flattening and increasing in depth from side to side. 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, American plaice is a sedentary species migrating only for spawning and feeding.

Population Status: In the Gulf of Maine and Georges Bank area, the American plaice stock is not overfished and overfishing is not occurring. However, a stock assessment conducted in 2012 indicates that the stock will not rebuild by 2014, the currently specified rebuilding target date, even if no fishing is allowed on the stock in FY 2013. Because of this inadequate rebuilding progress, a revised 10 year rebuilding strategy with a 50% probability of success was was developed through FW51.

6.2.1.6 Witch Flounder

Life History: The 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. NMFS manages witch flounder 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 to 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 and 50 °F (0 to 10°C).

Population Status: Witch flounder are overfished and overfishing is occurring.

6.2.1.7 Gulf of Maine Winter Flounder

Life History: The winter flounder, *Psuedopleuronectes 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. NMFS manages and assesses winter flounder 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. Winter flounder spawn from winter through spring, with peak spawning occurring 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. The eggs of winter flounder are demersal, adhesive, and stick together in clusters. Larvae are initially planktonic but become increasingly bottom-oriented as metamorphosis approaches. Metamorphosis is when the left eye migrates to the right side of the body and the larvae become “flounder-like”. It begins around 5 to 6 weeks after hatching, and finishes by

the time the larvae are 0.3 to 0.4 in (8 to 9 mm) in length at about 8 weeks after water where individuals may grow to about 4 in (100 mm) within the first year.

Population Status: The exact status determination for GOM winter flounder is unknown. Overfishing is not occurring.

6.2.1.8 Georges Bank Winter Flounder

Life History: The life history of the GB winter flounder**,** *Psuedopleuronectes americanus*, is comparable to the GOM winter flounder life history described above.

Population Status: The stock is not overfished and not undergoing overfishing. The GB winter flounder stock is scheduled to rebuild in 2017 under a 75% probability of meeting the target SSB.

6.2.1.9 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 Cape Cod/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: The Cape Cod/GOM yellowtail flounder stock continues to be overfished and overfishing is continuing. However, fishing mortality has been declining since 2004 and was at the lowest level observed in the time series in 2009. Spawning stock biomass has increased the past few years.

6.2.1.10 Georges Bank Yellowtail Flounder

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

Population Status: The exact status determination for GB yellowtail flounder is unknown. Overfishing is unknown.

6.2.1.11 Southern New England/Mid-Atlantic 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 above. The median age at maturity for females is 1.6 years off southern New England.

Population Status: Based on a 2012 assessment, the SNE/MA yellowtail flounder stock is not overfished, not subject to overfishing, and is rebuilt. The assessment concluded that the stock is less productive than previously believed and, as a result, the overall biomass at recently seen low levels represents the rebuilt state of nature for the stock.

6.2.1.12 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 (deepwater redfish are a larger species), size-specific migration, or gender-specific migration (females are larger). Redfish make diurnal vertical migrations linked to their primary euphausiid prey. Nothing is known about redfish breeding behavior. However, redfish fertilization is internal and fecundity is relatively low.

Population Status: The redfish stock is not overfished and overfishing is not occurring.

6.2.1.13 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. Age and size at maturity of pollock have declined in recent years. This similar trend has also been reported in other marine fish species such as haddock and witch flounder.

Population Status: Last assessed in during the 2014 operational assessments, the pollock stock is not overfished and overfishing is not occurring.

6.2.1.14 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 to 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.

Population Status: The 2013 assessment for white hake concluded the stock is not overfished and overfishing is not occurring (NEFSC 2013).

6.2.1.15 SNE/MA Winter Flounder

Life History: The winter flounder, blackback, or lemon sole, *Psuedopleuronectes americanus*, is a demersal flatfish distributed in the western North Atlantic from Labrador to Georgia. Winter flounder prefer mud, sand, clay, and even gravel habitat, but offshore populations may occur on hard bottom (Collette and Klein-MacPhee 2002). They migrate inshore in the fall and early winter and spawn in late winter and early spring (Pereira et al. 1999), with peak spawning occurring in Massachusetts Bay and south of Cape Cod during February and March, continuing into May. After spawning, adults typically leave inshore areas when water temperatures exceed 59 °F (15ºC) although some remain inshore year-round. The eggs of winter flounder are demersal, adhesive, and stick together in clusters. Larvae are initially planktonic but become increasingly bottom-oriented as metamorphosis approaches. Metamorphosis is when the left eye migrates to the right side of the body and the larvae become "flounder-like". It begins around 5 to 6 weeks after hatching, and finishes by the time the larvae are 0.3 to 0.4 in (8 to 9 mm) in length at about 8 weeks after hatching. Newly metamorphosed young-of-the-year winter flounder reside in shallow water where individuals may grow to about 4 in (100 mm) within the first year (Collette and Klein-MacPhee 2002). In U.S. waters, the resource is assessed and managed as three stocks: Gulf of Maine, Southern New England/Mid-Atlantic (SNE/MA), and Georges Bank.

Population Status: A benchmark assessment completed for SNE/MA winter flounder in 2011 concluded that this stock was overfished but overfishing was not occurring in 2010 (NEFSC 2011b).

6.2.1.16 GOM/GB Windowpane Flounder

Life History: Windowpane flounder or sand flounder, *Scophthalmus aquosus*, is a left-eyed, flatfish species that occurs in the northwest Atlantic from the Gulf of St. Lawrence to Florida (Collette and Klein-MacPhee 2002). Windowpane prefer sandy bottom habitats. They 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 between 32º-80ºF (0º-26.8ºC) (Moore 1947). On Georges Bank, the species is most abundant at depths <60 m during late spring through autumn but overwintering occurs in deeper waters out to 366 m (Chang et al. 1999). Windowpane flounders are assessed and managed as two stocks: Gulf of Maine-Georges Bank

(GOM/GB) and Southern New England-Mid-Atlantic Bight (SNE/MA) 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 and 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 and Able 1995). Eggs incubate for 8 days at 50º-55ºF (10º-13ºC) and eye migration occurs approximately 17- 26 days after hatching (G. Klein-MacPhee, unpubl. data, as cited in Collette and 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 windowpane settle inshore and then move offshore to deeper waters as they grow. Trawl survey data suggest that windowpane on Georges Bank aggregate in shallow water during summer and early fall and move offshore in the winter and early spring (Grosslein and Azarovitz 1982).

Population Status: Indices from NEFSC fall surveys are used as an indicator of stock abundance and biomass. These biomass indices have fluctuated above and below the time series median as fishing mortality rates have fluctuated below and above the point where the stock could replenish itself. Biomass indices increased to levels at or slightly above the median during 1998-2003, but then fell below the median from 2004-2010 and was 29% of B_{MSY} in 2010 (NEFSC 2012). According to a 2012 assessment update, the stock was overfished and overfishing was occurring in 2010.

6.2.1.17 SNE/MAB Windowpane Flounder

Life History: Windowpane flounder, *Scophthalmus aquosus*, is a left-eyed, flatfish species that occurs in the northwest Atlantic from the Gulf of St. Lawrence to Florida, with the greatest abundance on Georges Bank and in the New York Bight (Collette and Klein-MacPhee 2002). Windowpane prefer sandy bottom habitats at depths < 180 ft. (55 m), but they occur at depths from the high water mark to 656 ft. (200 m) and at temperatures between 32º-80ºF (0º-26.8ºC) (Moore 1947). Windowpane flounders are assessed and managed as two stocks: Gulf of Maine-Georges Bank (GOM/GB) and Southern New England-Mid-Atlantic Bight (SNE/MA) 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 and Azarovitz 1982). 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 and Able 1995). Eggs incubate for 8 days at 50º-55ºF (10º-13ºC) and eye migration occurs approximately 17- 26 days after hatching (G. Klein-MacPhee, unpubl. data, as cited in Collette and Klein-MacPhee 2002). During the first year, spring-spawned fish have significantly faster growth rates than autumn-spawned fish, which may lead to different natural mortality rates (Neuman et al. 2001).

Population Status: A 2012 assessment update indicated that in 2010 biomass was well above the B_{MSY} proxy (146%) and overfishing was not occurring (NEFSC 2012). As a result this stock has been declared rebuilt.

6.2.1.18 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 sand and gravel bottom (Orach-Meza 1975) at an average depth of 49-262 ft. (15-80 m) (Clark and Livingstone 1982) and temperatures of 43º- 48º F (6º-9º C) (Scott 1982). In U.S. 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 was 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 was 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 and 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 and Crim 1995a) and females lay egg masses in 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 and Brown 1991; Yao and Crim 1995a).

Population Status: Between 1975 and 1985, NEFSC spring trawl survey biomass indices increased to record high levels, peaking in 1981and 1985. Since 1985, survey catch per tow indices have generally declined, and the 2010 index was the lowest value in the time series. Catch and exploitation rates have also been low, but stock size has not increased. A 2012 assessment update determined that in 2010 ocean pout was overfished, but overfishing was not occurring (NEFSC 2012).

6.2.1.19 Atlantic Halibut

Life History: Atlantic halibut, *Hippoglossus hippoglossus*, is the largest species of flatfish found in the northwest Atlantic Ocean. This long-lived, late-maturing flatfish is distributed from Labrador to southern New England (Collette and Klein-MacPhee 2002). They prefer sand, gravel, or clay substrates at depths up to 1000 m (Scott and Scott 1988; Miller et al. 1991). Along the coastal Gulf of Maine, halibut move to deeper water in winter and shallower water in summer (Collette and 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 and Gulliksen 1988). Spawning is believed to occur in waters of the upper continental slope at depths of 200 m or greater (Scott and Scott 1988). Halibut eggs are buoyant but drift suspended in the water at depths of 54-90 m (Tåning 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: Survey indices are highly variable because the NEFSC trawl surveys catch low numbers of halibut. The spring survey abundance index suggested a relative increase during the late 1970s to the early 1980s, a decline during the 1990s, and an increase since the late 1990s. Based on the results of a 2012 assessment update, Atlantic halibut is overfished and overfishing is not occurring (NEFSC 2012).

6.2.1.20 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 and 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 to 240 m) (Nelson and Ross 1992) and at temperatures of 29.7º-50.4º F (-1.3º-10.2º C) (Collette and Klein-MacPhee 2002). They

prefer complex benthic habitats with large stones and rocks (Pavlov and 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 and Ross 1992). Most individuals mature by age 5-6 when they reach approximately 18.5 in (47 cm) total length (Nelson and Ross 1992, Templeman 1986). However, size at first maturity varies regionally; northern fish mature at smaller sizes than faster growing southern fish. There is conflicting information about the spawning season for Atlantic wolffish in the Gulf of Maine-Georges Bank region. Peak spawning period is believed to occur from September to October (Collette and Klein-MacPhee 2002), though laboratory studies have shown that wolffish can spawn most of the year (Pavlov and Moksness 1994). Eggs are laid in masses and that the males are thought to brood for several months. Incubation time is dependent on water temperature and may be 3 to 9 months. Larvae and early juveniles are pelagic between 20 and 40 mm TL, with settlement beginning by 50 mm TL (Falk-Petersen and Hansen 1990).

Population Status: NEFSC spring and fall bottom trawl survey indices show abundance and biomass of Atlantic wolffish generally has declined over the last two to three decades. However, Atlantic wolffish are encountered infrequently on NEFSC bottom trawl surveys and there is uncertainty as to whether the NEFSC surveys adequately sample this species (NDPSWG, 2009). Atlantic wolffish continues to be considered a data poor species. An assessment update in 2012 determined that the stock is overfished, but overfishing is not occurring.

6.2.2 Assemblages of Fish Species

Georges Bank and the Gulf of Maine have historically had high levels of fish production. Several studies have identified demersal fish assemblages over large spatial scales. Overholtz and Tyler (1985) found five depth-related groundfish assemblages for Georges Bank and the Gulf of Maine that were persistent temporally and spatially. The study identified depth and salinity as major physical influences explaining assemblage structure. Table 18 (adapted from Amendment 16) compares the six assemblages identified in Gabriel (1992) with the five assemblages from Overholtz and Tyler (1985). This EA considers these assemblages and relationships to be relatively consistent. Therefore, these descriptions generally describe the affected area. The assemblages include allocated target species, as well as non-allocated target species and bycatch. The terminology and definitions of habitat types in Table 18 vary slightly between the two studies. For further information on fish habitat relationships, see Table 16.

Table 18 - Comparison of Demersal Fish Assemblages of Georges Bank and the Gulf of Maine.

Overholtz and Tyler (1985)		Gabriel (1992)	
Assemblage	Species	Species	Assemblage
Slope and Canyon	offshore hake, blackbelly rosefish, Gulf stream flounder, fourspot flounder, goosefish, silver hake, white hake, red hake	offshore hake, blackbelly rosefish, Gulf stream flounder, fawn cusk-eel, longfin hake, armored sea robin	Deepwater
Intermediate	silver hake, red hake, goosefish, Atlantic cod, haddock, ocean pout, yellowtail flounder, winter skate, little skate, sea raven, longhorn sculpin	silver hake, red hake, goosefish, northern shortfin squid, spiny dogfish, cusk	Combination of Deepwater Gulf of Maine/Georges Bank and Gulf of Maine-Georges Bank Transition
Shallow	Atlantic cod, haddock, pollock, silver hake, white hake, red hake, goosefish, ocean pout	Atlantic cod, haddock, pollock	Gulf of Maine-Georges Bank Transition Zone
	yellowtail flounder, windowpane winter flounder, winter skate, little skate, longhorn sculpin, summer flounder, sea raven, sand lance	yellowtail flounder, windowpane winter flounder, winter skate, little skate, longhorn sculpin	Shallow Water Georges Bank-southern New England
Gulf of Maine-Deep	white hake, American plaice, witch flounder, thorny skate, silver hake, Atlantic cod, haddock, cusk, Atlantic wolffish	white hake, American plaice, witch flounder, thorny skate, redfish	Deepwater Gulf of Maine-Georges Bank
Northeast Peak	Atlantic cod, haddock, pollock, ocean pout, winter flounder, white hake, thorny skate, longhorn sculpin	Atlantic cod, haddock, pollock	Gulf of Maine-Georges Bank Transition Zone

6.2.3 Stock Status Trends

The most recent stock assessments for the 20 groundfish stocks can be found via the NEFSC website at http://www.nefsc.noaa.gov/saw/. The information in this section is adapted from the most recent stock assessment reports for the groundfish stocks. Table 19 summarizes the status of the northeast groundfish stocks.

Table 19 - Status of the Northeast Groundfish Stocks.

Stock Status	Stock (assessment source)
Overfished and Overfishing Biomass < ½ B_{MSY} and F > F_{MSY}	GB Cod (SARC 55) GOM Cod (2014 Update Assessment) Cape Cod/GOM Yellowtail Flounder (2012 Assessment Update[3]) White Hake (SARC 56) Witch Flounder (2012 Assessment Update) Northern Windowpane (operational assessment) GB Yellowtail Flounder (2014 TRAC)[1]
Overfished but not Overfishing Biomass < ½ B_{MSY} and F ≤ F_{MSY}	Ocean Pout (2012 Assessment Update) Atlantic Halibut (2012 Assessment Update) GOM Winter Flounder (2014 Update Assessment)[2] Atlantic wolffish (2012 Assessment Update) SNE/MA Winter Flounder (SARC 52)
Not Overfished but Overfishing Biomass ≥ ½ B_{MSY} and F >	
Not Overfished and not Overfishing Biomass ≥ ½ B_{MSY} and F ≤ F_{MSY}	Pollock (2014 Operational Assessment) Acadian Redfish (2012 Assessment Update) SNE/MA yellowtail flounder (SARC 54) American Plaice (2012 Assessment Update) GOM Haddock (SARC 59) GB Haddock (2012 Assessment Update) GB Winter Flounder(2014 Operational Assessment) Southern Windowpane (2012 Assessment Update)

Notes:
B_{MSY} = biomass necessary to produce maximum sustainable yield (MSY) F_{MSY} = fishing mortality rate that produces the MSY

[1] Overfished, and the overfishing status of the stock is unknown.

[2] Rebuilding, but no defined rebuilding program due to a lack of data. Unknown whether the stock is overfished.

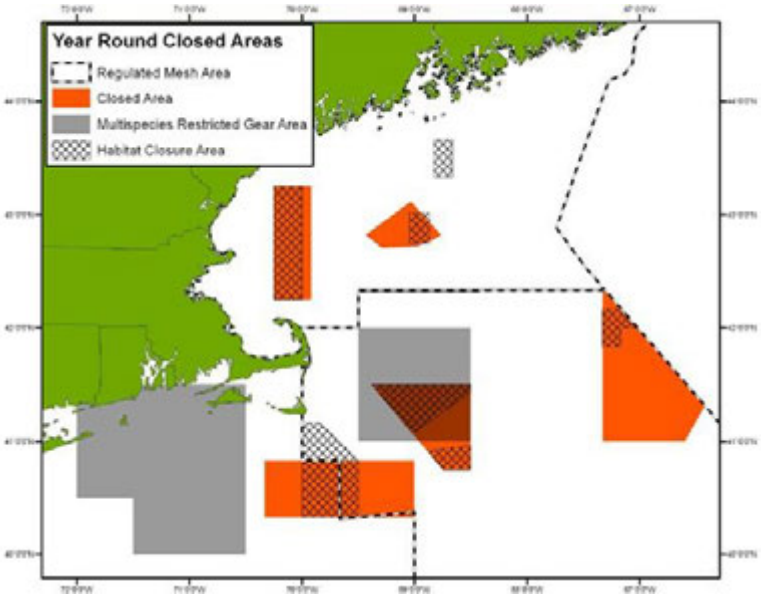
[3] The complete reference for "2012 Assessment Update" is: Northeast Fisheries Science Center. 2012. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010. US Department of Commerce, Northeast Fish Sci Cent Ref Doc. 12-06; 789 p.

6.2.4 Areas Closed to Fishing

Select areas are closed to some level of fishing to protect the sustainability of fishery resources by reducing fishing mortality, protecting spawning fish or protecting habitat. Long- term closures result in the removal or reduction of fishing effort from important fishing grounds. Figure 12 shows the Closed Areas for FY 2014.

Amendment 13 to the Northeast Multispecies FMP and Amendment 10 of the Atlantic Sea Scallop FMP established year-round habitat closed areas which are off-limits to all mobile, bottom-tending gear like trawls and dredges. These closures were designed to minimize the adverse effects of fishing on EFH for species managed by the NEFMC (Table 16). In many cases, these closed areas overlap portions of the groundfish mortality closures (see Figure 12). However, in other cases (Jeffreys Bank in the Gulf of Maine and the area southeast of Nantucket Island) they do not. NEFMC Omnibus EFH Amendment 2 is currently evaluating the closed habitat areas. Therefore, these areas may be changed or eliminated in the future. FW 48 allowed sectors to request exemptions to the closed areas. In addition, portions of four submarine canyons on the outer continental shelf are closed to all bottom trawling in order to protect vulnerable habitats for tilefish. Detailed descriptions and maps of these areas are available in Amendment 1 to the MAFMC Tilefish FMP.

Figure 12 - Northeast Multispecies Closed Areas and U.S./Canada



6.2.5 Interaction between Gear and Allocated Target Species

FY 2010 through FY 2011 data show that the majority of fish of all species caught on groundfish trips are caught with trawls. GARM III indicated that only cod and white hake are caught in significant numbers by gillnets. Only haddock are caught in significant numbers by hook and line.

6.3 Non-Allocated Target Species and Bycatch

Non-allocated target species are species which are not assigned to commercial groundfish vessels but can be targeted and landed. Bycatch refers to fish which are harvested in a fishery, but are discarded and not sold or kept for personal use. Non-allocated target species and bycatch may include a broad range of species. For purposes of this assessment the non-allocated target species and bycatch most likely to be affected include spiny dogfish, skates, and monkfish. This approach follows the convention established in Amendment 16. Spiny dogfish, skates, and monkfish were the top three non-groundfish species landed by multispecies vessels in FY 2006 and FY 2007 under the Category B (regular) DAS program (Amendment 16, Table 87). American lobster is also included as a non-target bycatch species for FY 2012 because many sector vessels also fish in the lobster fishery. These species have no allocation under the Northeast Multispecies FMP and are managed under separate FMPs. Fishermen commonly land monkfish and skates. Spiny dogfish tend to be relatively abundant in catches. Fishermen may land some spiny dogfish, but dogfish are often the predominant component of the discarded bycatch. Fishermen may discard monkfish when regulations or market conditions constrain the amount of the catch that they can land.

Scallops, fluke, whiting and squid are included in this section because fishing activity for these species will be affected by measures in this action that are designed to reduce or control catches of groundfish species by these fisheries.

6.3.1 Spiny Dogfish

Life History: The spiny dogfish, *Squalus acanthias*, occurs in the western North Atlantic from Labrador to Florida. Regulators consider spiny dogfish to be a unit stock off the coast of New England. In summer, dogfish migrate northward to the Gulf of Maine-Georges Bank region and into Canadian waters. They return southward in autumn and winter. Spiny dogfish tend to school by size and, when mature, by sex. The species bears live young, with a gestation period of about 18 to 22 months, and produce between 2 to 15 pups with an average of 6. Size at maturity for females is around 31 in (80 cm), but can vary from 31 to 33 in (78 cm to 85 cm) depending on the abundance of females.

Population Management and Status: The NEFMC and MAFMC jointly develop the spiny dogfish FMP for federal waters. The Atlantic States Marine Fisheries Commission (ASMFC) concurrently develops a plan for state waters. Spawning stock biomass of spiny dogfish declined rapidly in response to a directed fishery during the 1990's. NFMS initially implemented management measures for spiny dogfish in 2001. These measures have been effective in reducing landings and fishing mortality. Based upon the 2009 updated stock assessment performed by the Northeast Fisheries Science Center, the spiny dogfish stock is not presently overfished and overfishing is not occurring. NMFS declared the spiny dogfish stock rebuilt for the purposes of U.S. management in May 2010.

6.3.2 Skates

Life History: The seven species in the Northeast Region skate complex are: 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*). The 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 the little and winter skates in the Northeast Region. The thorny and smooth skates typically occur in the Gulf of Maine. The 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. Skates tend to move seasonally in response to changes in water temperature. Therefore, 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 to 12 months, with the young having the adult form at the time of hatching.

Population Management and Status: NMFS implemented the Northeast Skate Complex Fishery Management Plan (Skate FMP) in September 2003. The FMP required by both dealers and vessels to report skate landings by species (http://www.nefmc.org/skates/fmp/fmp.htm). 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. Amendment 3 also reduced possession limits, in-season possession limit triggers, and 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 2011/spring 2012 one skate species was overfished (thorny) and overfishing was not occurring in any of the seven skate species.

Skate landings have generally increased since 2000. 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. Modest reductions in landings and 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*, also called 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. These migrations may relate to spawning or possibly to food availability.

Female monkfish begin to mature at age 4 with 50 percent of females maturing by age 5 (about 17 in [43 cm]). Males generally mature at slightly younger ages and smaller sizes (50 percent 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 about 1 to 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 about 3 in (8 cm).

Population Management and Status: NMFS implemented the Monkfish FMP in 1999 (NEFMC and MAFMC 1998). 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. Monkfish in both management regions are not overfished and overfishing is not occurring.

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. Female summer flounder may live up to 20 years, but males rarely live for more than 10 years. Growth rates differ appreciably between the sexes with females attaining weights up to 11.8 kg (26 lbs.).

Population Management and Status: The FMP was developed by the Mid-Atlantic Fishery Management Council in 1988. 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.

The stock is not overfished and overfishing is not occurring (NEFSC 2013c).

6.3.5 American Lobster

Life History: The American lobster, *Homarus americanus*, occurs in continental shelf waters from Maine to North Carolina. 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 external skeleton that is periodically cast off (molted) to allow growth and mating to take place. Eggs are carried under the female's abdomen during the 9 to 12 month incubation period. Larger lobsters produce eggs with greater energy content and thus, may produce larvae with higher survival rates (Attard and Hudon, 1987). Seasonal timing of egg extrusion and larval hatching is somewhat variable among areas and may also vary due to seasonal weather patterns. Overall, hatching tends to occur over a four 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. They will molt more than 20 times over a period of 5 to 8 years before they reach the minimum legal size to be harvested. Cooper and Uzmann, (1971) and Uzmann, et al., (1977) observed that tagged lobster were observed to move to relatively cool deep canyon areas in late fall and winter, and then migrate back to shallower and relatively warm water in spring and summer.

Population Management and Status: The states and NMFS cooperatively manage the American lobster resource and fishery under the framework of the Atlantic States Marine Fisheries Commission (ASMFC). States have jurisdiction for implementing measures in state waters, while NMFS implements complementary regulations in federal waters. Inshore landings have increased steadily since the early 1970s. Fishing effort is intense and increasing throughout much of the range of the species. The majority of the landings are reportedly harvested from state waters (within 3 miles of shore). The most recent peer-reviewed stock assessment for American lobster, published by the ASMFC in 2009, identifies the status of

the three biological stock units, delineated primarily on the basis of regional differences in life history parameters, such as lobster distribution and abundance, patterns of migration, location of spawners, and the dispersal and transport of larvae. These stock units are the Gulf of Maine, Georges Bank, and Southern New England. While each area has an inshore and offshore component, Gulf of Maine and Southern New England areas support predominantly inshore fisheries and the Georges Bank supports a predominantly offshore fishery. The most recent 2009 Stock Assessment Report concluded that "(t)he American lobster fishery resource presents a mixed picture, with stable abundance for much of the Gulf of Maine stock, increasing abundance for the Georges Bank stock, and decreased abundance and recruitment yet continued high fishing mortality for the Southern New England stock (ASMFC 2009).

6.3.6 Whiting (Silver Hake)

This description is quoted from the NEFSC Status of Fishery Resources (http://www.nefsc.noaa.gov/sos/spsyn/pg/silverhake/).

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 and Packer 2004). In U.S. waters, two stocks have been identified based on differences of head and fin lengths (Almeida 1987), otolith morphometrics (Bolles and Begg 2000), otolith growth differences, and seasonal distribution patterns (Lock and 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 and Packer 2004).

Population Management and 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 6,800 mt in 2005. Last assessed in 2010 at SAW/SARC 51, silver hake is not overfished and overfishing is not occurring in the northern or southern management areas (NEFSC 2011a)

The otter trawl remains the principal gear used in the U.S. fishery, and recreational catches have been low since 1985. Silver hake are managed under the New England Fishery Management Council's Northeast Multispecies Fishery Management Plan ("non-regulated multispecies" category). In 2000, the New England Fishery Management Council 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). Amendment 19 established Annual Catch Limits, Accountability Measures, and updated stock status definitions.

6.3.7 Longfin Squid

This description is quoted from the NEFSC Status of Fishery Resources (http://www.nefsc.noaa.gov/sos/spsyn/iv/lfsquid/).

Life History: Longfin inshore squid (*Loligo 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 stock area extends from the Gulf of Maine to Cape Hatteras. Distribution varies seasonally. North of Cape Hatteras, squid migrate offshore during late 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 about nine months, grows rapidly, and spawns year-round (Brodziak and Macy 1996) 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 and Macy 1996).

Population Management and Status: 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 longfin 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 near-shore pound net and fish trap fisheries occur during spring and summer. Since 1984, annual offshore landings have generally been three-fold greater than inshore landings. The stock is managed by the Mid-Atlantic Fishery Management Council under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (FMP). Management measures for the *L. pealeii* stock include annual total allowable catches (TACs) which have been partitioned into seasonal quotas since 2000 (trimesters in 2000 and quarterly thereafter), a moratorium on fishery permits, and a minimum codend mesh size of 1 7/8 inches.

6.3.8 Atlantic Sea Scallops

Life History: This description is quoted from the NEFSC Status of Fishery Resources (http://www.nefsc.noaa.gov/sos/spsyn/iv/lfsquid/). 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 20ºC (68ºF). North of Cape Cod, concentrations generally occur in shallow water less than 40 m (22 fathoms) deep. South of Cape Cod and on Georges Bank, sea scallops typically occur at depths between 25 and 200 m (14 to 110 fathoms), with commercial concentrations generally between 35 and 100 m (19 to 55 fathoms). Sea scallops are filter feeders, feeding primarily on phytoplankton, but also on microzooplankton and detritus (Hart and Chute 2004). Sea scallops grow rapidly during the first several years of life. Between ages 3 and 5, they commonly increase 50 to 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.

Population and Management Status: The commercial fishery for sea scallops is conducted year round, primarily using offshore New Bedford style 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. Recreational fishing is insignificant. Sea scallops have a somewhat uncommon combination of life-history attributes: low mobility, rapid growth, and low natural mortality. The Council established the Scallop FMP in 1982. A number of Amendments and Framework Adjustments have been implemented since that time to adjust the original plan. The scallop resource was last assessed in 2010 (SARC 50) and it was not overfished, and overfishing was not occurring. The Scallop PDT has evaluated biomass and fishing mortality since and based on 2012 estimates, biomass is 119,000 mt, well above the threshold for an overfished stock (1/2 Bmsy = 62,000 mt), and almost at Bmsy (125,000 mt). The estimate of fishing mortality overall is 0.34, above the target F of 0.32 but below the overfishing limit threshold of 0.38. Total catch has been stable at about 20-30,000 mt since 2001, up from about 5,000 mt harvests of the late 1990s.

6.3.9 Interaction between Gear and Non-allocated Target Species and Bycatch

The majority of the proposed sectors have minimal operational history; therefore, the analysis of interactions between gear and non-allocated target species and bycatch is based in part on catch information for the Northeast Multispecies FMP common pool fishery from FY 1996 to FY 2006. It is also based on sector data from FY 2009 to FY 2011, as presented in Section 6.5.10.

The Final Supplemental Environmental Impact Statement to Amendment 2 to the Monkfish FMP (NEFMC and MAFMC 2003) evaluated the potential adverse effects of gears used in the directed monkfish fishery. It evaluated impacts for monkfish and other federally-managed species, as well as the effects of fishing activities regulated under other federal FMPs on monkfish. Bottom trawls and bottom gillnets and the two gears used in the monkfish fishery. Amendment 2 to the Monkfish FMP (NEFMC and MAFMC 2003) describes these gears in detail. Sectors would use these same gears in FY 2012.

Fishermen in the Northeast Region harvest skates in two very different ways. Fishermen harvest whole skates for lobster bait. They also harvest skate wings for food. Vessels tend to catch skates when targeting other species like groundfish, monkfish, and scallops. The vessels will land skate if the price is high enough. The recent NEFMC Amendment to the Skate FMP and accompanying Final Supplemental Environmental Impact Statement (NEFMC 2009b) contain detailed information about skate fisheries.

Dogfish have the potential to interact with all gear types used by the sectors. Table 20 shows that otter trawl gear caught the majority of non-allocated target species and bycatch between FY 1996 to FY 2006.

Table 20 – Landings (mt) for non-allocated target species and bycatch by gear type[a]

	Trawl		Gillnet		Dredge		Other Gear		Total[b]	
Species	Landings	Discard	Landings	Discard	Landings	Discard	Landings	Discard	Landings	Discard
Monkfish	NA	16,516	NA	6,526	NA	16,136	NA	4 [c]	228,000	39,182
Skates	117,381	315,308	29,711	26,601	--	146,725	4,413	2,646 [d]	151,505	491,280
Dogfish	24,368	61,914	72,712	39,852	--	--			98,026	101,766

Notes:
NA = landings or discard data not available for individual fishery gear type for this species.
-- = None reported
[a] Monkfish 1996-2006, skates 1996-2006, dogfish 1996-2006
[b] Total landings or discards may differ slightly from the sum of the individual fishery entries due to differences in rounding.
[c] Shrimp Trawl
[d] Line and Shrimp Trawl
Source: Northeast Data Poor Stocks Working Group 2007a; Northeast Data Poor Stocks Working Group 2007b; Sosebee et al. 2008; NEFSC 2006a.

6.4 Protected Resources

6.4.1 Species Present in the Area

Numerous protected species inhabit the environment within the Northeast Multispecies FMP management unit (Table 1). These species are under NMFS jurisdiction and are afforded protection under the Endangered Species Act of 1973 (ESA) and/or the Marine Mammal Protection Act of 1972 (MMPA).

Table 21 - Species Protected Under the Endangered Species Act and/or Marine Mammal Protection Act that May Occur in the Operation Area for the Northeast Multispecies Fishery.

Species	Status	Potentially affected by this action?
Cetaceans		
North Atlantic right whale (*Eubalaena glacialis*)	Endangered	Yes
Humpback whale (*Megaptera novaeangliae*)	Endangered	Yes
Fin whale (*Balaenoptera physalus*)	Endangered	Yes
Sei whale (*Balaenoptera borealis*)	Endangered	Yes
Blue whale (*Balaenoptera musculus*)	Endangered	No
Sperm whale (*Physeter macrocephalus*	Endangered	No
Minke whale (*Balaenoptera acutorostrata*)	Protected	Yes
Pilot whale (*Globicephala spp.*)[1]	Protected	Yes
Risso's dolphin (*Grampus griseus*)	Protected	Yes
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Protected	Yes
Short Beaked Common dolphin (*Delphinus delphis*)[2]	Protected	Yes
Spotted dolphin (*Stenella frontalis*)	Protected	No
Bottlenose dolphin (*Tursiops truncatus*)[3]	Protected	Yes
Harbor porpoise (*Phocoena phocoena*)	Protected	Yes
Sea Turtles		
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Yes
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Yes
Green sea turtle (*Chelonia mydas*)	Endangered[4]	Yes

Loggerhead sea turtle (*Caretta caretta*), Northwest Atlantic 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, Carolina DPS & South Atlantic DPS	Endangered	Yes
Cusk (*Brosme brosme)*	Candidate	Yes
Pinnipeds		
Harbor seal (*Phoca vitulina*)	Protected	Yes
Gray seal (*Halichoerus grypus*)	Protected	Yes
Harp seal (*Phoca groenlandicus*)	Protected	Yes
Hooded seal (*Cystophora cristata*)	Protected	Yes
Critical Habitat		
Northern Atlantic right whale	ESA-listed	No
Northwest Atlantic DPS loggerhead sea turtle	ESA-listed	No
Atlantic salmon	ESA-listed	No

Notes:

[1] There are 2 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*.

[2] Prior to 2008, this species was called "common dolphin."

[3] This includes the Western North Atlantic Offshore, Northern Migratory Coastal, and Southern Migratory Coastal Stocks of Bottlenose Dolphins.

[4] Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters.

In Table 1, please note that cusk, a NMFS "species of concern," as well as a "candidate species" under the ESA, occurs in the affected environment of the multispecies fishery. Candidate species are those

petitioned species that NMFS is actively considering for listing as endangered or threatened under the ESA and also include those species for which NMFS has initiated an ESA status review through an announcement in the Federal Register. Candidate species also receive no substantive or procedural protection under the ESA; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on candidate species from any proposed project. NMFS has initiated review of recent stock assessments, bycatch information, and other information for these candidate/proposed species. The results of those efforts are needed to accurately characterize recent interactions between fisheries and the candidate/proposed species in the context of stock sizes. Any conservation measures deemed appropriate for these species will follow the information reviews. Please note that once a species is proposed for listing the conference provisions of the ESA apply (see 50 CFR 402.10).

In regards to cusk, NMFS initiated a status review due to concerns over the status of and threats to cusk, particularly bycatch. NMFS is involved in various proactive conservation initiatives to obtain more information on this data poor species to assess its status and further conservation efforts. These initiatives involve cooperative efforts with industry, scientists, and other partners to learn more about cusk. NMFS is especially interested in the investigation and identification of methods to reduce bycatch or discard mortality of cusk, and, in particular, studies of how to alleviate barotrauma effects in released cusk are of high interest. In the Northeastern U.S., cusk are predominantly caught in the Gulf of Maine in commercial bottom trawl, bottom longline, gillnet, lobster trap, and handline/rod and reel gears, as well recreational handline gear (O'Brien, 2010; GMRI, 2012). Additional information on cusk and some conservation efforts can be found at http://www.nero.noaa.gov/prot_res/CandidateSpeciesProgram/CuskSOC.html; please note, however, as cusk receive no substantive or procedural protection under the ESA (due to its candidate species status), this species will not be discussed further in this document

6.4.2 Species and Critical Habitat Not Likely to be Affected by the Proposed Action

Based on available information, it has been determined that this action is not likely to affect shortnose sturgeon, spotted dolphin, hawksbill sea turtles, blue whales, or sperm whales. Further, this action is not likely to adversely affect Atlantic salmon, the Northwest Atlantic DPS of loggerhead or North Atlantic right whale critical habitats. This determination has been made because either the occurrence of the species is not known to overlap with the multispecies fishery and/or there have never been documented interactions between the species and the multispecies fishery. In the case of critical habitat, this determination has been made because either the habitat does not occur within the range of the multispecies fishery or the fishery will not affect the primary constituent elements of the critical habitat, and therefore, will result in the destruction or adverse modification of critical habitat.

6.4.3 Species Potentially Affected by the Proposed Action

The multispecies fishery may affect multiple protected species of cetacean, sea turtles, pinnipeds, and fish (see Table 21). Of primary concern is the potential for the fishery to interact (e.g., bycatch, entanglement) with these species. To understand the potential risk of an interaction, 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) records of protected species interaction with particular fishing gear types. Information on species occurrence in the affected environment of the multispecies fishery will be presented in this section (1.1.3), while information on protected species interactions with fishery gear will be presented in Section 1.1.4.

6.4.3.1 Sea Turtles

Status and Trends
Table 22 includes the four ESA listed species of sea turtles that occur in the affected environment of the multi-species fisheries. 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, can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b; Conant *et al.* 2009; NMFS and USFWS 2013), and recovery plans for the loggerhead sea turtle (Northwest Atlantic DPS; NMFS and USFWS 2008), leatherback sea turtle (NMFS and USFWS 1992, 1998a), Kemp's ridley sea turtle (NMFS *et al.* 2011), and green sea turtle (NMFS and USFWS 1991, 1998b).

Table 22 - Sea turtle species found in the affected environment of the multispecies fishery.

Species	Listed At	Status	Trends
Green	Species Level	Endangered: Breeding populations in Florida and on the Pacific coast of Mexico Threatened: Other populations	Based on nesting data for four nesting sites, green sea turtle abundance is increasing.[1]
Kemp's ridley	Species Level	Endangered	Total annual number of nest at Rancho Nuevo, Tamaulipas, Mexico, the primary stretch of nesting beach, showed gradual increases in 1990s. Since 2009, nesting has not shown a notable increase.[2]
Loggerhead	Distinct Population Segment (DPS)	Northwest Atlantic DPS: Threatened	• Nesting data from 2008-2012 shows a positive nesting trend since 2007.[3] • In-water studies show an increasing trend in abundance from 3 of the 4 in-water sites in the southeast U.S.(the other site showed no discernable trend, and a decreasing trend at 2 sites in the Mid-Atlantic.[4]
Leatherback	Species Level	Endangered	Nesting counts in many areas show an increasing trend, while the largest nesting area (Suriname and French Guiana) show a stable trend.[5]

Sources:
[1] Seminoff 2004; NMFS and USFWS 2007d.
[2] NMFS *et al*. 2011;Pena *et al*. 2012.
[3] http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/; NMFS and USFWS 2008; Witherington *et al*. 2009; and TEWG 2009.
[4] TEWG 2009; NMFS and USFWS 2008.
[5] NMFS and USFWS 2013

Occurrence and Distribution

The multispecies fishery occurs in waters north of 35°N, where sea turtles occur seasonally. A general overview of sea turtle occurrence and distribution in the continental shelf waters of the Northwest Atlantic Ocean is provided below to assist in understanding how the multispecies fisheries overlaps in time and space with the occurrence of sea turtles.

Hard-shelled sea turtles

Distribution

In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, MA, 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, loggerhead sea turtles are known to occur in the Gulf of Maine (GOM), feeding 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 2004; 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).

Seasonality

Hard-shelled sea turtles occur year-round in waters south of Cape Hatteras, North Carolina. 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 2004; 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 GOM in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the GOM 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 North Carolina, particularly south of Cape Hatteras, and further (Shoop and Kenney 1992; Epperly *et al.* 1995b; Hawkes *et al.* 2011; Griffin *et al.* 2013).

Leatherback sea turtles

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). Leatherbacks, a pelagic species, are also known to use coastal waters of the U.S. continental shelf (James *et al.* 2005; Eckert *et al.* 2006; Murphy *et al.* 2006; Dodge *et al.* 2014). Leatherbacks have a greater tolerance for colder water in comparison to hard-shelled sea turtles. They are also found in more northern waters later in the year, with most leaving the Northwest Atlantic shelves by mid-November (James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014).

6.4.3.2 Large Cetaceans

Status and Trends

Table 23 provides the species of large whales that occur in the affected environment of the multispecies fisheries. For additional information on the biology, status, and range wide distribution of each whale species please refer to: Waring *et al*. 2014; NMFS 1991, 2005, 2010b, 2011, 2012.

Table 23 - Large whale species in the affected environment of the multispecies fishery

Species	Listed Under the ESA	Protected Under the MMPA	Minimum Population Size	Population Trend	MMPA Strategic Stock[1]
North Atlantic Right Whale	Yes-Endangered	Yes	454	positive and slowly accelerating	Yes
Humpback Whale	Yes-Endangered	Yes	823	positive	Yes
Fin Whale	Yes-Endangered	Yes	2,817	unknown	Yes
Sei Whale	Yes-Endangered	Yes	236	unknown	Yes
Minke Whale	No	Yes	16,199	unknown	No

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

Source: Waring *et al*. 2014

Occurrence and Distribution

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 35°N) wintering/calving grounds and high latitude spring/summer foraging grounds (primarily north of 41°N; Waring *et al*. 2014; NMFS 1991, 2005, 2010b, 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 (Waring *et al*. 2014; 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 2001; Payne *et al.* 1990; Schilling *et al.* 1992).

It is important to note, these foraging areas are consistently returned annually, and therefore, can be considered important, high use areas for whales.

As the affected area of the multi-species fishery occurs in waters north of 35°N, and whales may be present in these waters throughout the year, the multispecies fisheries and large whales are likely to co-occur in the affected area. To further assist in understanding how the multi-species fisheries overlaps in time and space with the occurrence of large whales, a general overview on species occurrence and distribution in the continental shelf waters of the affected environment of the multispecies fishery is provided in the following table (Table 24). For additional information on the biology, status, and range wide distribution of each whale species please refer to: Waring *et al*. 2014; NMFS 1991, 2005, 2010b, 2011, 2012.

Table 24 - Large cetacean occurrence in the Gulf of Maine (GOM), Georges Bank (GB), Southern New England (SNE), and Mid-Atlantic sub-regions of the multi-species fisheries[1]

Species	Prevalence in Affected Area	High Use Areas and Approximate Months of Occurrence (if known)
North Atlantic Right Whale	• Distributed throughout all continental shelf waters of the Mid-Atlantic, GOM, GB, and SNE sub-regions throughout the year. • Regularly move through the waters off the Mid-Atlantic states, including New Jersey, New York, Rhode Island, and Southern Massachusetts (migratory corridor to/from feeding and calving grounds; primarily November through April). • Winter through summer (approximately December/January-July 31): Distributed in greatest densities in GOM and GB sub-regions (foraging grounds). • Increasing evidence of wintering areas (approximately November – January) in Cape Cod Bay; GOM (e.g., Jeffreys and Cashes Ledges, Jordan Basin); and Massachusetts Bay (e.g., Stellwagen Bank).	• Approximately April-July: Great South Channel and GB (foraging grounds) • Approximately January through May: Cape Cod and Massachusetts Bays (foraging grounds) • Approximately March through April: waters off the eastern shore of Cape Cod (foraging grounds)
Humpback	• Distributed throughout all continental shelf waters of the Mid-Atlantic, GOM, GB, and SNE sub-regions throughout the year. • Regularly move through the waters off the Mid-Atlantic states, including New Jersey, New York, Rhode Island, and Southern Massachusetts throughout the year (migratory corridor to/from feeding and calving grounds). • Spring through fall (approximately March through November), distributed in greatest densities in the GOM and GB sub-regions	From approximately March through November: • GOM • Massachusetts (esp. Stellwagen Bank) and Cape Cod Bays • GB

Species	Prevalence in Affected Area	High Use Areas and Approximate Months of Occurrence (if known)
	(foraging grounds). • Increasing evidence of wintering areas (for juveniles) in the Mid-Atlantic (e.g., waters in the vicinity of Chesapeake and Delaware Bays; peak presence approximately January through March)	
Fin	• Distributed throughout all continental shelf waters of the Mid-Atlantic, GOM, GB, and SNE sub-regions throughout the year. • Regularly move through the waters off the Mid-Atlantic states, including New Jersey, New York, Rhode Island, and Southern Massachusetts (migratory corridor to/from feeding and calving grounds). • Spring through fall (approximately March through August): distributed in greatest densities in the GOM and GB sub-regions; lower densities are found in these regions in the fall (approximately September-November). • Evidence of wintering areas in mid-shelf areas east of New Jersey, Stellwagen Bank; and eastern perimeter of GB.	From approximately March through August: • Massachusetts Bay (esp. Stellwagen Bank) • Great South Channel • Waters off Cape Cod (~40-50 meter contour) • western GOM (esp. Jeffrey's Ledge) • Eastern perimeter of GB • Mid-shelf area off the east end of Long Island.
Sei	• Uncommon in shallow, inshore waters of the Mid-Atlantic, SNE, GB, and GOM sub-regions; 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 sub-regions.	Throughout the spring and summer: • GOM • GB (esp. eastern and southwestern edge (Hydrographer Canyon) into Northeast Channel
Minke	Spring through fall found in greatest densities in the GOM and GB sub-regions	From approximately March through December (peak=July through October): • Massachusetts Bay (esp. Stellwagen Bank) • Cape Cod Bay • GOM

Notes:
[1] Information presented in table is representative of large cetacean occurrence in the Northwest Atlantic

Species	Prevalence in Affected Area	High Use Areas and Approximate Months of Occurrence (if known)
continental shelf waters out to the 2,000 meter isobath. *Sources*: NMFS 1991, 2005, 2010b, 2011, 2012; Hain *et al.* 1992; Payne 1984; Hamilton and Mayo 1990; Schevill *et al*. 1986; Watkins and Schevill 1982; Payne *et al*.1990; Winn et al. 1986; Kenney et al. 1986, 1995; Khan *et al*. 2009, 2010, 2011, 2012; Brown *et al*. 2002; NOAA 2008; 50 CFR 224.105; CETAP 1982; Clapham *et al*. 1993; Swingle *et al*. 1993; Vu *et al*. 2012; Baumgartner *et al*. 2011; Cole *et al*. 2013; Risch *et al*. 2013; Waring *et al*. 2014.		

6.4.3.3 Small Cetacean

Status and Trends

Table 25 provides the species of small cetaceans that occur in the affected environment of the multispecies fisheries. For additional information on the biology, status, and range wide distribution of each small cetacean species please refer to Waring *et al*. 2014.

Table 25 - Small cetacean species that occur in the affected environment of the multispecies fishery

Species	Listed Under the ESA	Protected Under the MMPA	Minimum Population Size	Population Trend	MMPA Strategic Stock
Atlantic White Sided Dolphin	No	Yes	30,403	unknown	No
Short-Finned Pilot Whale	No	Yes	15,913	unknown	No
Long-Finned Pilot Whale	No	Yes	19,930	unknown	No
Rissos Dolphin	No	Yes	12,619	unknown	No
Short Beaked Common Dolphin	No	Yes	112,531	unknown	No
Harbor Porpoise	**No**	**Yes**	**61,415**	**unknown**	**Yes[1]**
Bottlenose Dolphin (*Western North Atlantic Offshore Stock*)	No	Yes	56,053	unknown	No
Bottlenose Dolphin (*Western North Atlantic Northern Migratory Coastal Stock*)	**No**	**Yes**	**8,620**	**unknown**	**Yes[2]**
Bottlenose Dolphin (*Western North Atlantic Southern Migratory Coastal Stock*)	**No**	**Yes**	**6,326**	**unknown**	**Yes[3]**

Notes: [1] Harbor porpoise are considered a strategic stock under the MMPA as the level of direct human-caused mortality has exceeded the PBR level for this species.

[2,3] Both northern and southern migratory coastal stocks of bottlenose dolphins are considered a strategic stock under the MMPA as both stocks are designated as depleted under the Act.

Source: Waring *et al*. 2014

Occurrence and Distribution

Small cetaceans are found throughout the waters of the Northwest Atlantic Ocean. In the affected area, they can be found throughout the year from Cape Hatteras, North Carolina (35°N), to the Canadian border (Waring *et al*. 2014). Within this range; however, there are seasonal shifts in species distribution and abundance. As the affected area of the multi-species fishery occurs in waters north of 35°N, and small cetaceans may be present in these waters throughout the year, the multispecies fisheries and small cetaceans are likely to co-occur in the affected area. To further assist in understanding how the multi-species fisheries overlaps in time and space with the occurrence of small cetaceans, a general overview of

species occurrence and distribution in the continental shelf waters of the affected environment of the multispecies fishery is provided in the following table (Table 26). For additional information on the biology, status, and range wide distribution of each species please refer to Waring *et al*. 2014,

Table 26 - Small cetacean occurrence in the GOM, GB, SNE, and Mid-Atlantic sub-regions of the multi-species fisheries[1]

Species	Prevalence and Approximate Months of Occurrence (if known)
Atlantic White Sided Dolphin	• Distributed throughout the continental shelf waters (primarily to 100 meter isobath) of the Mid-Atlantic (north of 35°N), SNE, GB, and GOM sub-regions; however, most common in the SNE, GB, and GOM sub-regions (i.e., shelf waters from Hudson Canyon (~ 39°N) and into GB, Massachusetts Bay, and the GOM). • Seasonal shifts in distribution: ***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 sub- regions), low densities found year round, with waters off Virginia and North Carolina representing 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 meter isobaths) of the Mid-Atlanitc, SNE, and GB sub-regions (esp. in Oceanographer, Hydrographer, Block, and Hudson Canyons). • Occasionally found in the GOM. • Seasonal shift in distribution: ***January-May**: occur from Cape Hatteras, NC, to GB * **Mid-summer-autumn**: moves onto GB; *Peak abundance* found on GB in the autumn.
Risso's Dolphin	• Common in the continental shelf edge waters of the Mid-Atlantic, SNE, and GB sub-regions; rare in the GOM sub-region. • From approximately March-November: distributed along continental shelf edge from Cape Hatteras, NC, to GB. • From approximately December-February: distributed in continental shelf edge of the Mid-Atlantic (SNE and Mid-Atl. sub-regions).
Harbor Porpoise	• Distributed throughout the continental shelf waters (primarily in waters less than 150 meters) of the Mid-Atlantic (north of 35°N), SNE, GB, and GOM sub-regions. • Seasonal shifts in distribution:

Species	Prevalence and Approximate Months of Occurrence (if known)
	***July-September**: Concentrated in the northern GOM; low numbers can be found on GB. ***October-December**: widely dispersed in waters from New Jersey to Maine. ***January-March**: intermediate densities in waters off New Jersey to North Carolina (SNE and Mid-Atl sub-regions); low densities found in waters off New York to GOM. ***April-June**: widely dispersed from New Jersey to Maine
Bottlenose Dolphin:	**Western North Atlantic Offshore Stock** • Spring-Summer: Primarily distributed along the outer continental shelf/edge-slope of the Mid-Atlantic, SNE, and GB sub-regions • Winter: Distributed in waters south of 35°N **Western North Atlantic Northern Migratory Stock** • Summer (July-August): distributed from the coastal waters from the shoreline to approximately the 25-m isobaths between the Chesapeake Bay mouth and Long Island, New York (Mid-Atl and SNE sub-regions). • Winter (January-March): Distributed in coastal waters south of 35°N. **Western North Atlantic Southern Migratory Stock** • Spring and Summer (April-August): distributed along coastal waters from North Carolina to Virginia (Mid-Atl and SNE sub-regions). • Fall and Winter (October-March): Distributed in coastal waters south of 35°N.
Pilot Whales: *Short- and Long-Finned*	**Short- Finned Pilot Whales** • Primarily occur south of 40°N (Mid-Atl and SNE sub-regions); although low numbers have been found along the southern flank of GB, but no further than 41°N. • Distributed primarily in the continental shelf edge-slope waters of Mid-Atlantic and SNE sub-regions from approximately May through December, with individuals moving to more southern waters (i.e., 35°N and south) beginning in the fall. **Long-Finned Pilot Whales** • Range from 35°N to 44°N • Winter to early spring (approximately November through April): primarily distributed along the continental shelf edge-slope of the Mid-Atlantic, SNE, and GB sub-regions. • Late spring through fall (approximately May through October): movements and distribution shift onto/within GB, the Great South Channel, and the GOM. **Area of Species Overlap:** between 38°N and 40°N (Mid-Atl and SNE sub-regions)

Species	Prevalence and Approximate Months of Occurrence (if known)
Notes: [1] Information presented in table is representative of small cetacean occurrence in the Northwest Atlantic continental shelf waters out to the 2,000 meter isobath. *Sources*: Waring *et al*. 1992, 2007**,** 2014**;** Payne and Heinemann 1993; Payne 1984; Jefferson *et al*. 2009.	

6.4.3.4 Pinnipeds

Status and Trends

Table 27 provides the species of pinnipeds that occur in the affected environment of the multispecies fisheries. For additional information on the biology, status, and range wide distribution of each pinniped species please refer to Waring *et al*. 2014.

Table 27 - Pinniped species that occur in the affected environment of the multispecies fishery

Species	Listed Under the ESA	Protected Under the MMPA	Minimum Population Size	Population Trend	MMPA Strategic Stock
Harbor Seal	No	Yes	55,409 (in U.S. waters)	unknown	No
Gray Seal	No	Yes	Unknown for U.S. waters; total Canadian population=331,000	positive	No
Harp Seal	No	Yes	Unknown for U.S. waters; total western North Atlantic stock=7.1 million	positive	No
Hooded Seal	No	Yes	Unknown for U.S. waters; minimum population size for the North Atlantic stock=512,000	unknown	No
Source: Waring *et al*. 2014					

Occurrence and Distribution

Pinnipeds are found in the nearshore, coastal waters of the Northwest Atlantic Ocean. In the affected area, 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, 2014). As the affected area of the multi-species fishery occurs in waters north of 35°N, and pinnipeds may be present in these waters throughout the year, the multispecies fisheries and pinnipeds are likely to co-occur in the affected area. To further assist in understanding how the multi-species fisheries overlaps in time and space with the occurrence of pinnipeds, a general overview of species occurrence and distribution in the affected environment of the multispecies fishery is provided in the following table (Table 28). For additional information on the biology, status, and range wide distribution of each species of pinniped please refer to Waring *et al*. 2007, 2014.

Table 28 - Pinniped occurrence in the GOM, GB, SNE, and Mid-Atlantic sub-regions of the multi-species fisheries

Species	Prevalence and Approximate Months of Occurrence (if known)
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, North Carolina (35°N). • Seasonal distribution: *__Year Round__: Waters of Maine *__September-May__: Waters from New England to New Jersey; potential for some animals to extend range into waters as far south as Cape Hatteras, NC.
Gray Seal	• Distributed in waters from New Jersey to Maine • Seasonal distribution: *__Year Round__: Waters from Maine to Massachusetts *__September-May__: Waters from Rhode Island to New Jersey
Harp Seal	• Winter-Spring (approximately January-May): Waters from Maine to New Jersey.
Hooded Seal	• Winter-Spring (approximately January-May): Waters of New England.
Sources: Waring *et al*. 2007 (for hooded seals); Waring *et al*. 2014.	

6.4.3.5 Atlantic Sturgeon

Status

Table 29 lists the 5 DPSs of Atlantic sturgeon likely to occur in the affected area. For additional information on the biology, status, and range wide distribution of each distinct population segment please refer to 77 FR 5880 and 77 FR 5914 (finalized February 6, 2012), as well as the Atlantic Sturgeon Status Review Team's (ASSRT) 2007 status review of Atlantic sturgeon (ASSRT 2007).

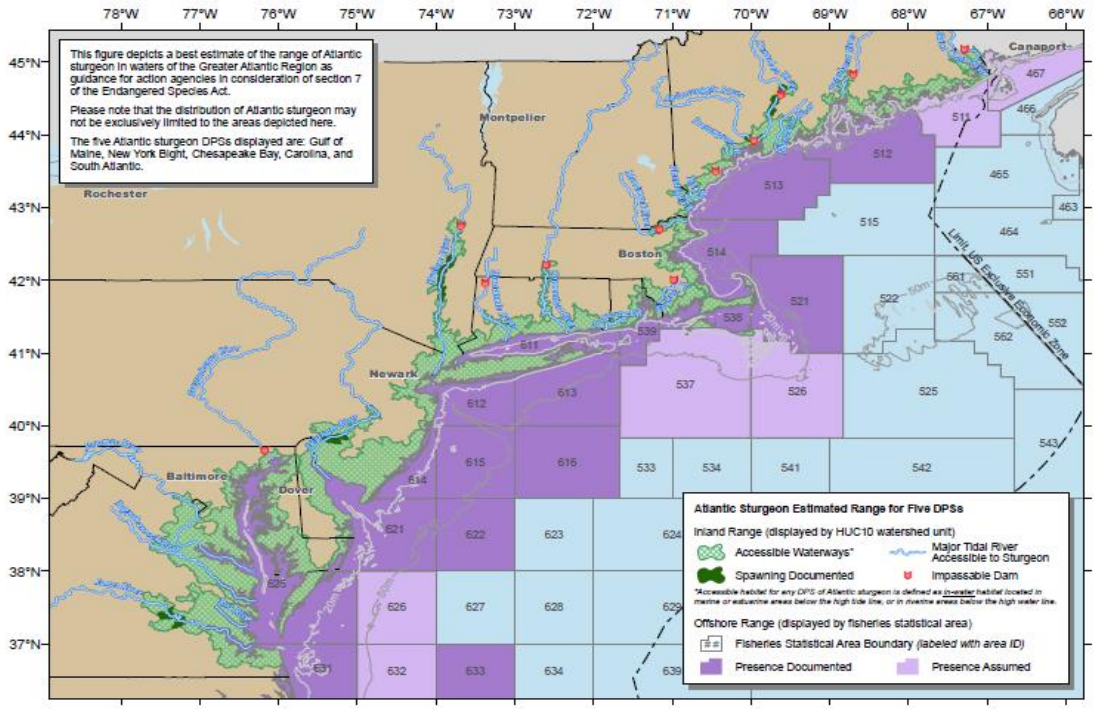
Table 29 - Atlantic Sturgeon DPSs occurring in the affected environment of the multispecies fishery.

Species	Listed Under the ESA
Gulf of Maine (GOM) DPS	threatened
New York Bight (NYB) DPS	endangered
Chesapeake Bay (CB) DPS	endangered
Carolina DPS	endangered
South Atlantic (SA) DPS	endangered

Occurrence and Distribution

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 (See Figure 13; 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; Erickson *et al*. 2011; Wirgin *et al*. 2012; O'Leary *et al*. 2014; Waldman *et al.* 2013).

Figure 13 - Estimated Range of Atlantic Sturgeon Distinct Population Segments (DPSs)



Source: http://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/maps/atlanticsturgeon.pdf.pdf

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 Atlantic sturgeon undertake seasonal movements along the coast. 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 meters, 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). A similar seasonal trend was found by Dunton *et al*. 2010; analysis of fishery-independent survey data indicated a coastwide distribution of Atlantic sturgeon during the spring and fall; a southerly (e.g., North Carolina, Virginia) distribution during the winters; and a centrally located (e.g., Long Island to Delaware) distribution during the summer. Although studies such as Erickson *et al*. (2011) and Dunton *et al*. (2010) provide some indication that Atlantic sturgeon are undertaking seasonal movements horizontally and vertically along the U.S. eastern coastline, there is no evidence to date that all Atlantic sturgeon make these seasonal movements. For instance, during inshore surveys conducted by the Northeast Fisheries Science Center in the region of the GOM, Atlantic sturgeon

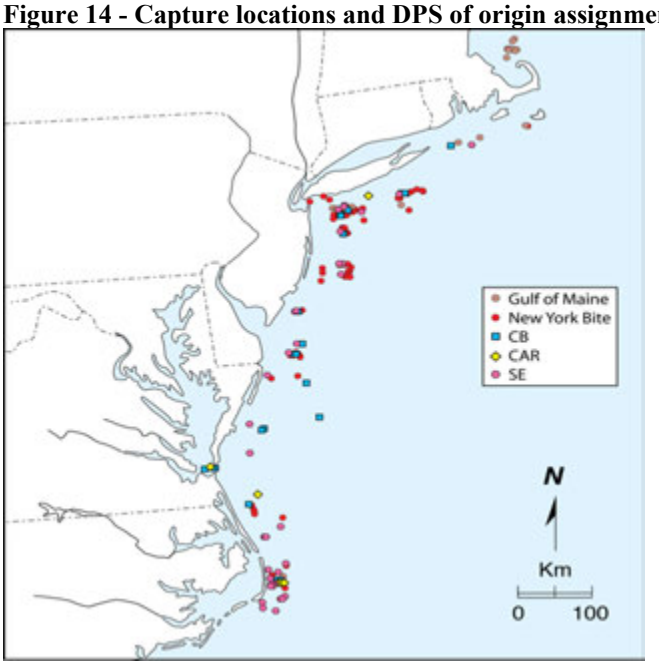
have been caught in the fall, winter, and spring between the Saco and Kennebec Rivers (Dunton *et al*. 2010).

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; depths in these areas are generally no greater than 25 meters (Stein *et al*. 2004a; Laney *et al*. 2007; Dunton *et al*. 2010; Erickson *et al*. 2011). Although additional studies are still needed to clarify why these particular 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). The following are the currently known marine aggregation sites located within the range of the multispecies fishery:

- Waters off North Carolina, including Virginia/North Carolina border (Laney *et al*. 2007);
- Waters off the Chesapeake and Delaware Bays (Stein *et al*. 2004a; Dunton *et al*. 2010; Erickson *et al*. 2011; Oliver *et al*. 2013);
- New York Bight (e.g., waters off Sandy Hook, New Jersey, and Rockaway Peninsula, New York; Stein *et al*. 2004a; Dunton *et al.* 2010; Erickson *et al*. 2011; O'Leary *et al*. 2014;);
- Massachusetts Bay (Stein *et al.* 2004a);
- Long Island Sound (Bain *et al.* 2000; Savoy and Pacileo 2003; Waldman *et al.* 2013);
- Connecticut River Estuary (Waldman *et al.* 2013);
- Kennebec River Estuary (termed a "hot spot" for Atlantic sturgeon by Dunton *et al*. 2010).

In addition, since listing of the five Atlantic sturgeon DPSs, several genetic studies have occurred to address DPS distribution and composition in marine waters. Genetic analysis has been conducted on Atlantic sturgeon captured (fishery-independent) from aggregations in Long Island Sound and the Connecticut River (summer aggregations; Waldman *et al*. 2013), as well as the New York Bight, specifically the coastal waters off the Rockaway Peninsula (spring and fall aggregations; O'Leary *et al*. 2014). Results from these studies showed that these aggregations, regardless of location, were comprised of all 5 DPSs, with the NYB DPS consistently identified as the main contributor of the mixed aggregations, followed by the GOM, CB, SA, and Carolina DPSs. In a similar assessment, genetic analysis was conducted on Atlantic sturgeon captured (fishery-dependent) during the Northeast Fisheries Observer Program and At Sea Monitoring Program, which ranges from Maine to North Carolina. Results from this assessment affirmed that in waters of the Mid-Atlantic, all 5 DPSs co-occur (Figure 14), with the percentage of each DPS estimated to be as follows: 51% NYB DPS; 22% SA DPS; 13 % CB DPS; 11% GOM DPS; 2 % Carolina DPS; and 1 % Canadian stock (Damon-Randall *et al*. 2013); however, these results have not been examined relative to the amount of observed fishing effort throughout the area. In a study by Wirgin *et al*. 2012, genetic analysis revealed that the summer assemblage of Atlantic sturgeon in Minas Basin, Inner Bay of Fundy, Canada, was comprised not only of Canadian origin Atlantic sturgeon, but also Atlantic sturgeon from the GOM DPS (34-64% contribution to the mixed assemblage) and NYB DPS (1-2% contribution to the mixed assemblage). Although additional studies are needed to further clarify the DPS distribution and composition in non-natal estuaries and coastal locations, these studies provide some initial insight on DPS distribution and co-occurrence in particular areas along the U.S. eastern sea board.

Figure 14 - Capture locations and DPS of origin assignments for Observer Program specimens (n=173).



Source: Map provided by Dr. Isaac Wirgin; Damon-Randall *et al*. 2013

Based on the above studies and available information, as the affected area of the multi-species fishery occurs in waters north of 35°N, and Atlantic sturgeon from any of the 5 DPSs may be present in these waters throughout the year, the multispecies fisheries and Atlantic sturgeon of the 5 DPSs are likely to co-occur in the affected area.

6.4.3.6 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 (Figure 15), while the marine range of the GOM DPS extends from the GOM (primarily northern portion of the GOM), to the coast of Greenland (NMFS and USFWS 2005; Fay *et al*. 2006). 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; USASAC 2004; Hyvarinen *et al.* 2006; Lacroix and McCurdy 1996; Lacroix *et al.* 2004, 2005; Reddin 1985; Reddin and Short 1991; Reddin and Friedland 1993, Sheehan *et al.* 2012; NMFS and USFWS 2005; Fay *et al*. 2006). For additional information on the on the biology, status, and range wide distribution of the GOM DPS of Atlantic salmon please refer to NMFS and USFWS 2005; Fay *et al*. 2006.

Figure 15. Geographic range of the Gulf of Maine DPS of Atlantic salmon.

Source: NMFS and USFWS 2005

Based on the above information, as the multispecies fisheries operates throughout the year, and is known to operate in the GOM, it is possible that the fishery will overlap in time and space with Atlantic salmon migrating northeasterly between U.S. and Canadian waters.

6.4.4 Interactions Between Gear and Protected Resources

Protected species described in Section 1.1.3 are all known to be vulnerable to interactions with various types of fishing gear. In the following sections, available information on gear interactions with a given species (or species group) will be provided. Please note, 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 those gear types that are known to pose the greatest risk to the species under consideration.

6.4.4.1 Marine Mammals

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.[7]The categorization in the LOF determines whether participants in that fishery are subject to certain provisions of the MMPA such as registration, observer coverage, and take reduction plan requirements. Individuals fishing in Category I or II fisheries must comply with requirements of any applicable take reduction plan.

Categorization of fisheries is based on the following two-tiered, stock-specific approach:

[7] The most recent LOF was issued August 25, 2014; 79 FR 50589.

- **Tier 1**- considers the cumulative fishery mortality and serious injury for a particular stock. If the total annual mortality and serious injury rates within a stock resulting from all fisheries are less than or equal to ten percent of the stock's potential biological removal rate (PBR), all fisheries associated with this stock fall into Category III.[8] -If mortality and serious injury rates are greater than ten percent of PBR, the following Tier 2, analysis occurs.

- **Tier 2** -considers fishery-specific mortality and serious injury for a particular stock. Specifically, this analysis compares fishery-specific annual mortality and serious injury rates to a stock's PBR to designate the fishery as a Category I, II, or III fishery (see Table 30).

Table 30 - Descriptions of the Tier 2 Fishery Classification Categories (50 CFR 229.2)

Category	Level of incidental mortality or serious injury of marine mammals	Annual mortality and serious injury of a stock in a given fishery is…
Category I	frequent	≥50% of the PBR level
Category II	occasional	between 1% and 50% of the PBR level
Category III	remote likelihood, or no known	≤1% of the PBR level

Please note, in this EA, the following discussion on fishery interactions with marine mammals (large cetaceans, and small cetaceans and pinnipeds) are in reference to the Tier 2 classifications of fisheries in Table 30.

6.4.4.1.1 Large Cetaceans

Atlantic large whales are at risk of becoming entangled in fishing gear because the whales feed, travel and breed in many of the same ocean areas utilized for commercial fishing. The greatest entanglement risk to large whales is posed by fixed fishing gear (e.g., sink gillnet and trap/pot gear) comprised of lines (vertical or ground) that rise into the water column. 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; Waring *et al.* 2014). For instance, in a study of right and humpback whale entanglements, Johnson *et al*. 2005 attributed: (1) 89% of entanglement cases, where gear could be identified, to fixed gear consisting of pot and gillnets and (2) entanglement of one or more body parts of large whales (e.g., mouth and/or tail regions) to four different types of line associated with fixed gear (the buoy line, groundline, floatline, and surface system lines).[9] Although available data, such as Johnson *et al*.2005, provides insight into large whale entanglement risks with fixed fishing gear, to date, due to uncertainties

[8] PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

[9] Buoy line connects the gear at the bottom to the surface system. Groundline in trap/pot gear connects traps/pots to each other to form trawls; in gillnet gear, groundline connects a gillnet or gillnet bridle to an anchor or buoy line. Floatline is the portion of gillnet gear from which the mesh portion of the net is hung. The surface system includes buoys and high-flyers, as well as the lines that connect these components to the buoy line.

surrounding the nature of the entanglement event, as well as unknown biases associated with reporting effort and the lack of information about the types and amounts of gear being used, determining which part of fixed gear creates the most entanglement risk for large whales is difficult (Johnson *et al.* 2005). As a result, any type or part of fixed gear is considered to create an entanglement risk to large whales and should be considered potentially dangerous to large whale species (Johnson *et al.* 2005).

The effects of entanglement to large whales range from no injury to death (NMFS 2014; Johnson *et al*. 2005; Angliss and Demaster 1998; Moore and Van der Hoop 2012). "When… [whales] become fouled in gear, normal breathing and movement may be impaired or stopped completely. If the animal does manage to struggle free, portions of gear may remain attached to the body. This trailing gear, often made of durable synthetic material, may create excess drag, snag onto objects in the environment and impede normal behavior like breathing, feeding, movement, or breeding. Other effects include infections and deformations" (quote from Center for Coastal Studies, May 14, 2003, in NMFS 2014; Moore and Van der Hoop 2012). Considering these factors, the risk of injury or death in the event of an entanglement may depend on 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 (e.g., the feasibility or success of disentanglement efforts), or other variables (NMFS 2014). 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 does indicate that the entanglement in fishing gear is a significant source of serious injury or mortality for Atlantic large whales (Table 11; Waring *et al*. 2014).

As described in Section 1.1.3 (Species Potentially Affected), there are four species of large whales likely to occur in the affected area of the multispecies fishery: North Atlantic right whale; humpback whale; fin whale; and minke whale. Table 31 summarizes all known serious injury and fatal entanglements of humpback, fin, sei, minke, and North Atlantic right whales from 1997 to 2011 (NMFS 2014; Waring *et al*. 2014). The entanglement data comes from the 2014 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment Report and pertains only to entanglements that the National Marine Fisheries Service considers to be the primary cause of serious injury or death to a whale (Waring *et al*. 2014).[10] In addition, only entanglement data from U.S. waters is presented.

[10] NMFS defines serious injury as an "injury that is more likely than not to result in mortality" (Waring *et al.* 2014).

Table 31 - Summary of confirmed serious injury and mortality of fin, minke, humpback, sei, and North Atlantic right whales from 1997-2011 due to fisheries entanglements.

Species	Total Confirmed Serious Injury Cases from 1997-2011	Total Confirmed Mortality Cases from 1997-2011	Annual Fishing Mortality, U.S. Waters Only[1]	Potential Biological Removal (PBR)
North Atlantic Right Whale	15	9	1.6	0.9
Humpback Whale	40	20	4	2.7
Fin Whale	4	8	0.8	5.6
Sei Whale	1	0	0.07	0.5
Minke Whale	6	34	2.7	162

Notes: [1] "Annual Fishing Mortality" refers to mortality and serious injury resulting from large whale interactions with commercial fisheries.

Sources: NMFS 2014; Waring *et al*. 2014.

As many entanglement events go unobserved, and because the gear type, fishery, and/or country of origin for reported entanglement events are often not traceable, it is important to recognize that the information presented in Table 31 likely underestimates the rate of large whale serious injury and mortality due to entanglement. Further, scarring data suggests that entanglements may be occurring more frequently than the observed incidences indicate (i.e., Table 31; NMFS 2014). For instance, a study conducted by Robbins (2009) analyzed entanglement scars observed in photographs taken during 2003-2006. This analysis suggests high rates of entanglements of GOM humpback whales in fishing gear. In an analysis of the scarification of right whales, 519 of 626 (82.9%) whales examined during 1980-2009 were scarred at least once by fishing gear (Knowlton *et al*. 2012). Further research using the North Atlantic Right Whale Catalogue has indicated that, annually, between 8.6% and 33.6% of right whales have been involved in entanglements (Knowlton *et al*. 2012). Based on this information, care should be taken when interpreting entanglement data as it is likely more incidences of entanglement are occurring than observation alone indicates.

As noted above, pursuant to the MMPA, NMFS publishes a LOF annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injurious and mortalities of marine mammals in each fishery. Large whales, in particular, humpback, fin, minke, and North Atlantic right whales, are known to interact with Category I and II fisheries in the (Northwest) Atlantic Ocean. As humpback, fin, and North Atlantic right whales are listed as endangered under the ESA, these species are considered strategic stocks under the MMPA (see Section 1.1.3 Species Potentially Affected). Section 118(f)(1) of the MMPA requires the preparation and implementation of a Take Reduction Plan (TRP) for any strategic marine mammal stock that interacts with Category I or II fisheries. In response to its obligations under the MMPA, 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.[11] In 1997, the ALWTRP was implemented; however, since 1997, the Plan has been modified as NMFS and the ALWTRT learn more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. In fact, two recent adjustments include the Sinking Groundline Rule (September 2, 2008; 73 FR 51228), and the Vertical Line Rule (June 27, 2014; 79 FR 36586; December 12, 2014; 79 FR 73848).[12]

Broadly speaking, 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). Specifically, the Plan identifies gear modification requirements and restrictions for Category I and II gillnet and trap/pot fisheries in the Northeast, Mid-Atlantic, and Southeast regions of the U.S.; these fisheries must comply with all regulations of the Plan.[13]

The following table (Table 32) provides a brief summary of the specified gear modification requirements and restrictions under the ALWTRP for trap/pot or gillnet fisheries in the Northeast or Mid-Atlantic region of the U.S. As the affected environment of the proposed action will not extend into the Southeast region, those provisions of the Plan will not be discussed further. For further details on the gear modification requirements and restrictions under the ALWTRP please see: http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/

[11] 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.

[12] The most recent rule (Vertical Line Rule) focused on trap/pot vertical line reduction as the ALWTRT determined that gillnets represent less than 1% of the total vertical lines on the east coast and that the impacts from this gear on large whales is minimal (see Appendix 3A, NMFS 2014); however, even with the new Rule, gear will still be subject to existing restrictions under the ALWTRP for gillnet gear.

[13] 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 2014).

Table 32 - Summary of gear modification requirements and restrictions for the Northeast and Mid-Atlantic Trap/Pot and Gillnet Fisheries under the Atlantic Large Whale Take Reduction Plan.

Fishery	Gear Modification Requirement and Restrictions
Trap/Pot	**Northeast and Mid-Atlantic** • Trap/Pot Universal Requirements • Trap/Pot Weak Link Requirements • Trap/Pot Gear Marking Requirements **Northeast** • Minimum Number of Traps per Trawl Requirement • Minimum Number of Traps per Trawl Requirement Exemption (NH state waters; ¼ mile within Mohegan Island; Matinicus Island; and Ragged Island, Maine).
Gillnet	**Northeast and Mid-Atlantic** • Gillnet Universal Requirements • Gillnet Gear Marking Requirements • Gillnet Weak Link Requirements • Anchored Gillnet Anchoring Requirements • Drift Gillnet Night Fishing & Storage Restrictions

Except for the universal gear requirements, the additional gear modification requirements and restrictions identified in Table 32 will vary by location (i.e., management areas) and dates. The following table (Table 33) and figures (Figure 16 and Figure **17**) provide the Management Areas recognized by the ALWTRP in the Northeast and Mid-Atlantic; for details on the specific gear modification requirements and restrictions in each Management Area please see http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/.

Table 33 - Northeast and Mid-Atlantic Gillnet or Trap/Pot Management Areas under the Atlantic Large Whale Take Reduction Plan.

Fishery	Management Areas
Northeast Trap/Pot	• Northern Inshore State Trap/Pot Waters • Massachusetts Restricted Area • Stellwagen Bank/Jeffreys Ledge Restricted Area • Great South Channel Restricted Trap/Pot Area • Northern Nearshore Trap/Pot Waters • Southern Nearshore Trap/Pot Waters (Northeast) • Offshore Trap/Pot Waters (Northeast)
Northeast Gillnet	• Cape Cod Bay Restricted Area • Stellwagen Bank/Jeffreys Ledge Restricted Area • Great South Channel Restricted Gillnet Area • Other Northeast Gillnet Waters (Northeast)
Mid-Atlantic Trap/Pot	• Southern Nearshore Trap/Pot Waters • Offshore Trap/Pot Waters (Mid-Atlantic)
Mid-Atlantic Gillnet	• Other Northeast Gillnet Waters (Mid-Atlantic) • Mid/South Atlantic Gillnet Waters

Figure 16 - Summary of Trap/Pot Management Area under the Atlantic Large Whale Take Reduction Plan.

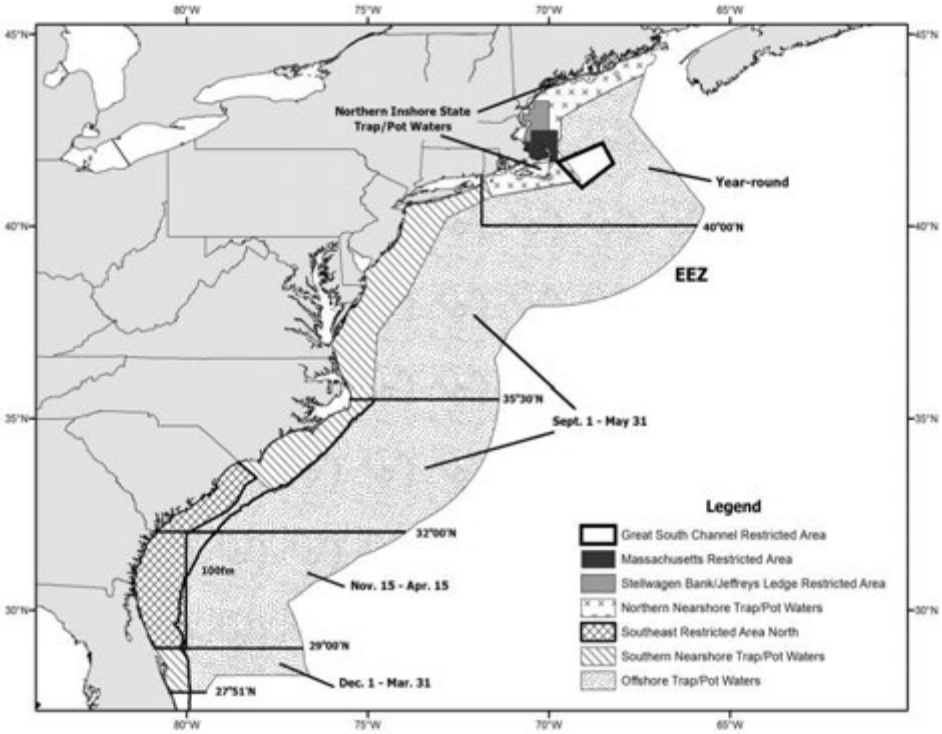
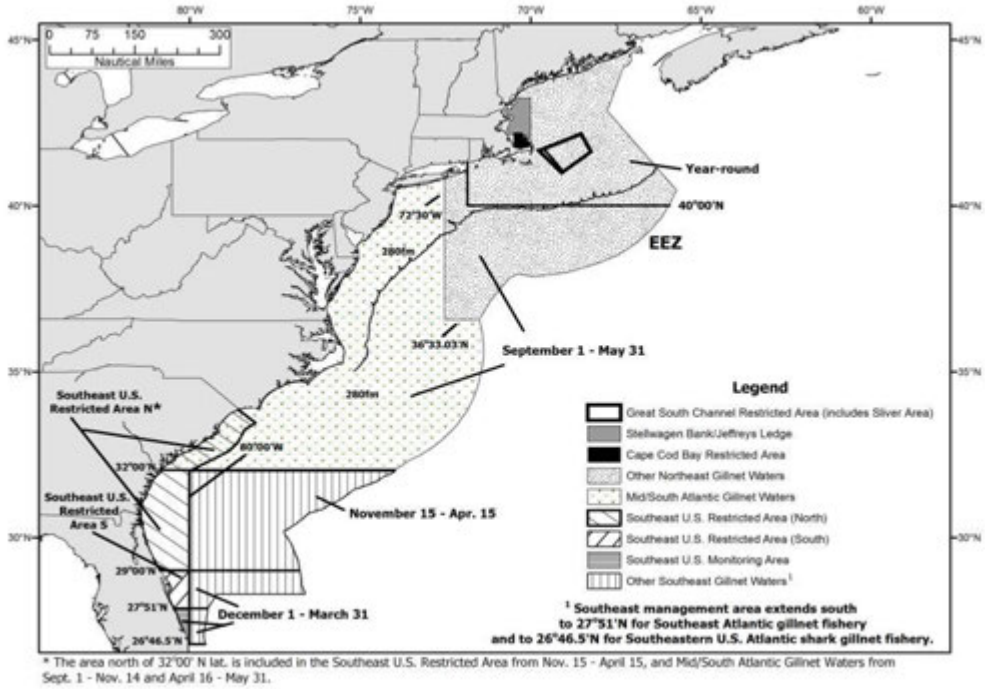


Figure 17 - Summary of Gillnet Management Areas under the Atlantic Large Whale Take Reduction Plan.



6.4.4.1.2 Small Cetaceans and Pinnipeds

Small cetaceans and pinnipeds are found throughout the waters of the Northwest Atlantic (see Section 1.1.3). As they feed, travel and breed in many of the same ocean areas utilized for commercial fishing, they are at risk of becoming entangled or bycaught in various types of fishing gear (see Table 14), with interactions resulting in serious injury or mortality to the animal. As noted above, pursuant to the MMPA, NMFS publishes a LOF annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injurious and mortalities of marine mammals in each fishery.

Table 34 provides information on the Category I and II fisheries that occur in the affected environment of the multispecies fishery, and the small cetacean and pinniped species that have been observed incidentally injured and/or killed by these fisheries. Information is also provided on the most recent mean annual mortality estimates for those species observed incidentally injured/killed in the fishery from 2007-2011.[14] Please note, Table 14 does not provide a comprehensive list of all species affected by each fishery, it only addresses those species that occur in the affected environment of the multispecies fishery (see Section 1.1.3). For a comprehensive list of species affected by each category of fishery, please see the recently issued LOF.

Table 34 - Small cetacean and pinniped species observed seriously injured and/or killed by Category I, II, and III fisheries in the affected environment of the multispecies fishery. A (1) indicates those species driving the fisheries classification.

Category I			
Fishery	**Species Observed Injured/Killed**	**Observed in 2007-2011**	**Mean Annual Mortality[1]**
Northeast Sink Gillnet	Bottlenose dolphin (offshore)	N	N/A
	Harbor porpoise (1)	Y	462
	Atlantic white sided dolphin	Y	33
	Short-beaked common dolphin	Y	41
	Pilot whale	Y	1
	Harbor seal	Y	346
	Gray seal	Y	1,043
	Harp seal	Y	208
Mid-Atlantic Gillnet	Bottlenose dolphin (Northern Migratory coastal) (1)	N	N/A
	Bottlenose dolphin (Southern Migratory coastal) (1)	N	N/A
	Bottlenose dolphin (offshore)	N	N/A
	Long-finned pilot whale	N	N/A
	Short-finned pilot whale	N	N/A
	White-sided dolphin	N	N/A

[14] For additional information on those species observed incidentally injured or killed in a particular fishery prior to 2007, please refer to Waring *et al*. 2014.

	Harbor porpoise	Y	198
	Short-beaked common dolphin	Y	12
	Risso's dolphin	Y	6.8
	Harbor seal	Y	49
	Harp seal	Y	63
	Gray seal	Y	57
Pelagic Longline	Long-finned pilot whale (1)	N	N/A
	Risso's dolphin	Y	10
	Short-finned pilot whale (1)	Y	119
	Short-beaked common dolphin	Y	1.7
	Bottlenose dolphin (offshore)	Y	1.7
Northeast/Mid-Atlantic American Lobster Trap/Pot	Harbor seal	N	N/A
Category II			
Mid-Atlantic Mid-Water Trawl-Including Pair Trawl	Bottlenose dolphin (offshore)	N	N/A
	Risso's dolphin	Y	0.2
	White-sided dolphin (1)	Y	6
	Short-beaked common dolphin	Y	0.6
	Long and short-finned pilot whales	Y	2.4
	Gray seal	Y	0.2
	Harbor seal	Y	0.2
Northeast Mid-Water Trawl-Including Pair Trawl	White-sided dolphin	N	N/A
	Short-beaked common dolphin	N	N/A
	Long and short-finned pilot whales (1)	Y	4
	Harbor seal	Y	0.7
Northeast Bottom Trawl	Harp seal	Y	0.4
	Harbor seal	Y	0.8
	Gray seal	Y	9.2
	Long and short-finned pilot whales	Y	10
	Short-beaked common dolphin	Y	19
	White-sided dolphin (1)	Y	73

	Harbor porpoise	Y	4.5
	Bottlenose dolphin (offshore)	Y	20
	Risso's dolphin	Y	2.5
Mid-Atlantic Bottom Trawl	White-sided dolphin	Y	4
	Long and short-finned pilot whales (1)	Y	26
	Short-beaked common dolphin (1)	Y	96
	Risso's dolphin (1)	Y	42
	Bottlenose dolphin (offshore)	Y	20
	Harbor seal	Y	0.2
Northeast Anchored Float Gillnet	Harbor seal	N	N/A
	White-sided dolphin	N	N/A
Atlantic Blue Crab Trap/Pot	Bottlenose dolphin (Northern Migratory coastal) (1)	N	N/A
	Bottlenose dolphin (Southern Migratory coastal) (1)	N	N/A
Mid-Atlantic Haul/Beach Seine	Bottlenose dolphin (Northern Migratory coastal) (1)	N	N/A
	Bottlenose dolphin (Southern Migratory coastal) (1)	N	N/A

Notes:
[1] Based on observer data from 2007-2011, estimates of serious injury and estimates of mortality are provided for every year of observation in Waring *et al*. 2014. Estimated "combined mortality" per year of observation is also provided in Waring *et. al* 2014; this is equal to the "estimated serious inury" + "estimated mortality" for every year observed. The "mean annual mortality" is the average of each "estimated combined mortality" value over the 5 year period of observation (Waring *et al.* 2014).

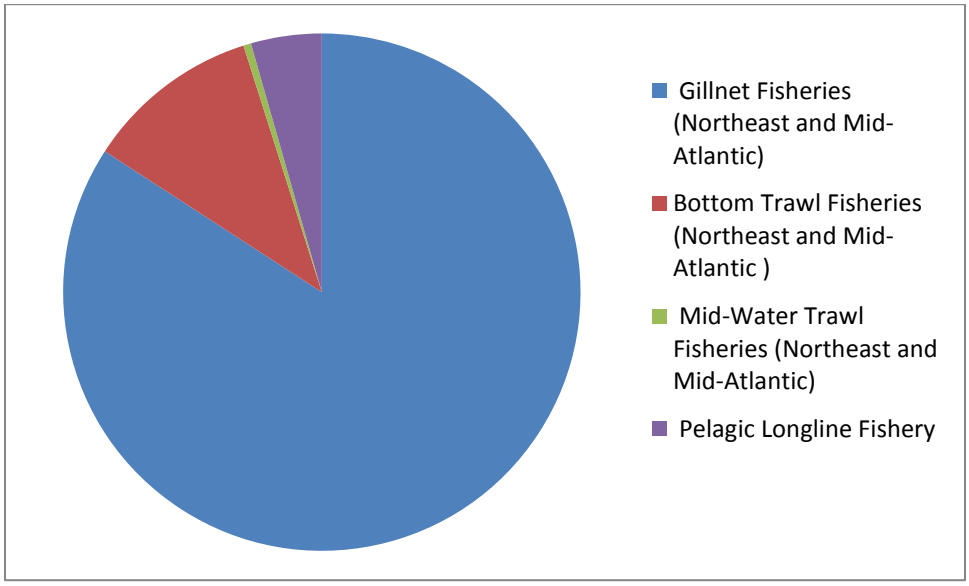
Sources: Waring *et al*. 2014; August 25, 2014, List of Fisheries (79 FR 50589).

Based on the information provided in

Table 34, it is apparent that there are multiple Category I and II fisheries in the affected environment of the multispecies fishery that result in the serious injury and morality of small cetaceans and pinnipeds. Of these fisheries; however, the Northeast and Mid-Atlantic gillnet fisheries, followed by the bottom trawl fisheries (Category I and II fisheries, respectively) pose the greatest risks of serious injury and mortality to small cetaceans and pinnipeds (Figure 18). Based on the available observer data from 2007-2011 (see

Table 34), approximately 84% of the total mean annual mortality to marine mammals (small cetaceans + seals, large whales excluded) is attributed to gillnet fisheries, followed by bottom trawl (10.94%), pelagic longline (4.42%) and mid-water trawl (0.48%) fisheries.

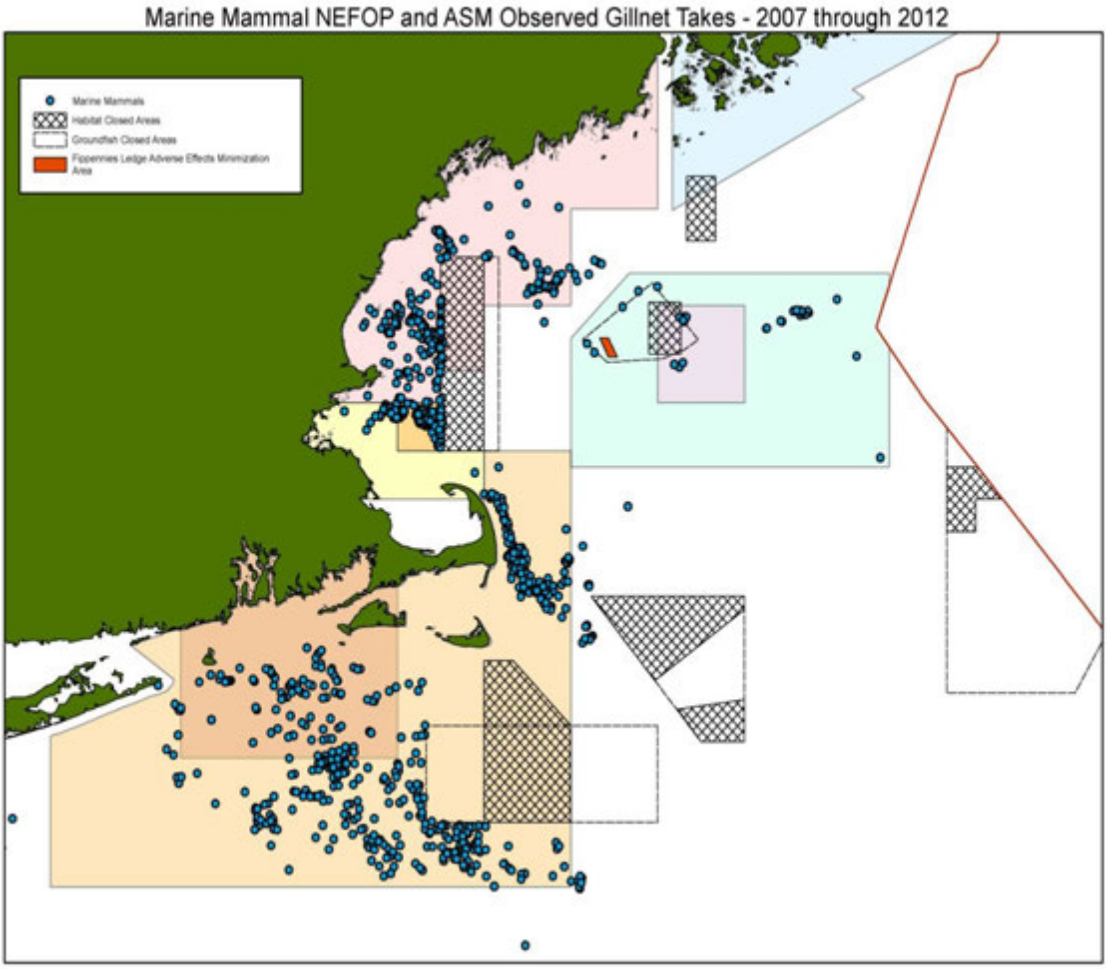
Figure 18 - 2007-2011 total mean annual mortality of small cetaceans and pinnipeds by Category I and II Fisheries.



Although there are multiple Category I and II fisheries that result in the serious injury and morality of small cetaceans and pinnipeds, the risk of an interaction with a specific fishery is affected by multiple factors, including where and when fishing effort is focused, the type of gear being used, and how effort overlaps in time and space with specific species in the affected area. For instance, the following figures (Figure 19 and Figure 20) depict observed marine mammal takes (large whales excluded) in gillnet and trawl gear in the GOM, GB, and SNE sub-regions of the multispecies fisheries from 2007-2011.[15] As depicted in Figures 7 and 8, over the last 5 years, there appears to be particular areas of the GOM, GB, and SNE sub-regions where fishing effort is overlapping in time and space with small cetacean or pinniped occurrence. Although uncertainties, such as shifting fishing effort patterns and data on true density (or even presence/absence) for some species, remain, the available observer data, as depicted in Figures 47 and 8, does provide some insight into areas in the ocean where the likelihood of interacting with a particular species is high and therefore, provides a means to consider potential impacts of future shifts or changes in fishing effort on small cetaceans and pinnipeds.

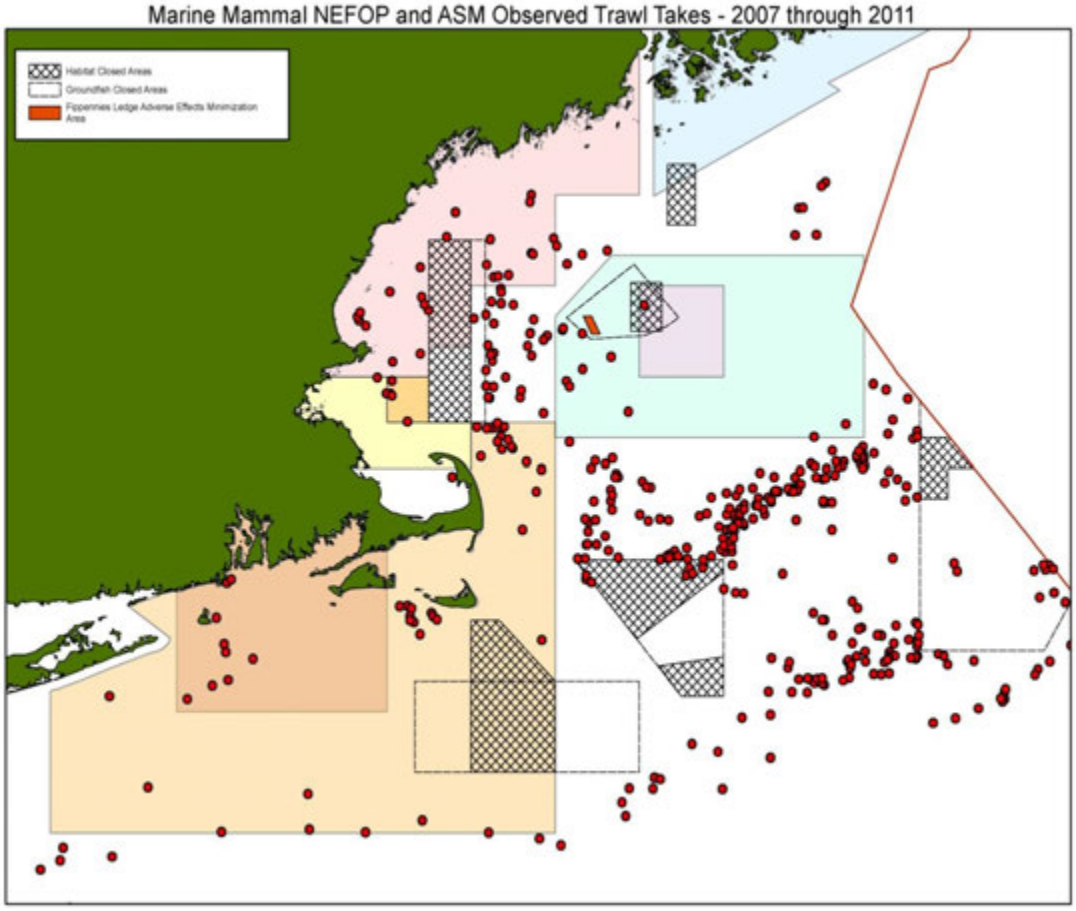
[15] Additional maps of marine mammal takes in various fishing gear can be found in Waring *et al*. 2014.

Figure 19 - Map of marine mammal bycatch in gillnet gear in the New England region (excluding large whales) observed by traditional fishery observers and at sea monitors between 2007 and 2011.



Notes: Small cetacean and pinnipeds have been observed taken primarily in: (1) the waters west of the GOM Habitat/Groundfish closed area: Harbor seals, harp seals, and harbor porpoise; (2) off of Cape Cod, MA: Gray seals, harbor seals, and harbor porpoise; (3) west of the NLCA (Groundfish closed area): Harbor porpoise, short- beaked common dolphin, gray seals, harp seals, and harbor seals; and (4) waters off southern Massachusetts and Rhode Island: Gray seals and harbor seals, and some harbor porpoise and short-beaked common dolphin.

Figure 20 - Map of marine mammal bycatch in trawl gear in the New England region (excluding large whales) observed by traditional fishery observers and at sea monitors between 2007 and 2011.



Notes: Small cetacean and pinnipeds observed taken primarily in: (1) the waters between and around CA I and CA II (Groundfish closed areas): Short-beaked common dolphin, pilot whales, white-sided dolphins, gray seals, and some risso's dolphins and harbor porpoise; and (2) eastern side of the GOM Habitat/Groundfish closed area: White-sided dolphins, and some pilot whales and harbor seals.

As noted above, numerous species of small cetaceans and pinnipeds interact with Category I and II fisheries in the Atlantic Ocean; however, several species in

Table 34 have experienced such great losses to their populations as a result of interactions with Category I and II fisheries that they are now considered strategic stocks under the MMPA.[16] These species are the harbor porpoise, the Western North Atlantic Northern Migratory Coastal Stock of bottlenose dolphin and the Western North Atlantic Southern Migratory Coastal Stock of bottlenose dolphin. Section 118(f)(1) of the MMPA requires the preparation and implementation of a TRP for any strategic marine mammal stock

[16] Harbor porpoise are considered a strategic stock under the MMPA as the level of direct human-caused mortality has exceeded the PBR level for this species. Both northern and southern migratory coastal stocks of bottlenose dolphins are considered a strategic stock under the MMPA as both stocks are designated as depleted under the Act.

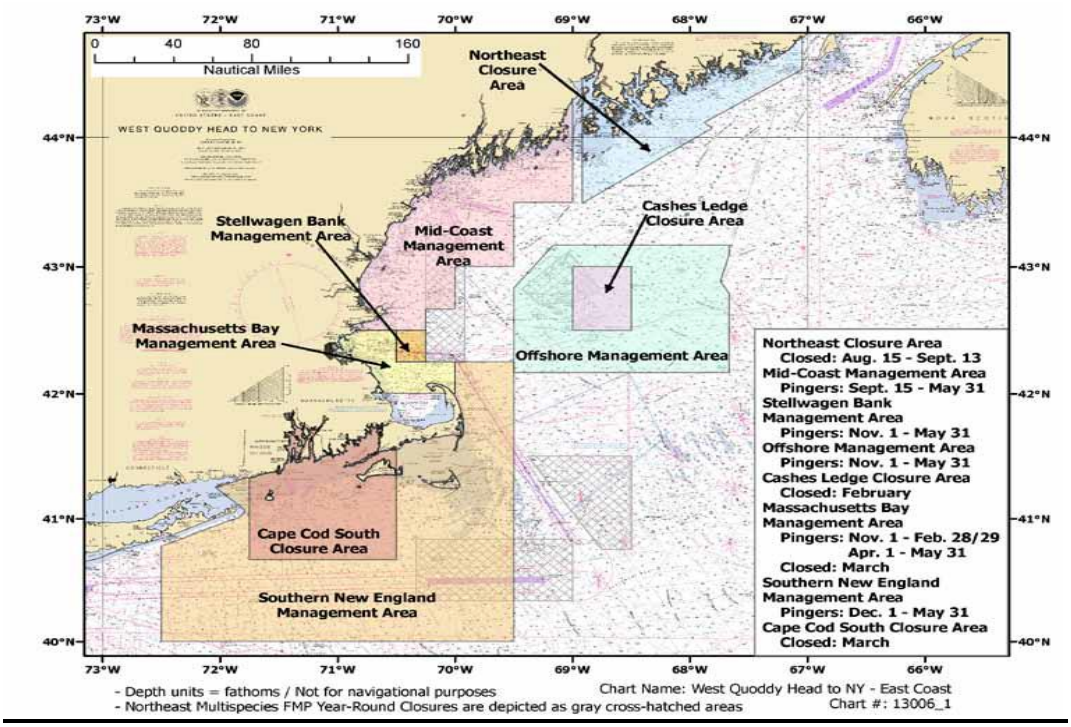
that interacts with Category I or II fisheries. As a result, the Harbor Porpoise TRP (HPTRP or Plan) and the Bottlenose Dolphin TRP (BDTRP or Plan) were developed and implemented for these species. The following provides a brief overview and summary for each TRP; however, additional information on each TRP can be found at: http://www.greateratlantic.fisheries.noaa.gov/protected/porptrp/ or http://www.nmfs.noaa.gov/pr/interactions/trt/bdtrp.htm

Harbor Porpoise Take Reduction Plan (HPTRP)

To address the high levels of incidental take of harbor porpoise in the groundfish sink gillnet fishery, a Take Reduction Team was formed in 1996. A rule (63 FR 66464) to implement the Harbor Porpoise Take Reduction Plan, and therefore, to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was published on December 2, 1998, and became effective on January 1, 1999; the Plan was amended on February 19, 2010 (75 FR 7383), and October 4, 2013 (78 FR 61821). Since gillnet operations differ between the New England and Mid-Atlantic regions, the follow sets of measures were devised for each region:

- **New England Region**: The New England component of the HPTRP pertains to all fishing with sink gillnets and other gillnets capable of catching multispecies in New England waters from Maine through Rhode Island. This portion of the Plan includes time and area closures, as well as closures to multispecies gillnet fishing unless pingers are used in the manner prescribed in the TRP regulations (Figure 21). For additional details see 50 CFR 229.33 and the outreach guide at http://www.greateratlantic.fisheries.noaa.gov/prot_res/porptrp/doc/HPTRPNewEnglandGuide.pdf

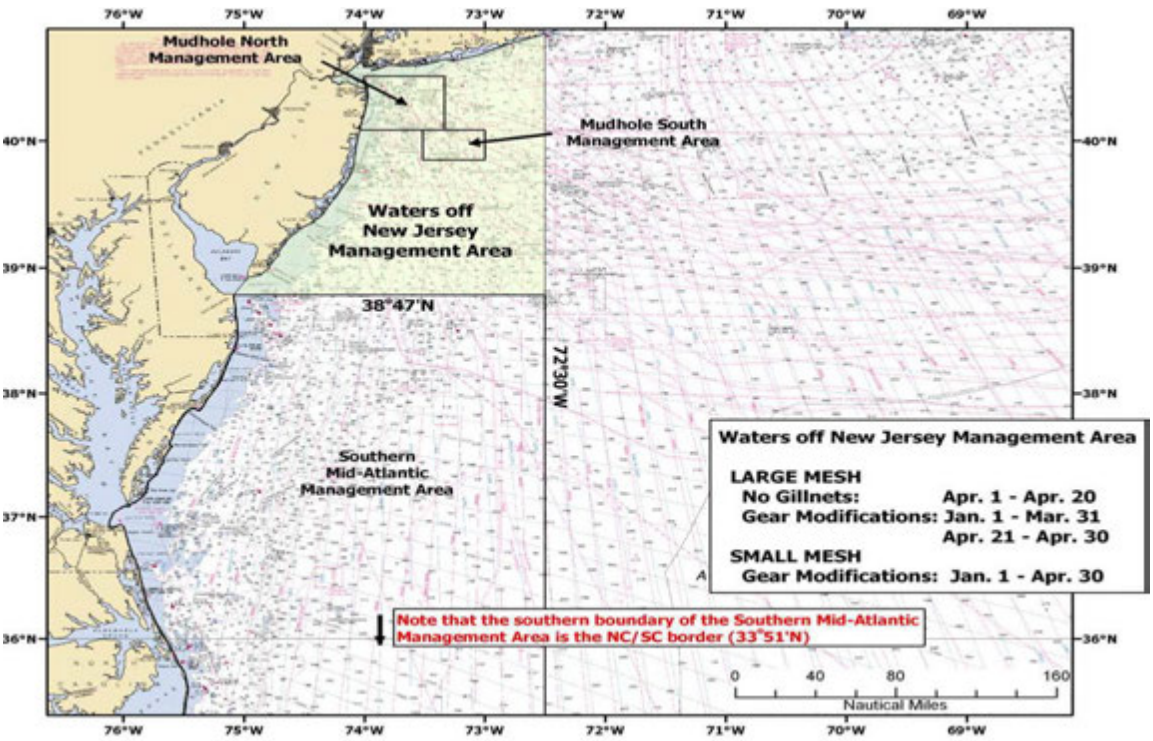
Figure 21. HPTRP Management Areas for New England.



- **Mid-Atlantic Region:** The Mid-Atlantic portion of the HPTRP pertains to the Mid-Atlantic shoreline from the southern shoreline of Long Island, New York to the North Carolina/South Carolina border. It includes four management areas (Waters off New Jersey, Mudhole North (located in Waters off New Jersey Management Area), Mudhole South (located in Waters off

New Jersey Management Area), and Southern Mid-Atlantic), each with time and area closures to gillnet fishing unless the gear meets certain specifications. Additionally, during regulated periods, gillnet fishing in each management area of the Mid-Atlantic is regulated differently for small mesh (> 5 inches to < 7 inches) and large (7-18 inches) mesh gear. The Plan also includes some time and area closures in which gillnet fishing is prohibited regardless of the gear specifications. Figure 22 and Figure 23 provide a depiction of the Mid-Atlantic Management Areas. For additional details see 50 CFR 229.34 and the outreach guide at http://www.greateratlantic.fisheries.noaa.gov/prot_res/porptrp/doc/HPTRPMidAtlanticGuide_Feb%202010.pdf

Figure 22. HPTRP-Waters off New Jersey Management Area.



Notes:

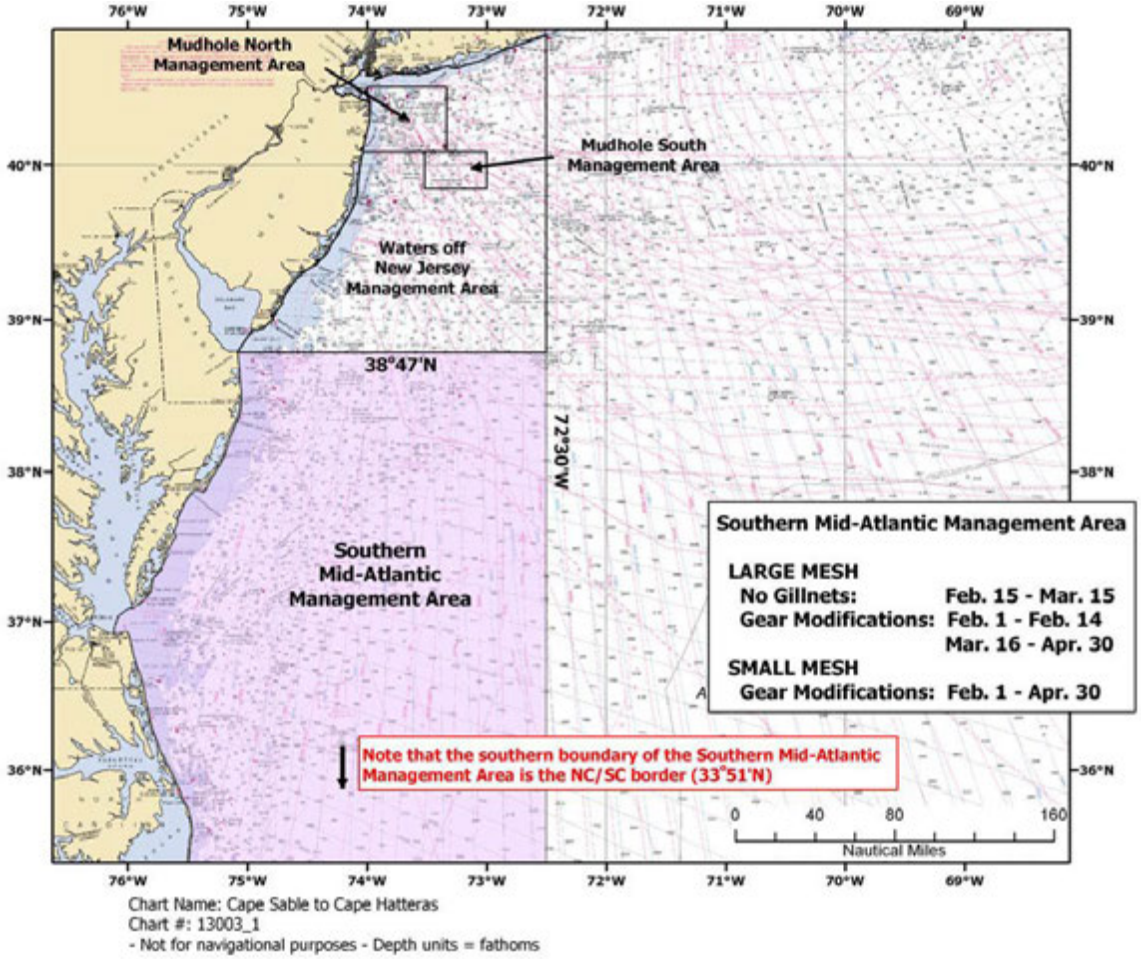
Mudhole North Management Area Small Mesh
Gear Modification: Jan. 1- Apr. 30
No Gillnet: Feb. 15-Mar. 15

Mudhole North Management Area Large Mesh
Gear Modification: Jan. 1- Apr. 30
No Gillnet: Feb. 15-Mar. 15; Apr. 1-Apr. 20

Mudhole South Management Area Small Mesh
Gear Modification: Jan. 1- Jan.31; Mar. 16-Apr.30
No Gillnet: Feb. 1-Mar.15

Mudhole South Management Area Large Mesh
Gear Modification: Jan. 1- Jan.31; Mar. 16-Mar. 31; Apr. 21- Apr. 30
No Gillnet: Feb. 1-Mar.15; Apr. 1- Apr. 20

Figure 23 - HPTRP-Southern Mid-Atlantic Management Area



Bottlenose Take Reduction Plan

In April 2006, NMFS published a final rule to implement the TRP for the WNA coastal stock of bottlenose dolphin (April 26, 2006, 71 FR 24776) to reduce the incidental mortality and serious injury in the Mid-Atlantic gillnet fishery and eight other coastal fisheries operating within the dolphin's distributional range. The other Atlantic coastal fisheries include the North Carolina inshore gillnet fishery, Southeast Atlantic gillnet fishery, Atlantic blue crab trap/pot fishery, Mid-Atlantic haul/beach seine fishery, North Carolina long haul seine fishery, North Carolina roe mullet stop net fishery, Southeastern U.S. Atlantic shark gillnet fishery, and the Virginia pound net fishery (NMFS 2002). The final rule also revised the large mesh size restriction under the Mid-Atlantic large mesh gillnet rule for conservation of endangered and threatened sea turtles to provide consistency among Federal and state management measures. The BDTRP was amended on July 31, 2012 (77 FR 45268) to permanently continue nighttime fishing restrictions of medium mesh gillnets operating in North Carolina coastal state waters. The measures contained in the Plan include gillnet effort reduction, gear proximity requirements, gear or gear deployment modifications, and outreach and educational measures to reduce dolphin bycatch below the marine mammals stock's PBR. For additional details on the BDTRP please visit: **http://www.nmfs.noaa.gov/pr/interactions/trt/bdtrp.htm.**

6.4.4.1.3 Sea Turtles

As described in section 6.4.3.1, sea turtles are widely distributed in the waters of the Northwest Atlantic. As a result, sea turtles often occupy many of the same ocean areas utilized for commercial fishing and therefore, interactions with fishing gear are possible. Sea turtles have been incidentally injured or killed in various gear types (e.g., gillnets, trawls, hook and line gear, dredge); however, of the gear types that could be possibly used in the multispecies fishery, trawl and gillnet pose the greatest risk to sea turtles and therefore, will be the focus of the following discussion. In addition, although sea turtle interactions with trawl and gillnet gear have been observed in waters from the GOM to the Mid-Atlantic, most of the observed interactions have occurred in the Mid-Atlantic. As few sea turtle interactions have been observed in the GOM and GB regions of the Northwest Atlantic, there is insufficient data available to conduct a robust model-based analysis on sea turtle interactions with trawl or gillnet gear in these regions and therefore, produce a bycatch estimate for these regions. As a result, the following bycatch estimates are based on observed sea turtle interactions in trawl and gillnet gear in the Mid-Atlantic.

In a study done by Warden (2011a), it was estimated that from 2005-2008, the average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic (i.e., i.e., south of Cape Cod, Massachusetts, to approximately the North Carolina/South Carolina border) was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls, but being released through a Turtle Excluder Device.[17] Of the 292 average annual observable loggerhead interactions, approximately 44 of those were adult equivalents (Warden 2011a).[18] This estimate is a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, which Murray (2008) estimated to be 616 sea turtles (CV=0.23, 95% CI over the nine-year period: 367-890). This decrease is likely due to decreased fishing effort in high-interaction areas (Warden 2011a). Warden (2011b), using species landed, also estimated total loggerhead interactions attributable to managed species. Five loggerhead interactions (estimated observable and unobservable but quantifiable) were attributed to Northeast multispecies. In addition, green, Kemp's ridley, and leatherback sea turtles have been documented in bottom trawl gear in areas that overlap with the Northeast groundfish fishery (NEFSC FSB database). One of these, a leatherback sea turtle, was captured on trip where the top landed species was whiting, while another sea turtle (unknown species) was captured on trip where the top landed species was pollock.

Murray (2013) conducted an assessment of loggerhead and unidentified hard-shell turtle interactions in Mid-Atlantic gillnet gear from 2007-2011. Based on Northeast Fisheries Observer Program data from 2007-2011, interactions between loggerhead and hard-shelled turtles (loggerheads plus unidentified hard-shelled) and commercial gillnet gear in the Mid-Atlantic averaged 95 hard-shelled turtles and 89 loggerheads (equivalent to 9 adults) annually (Murray 2013). However, average estimated interactions in large mesh gear in warm, southern Mid-Atlantic waters have declined relative to those from 1996-2006 (Murray 2009), as did the total commercial effort (Murray 2013). Murray (2013) also estimated interactions by managed species landed in gillnet gear from 2007-2011. An estimate was not provided for the Northeast multispecies fisheries; however, takes have been observed in sink gillnet fisheries targeting other species. One of these was documented by an at sea monitor north of 42° N latitude. Leatherback, Kemp's ridley, and green sea turtles have also been documented in Mid-Atlantic gillnet gear by fishery

[17] Warden (2011) and Murray (2013) define the mid-Atlantic slightly differently, but both include waters north to Massachusetts. See the respective papers for a more complete description of these areas.

[18] Adult equivalence considers the reproductive value of the animal (Warden 2011, Murray 2013), providing a "common currency" of expected reproductive output from the affected animals (Wallace et al. 2008), and is an important metric for understanding population level impacts (Haas 2010).

observers (NEFSC FSB database), with observed takes of Kemp's ridley and leatherback sea turtles having occurred in areas that overlap with the Northeast multispecies fishery.

Although sea turtles have the potential to interact with multiple gear types, such as trawl or gillnet gear, the risk of an interaction is affected by multiple factors, including where and when fishing effort is focused, the type of gear being used, environmental conditions, and sea turtle occurrence and distribution. Murray and Orphanides (2013) recently evaluated fishery-independent and dependent data to identify environmental conditions associated with turtle presence and the subsequent risk of a bycatch encounter if fishing effort is present; It was concluded that fishery independent encounter rates were a function of latitude, sea surface temperature (SST), depth, and salinity. When the model was fit to fishery dependent data (gillnet, bottom trawl, and scallop dredge), Murray and Orphanides (2013) found a decreasing trend in encounter rates as latitude increases; an increasing trend as SST increases; a bimodal relationship between encounter rates and salinity; and higher encounter rates in depths between 25 and 50 m. Similarly, Murray (2013) concluded, based on 2007-2011 data obtained on loggerhead interactions in gillnet gear, that bycatch rates were associated with latitude, SST, and mesh size, with highest interaction rates in the southern mid-Atlantic in warm surface waters and in large (>7 inch mesh). Based on the above 2005-2008 data obtained on loggerhead interactions in bottom trawl gear, Warden (2011a) also found that latitude, depth and SST were associated with the interaction rate, with the rates being highest south of 37° N in waters < 50 meters deep and SST > 15°C (Table 35).

Table 35 - Mid-Atlantic trawl bycatch rates (Warden 2011a).

Latitude Zone	Depth, SST	Loggerheads/Day Fished
<37 °N	<=50 m, <=15° C	0.4
	<=50 m, >=15° C	2.06
	>50 m, <= 15° C	0.07
	>50 m, >15° C	0.09
37 - 39 °N	<=50 m, <=15° C	0.04
	<=50 m, >=15° C	0.18
	>50 m, <= 15° C	0.01
	>50 m, >15° C	0.07
>39 °N	<=50 m, <=15° C	<0.01
	<=50 m, >=15° C	0.03
	>50 m, <= 15° C	<0.01
	>50 m, >15° C	0.01

6.4.4.1.4 Atlantic Sturgeon

As described in Section 6.4.3, 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, although genetic analyses suggests that the distribution of each varies within that range (King *et al*. 2001; Laney *et al*. 2007; Dunton *et al*. 2012; Wirgin *et al*. 2012; Waldman *et al*. 2013; O'Leary *et al*. 2014). Three separate publications using different information sources reached the same conclusion; Atlantic sturgeon occur primarily in waters less than 50 meters (although deeper waters are also used), aggregate in certain areas, and exhibit seasonal movement patterns (see Stein *et al*. 2004b;

Dunton *et al*. 2010; Erickson *et al*. 2011; see Section 6.4.3 for additional details). These characteristics of Atlantic sturgeon occurrence and distribution result in Atlantic sturgeon occupying many of the same ocean areas utilized for commercial fishing and therefore, occupying areas in which interactions with fishing gear are possible.

There are three documents, covering three time periods, that use data collected by the Northeast Fisheries Observer Program to describe bycatch of Atlantic sturgeon: Stein *et al*. (2004b) for 1989-2000; ASMFC (2007) for 2001-2006; and Miller and Shepard (2011) for 2006-2010; None of these provide estimates of Atlantic sturgeon bycatch by DPS. Information provided in all three documents indicate that sturgeon bycatch occurs in gillnet and trawl gear, with the most recent document estimating, based on fishery observer data and VTR data from 2006-2010, that annual bycatch of Atlantic sturgeon was 1,342 and 1,239, respectively (Miller and Shepard 2011). Specifically, Miller and Shepard (2011) observed Atlantic sturgeon interactions in trawl gear with small (< 5.5 inches) and large (≥ 5.5 inches) mesh sizes, as well as gillnet gear with small (< 5.5 inches), large (5.5 to 8 inches), and extra-large mesh (>8 inches) sizes. Although Atlantic sturgeon were observed to interact with trawl and gillnet gear with various mesh sizes, based on observer data, Miller and Shepard (2011) concluded that 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). Similar conclusions were reached in Stein *et al*. 2004b and ASMFC 2007 reports, in which both studies also concluded, after review of observer data from 1989-2000 and 2001-2006, that observed mortality is much higher in gillnet gear than in trawl gear. Based on the information presented in these three documents, factors thought to increase the risk of Atlantic sturgeon bycatch, and therefore death, in gillnet gear include:

- Setting gillnet gear at depths <40 meters;
- Using gillnet gear with mesh sizes >10 inches;
- Setting gillnet gear during spring, fall, and winter months;
- Long soak times (i.e., >24 hours); and
- Setting gear during warmer water temperatures

Although Atlantic sturgeon deaths have rarely been reported in otter trawl gear (ASMFC 2007), it is important to recognize that effects of an interaction may occur long after the interaction. Based on physiological data obtained from Atlantic sturgeon captured in otter trawls, Beardsall *et al*. (2013) suggests that factors such as longer tow times (i.e., > 60 minutes), prolonged handling of sturgeon (> 10 minutes on deck), and the type of trawl gear/equipment used, may increase the risk of physiological disruption or impairment (e.g., elevated cortisol levels, immune suppression, impaired osmoregulation, exhaustion) to Atlantic sturgeon captured in otter trawls and therefore, may result in an increased risk of post-release mortality. The authors also note that post-release exhaustion, even after a 60 minute trawl capture, results in behavioral disruption to Atlantic sturgeon and caution that repeated bycatch events may compound post-release behavioral effects to Atlantic sturgeon which in turn, may effect essential life functions of Atlantic sturgeon (e.g., predator avoidance, foraging, migration to foraging or spawning sites) and therefore, Atlantic sturgeon survival (Beardsall *et al*. 2013). Although the study conducted by Beardsall *et al*. (2013) provides some initial insight into the post-release effects to Atlantic sturgeon captured in trawl gear, additional studies are needed to clearly identify the "after" effects of a trawl interaction. As it is remains uncertain what the overall impacts to Atlantic sturgeon survival are from trawl interactions, trawls should not be completely discounted as a form of gear that poses a mortality risk to Atlantic sturgeon.

6.4.4.1.5 Atlantic Salmon

As described in section 1.1.3, the marine range of the GOM Distinct Population Segment extends from the GOM (primarily northern portion), to the coast of Greenland (NMFS and USFWS 2005; Fay *et al*. 2006). Although the distribution of Atlantic salmon in the marine environment likely overlaps with commercial fisheries, there have been a low number of observed interactions with fisheries and various gear types. According to the Biological Opinion issued by NMFS Greater Atlantic Regional Fisheries Office on December 16, 2013, NMFS Northeast Fisheries Science Center's (NEFSC) Northeast Fisheries Observer and At-Sea Monitoring Programs documented a total of15 individual salmon incidentally caught on over 60,000 observed commercial fishing trips from 1989 through August 2013 (NMFS 2013;Kocik *et al*. 2014). Specifically, Atlantic salmon were observed bycaught in gillnet (11/15) and bottom otter trawl gear (4/15), with 10 of the incidentally caught salmon listed as "discarded" and five reported as mortalities (Kocik (NEFSC), pers. comm (February 11, 2013) in NMFS 2013). The genetic identity of these captured salmon is unknown; however, the NMFS 2013 Biological Opinion considers all 15 fish to be part of the GOM Distinct Population Segment, although some may have originated from the Connecticut River restocking program (i.e., those caught south of Cape Cod, Massachusetts).

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), suggests that interactions with Atlantic salmon are rare events (NMFS 2013; Kocik *et al*. 2014); however, it is important to recognize that observer program coverage is not 100 percent. As a result, it is likely that some interactions with Atlantic salmon have occurred, but have not been observed or reported.

6.5 Human Communities/Social-Economic Environment

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 and common pool participants' groundfish fishing and their homeports. Table 36 contains a summary of major trends in the groundfish fishery. Additional information may be found in the FY2010, FY2011, and FY2012 and FY2013 performance reports for this fishery by the NEFSC (Kitts et al. 2011; Murphy et al. 2012; Murphy et al. 2014; Murphy et al. 2015).

Table 36 - Summary of major trends in the Northeast multispecies fishery

	2010			2011		
	Total	Sector Vessels	Common Pool	Total	Sector Vessels	Common Pool
Groundfish Gross Revenue	$83,212,207	$81,165,969	$2,046,238	$88,821,349	$87,982,963	$838,386
Non-groundfish Gross Revenue	$210,068,225	$115,537,375	$94,530,850	$235,565,188	$141,895,314	$93,669,874
Total Gross Revenue	$293,280,432	$196,703,344	$96,577,088	$324,386,537	$229,878,277	$94,508,260
Groundfish average price	$1.42	$1.41	$1.58	$1.43	$1.42	$1.58
Non-groundfish average price	$1.21	$1.18	$1.24	$1.11	$1.11	$1.11
Number of active vessels*	855	437	418	777	443	334
Number of active vessels that took a groundfish trip**	446	304	142	418	302	116
Number of groundfish trips	13,859	11,575	2,284	16,138	13,858	2,280
Number of non-groundfish trips	38,507	16,547	21,960	33,727	16,814	16,913
Number of days absent on groundfish trips	18,737	17,131	1,605	21,895	20,393	1,503
Number of days absent on non-groundfish trips	31,354	16,023	15,331	28,032	15,485	12,547
Total Crew Positions	2,268			2,166		
Total Crew-trips	125,033			122,785		
Total Crew-days	171,278			171,342		

	2012			2013		
	Total	Sector Vessels	Common Pool	Total	Sector Vessels	Common Pool
Groundfish Gross Revenue	$67,815,297	$67,209,195	$606,102	$55,220,469	$54,211,824	$1,008,645
Non-groundfish Gross Revenue	$228,136,612	$135,359,399	$92,777,213	$214,665,116	$129,680,139	$84,984,976
Total Gross Revenue	$295,951,909	$202,568,594	$93,383,315	$269,885,585	$183,891,963	$85,993,622
Groundfish average price	$1.43	$1.43	$1.71	$1.31	$1.30	$1.59
Non-groundfish average price	$1.07	$1.03	$1.13	$1.00	$0.95	$1.10
Number of active vessels*	763	445	318	735	419	316
Number of active vessels that took a groundfish trip**	400	303	97	327	245	82
Number of groundfish trips	14,328	12,990	1,338	10,056	9,125	911
Number of non-groundfish trips	33,024	17,172	15,852	33,317	17,900	15,417
Number of days absent on groundfish trips	19,839	18,998	842	17,013	16,356	657
Number of days absent on non-groundfish trips	29,151	16,341	12,811	29,439	16,916	12,523
Total Crew Positions	2,135			2,039		
Total Crew-trips	117,118			106,700		
Total Crew-days	169,129			157,600		

Notes: Data includes all vessels with a valid limited access multispecies permit. Sector plus common pool vessel counts may exceed the total vessel count because vessels may switch between sector and common pool eligibilities during the fishing year. Revenue and price reported in 2010 dollars. "Trips" refer to commercial trips in the northeast Exclusive Economic Zone (EEZ). Past reports included party/charter trips. From Murphy et al. (2015 in press).

6.5.1 Groundfish Fishery Overview

New England's fishery has been identified with groundfish fishing both economically and culturally for over 400 years. Broadly described, the Northeast multispecies fishery includes the landing, processing, and distribution of commercially important fish that live on the sea bottom. In the early years, the Northeast multispecies fishery caught primarily cod and haddock. Today, the Northeast Multispecies FMP (large-mesh and small-mesh) includes 13 species of groundfish (Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, white hake, and wolffish) harvested from three geographic areas (Gulf of Maine, Georges Bank, and southern New England/Mid-Atlantic Bight), representing 19 distinct stocks.

Prior to the Industrial Revolution, the groundfish fishery focused primarily on cod. The salt cod industry, which preserved fish by salting while still at sea, supported a hook and line fishery that included hundreds of sailing vessels and shoreside industries including salt mining, ice harvesting, and boat building. Late in the 19th century, the fleet also began to focus on Atlantic halibut, with landings peaking in 1896 at around 4,900 tons (4,445 mt) (NOAA 2007).

From 1900 to 1930, the fleet transitioned to steam powered trawlers and increasingly targeted haddock for delivery to the fresh and frozen fillet markets. With the transition to steam powered trawling, it became possible to exploit the groundfish stocks with increasing efficiency. This increased exploitation resulted in a series of boom and bust fisheries from 1930 to 1960 as the North American fleet targeted previously unexploited stocks, depleted the resource, and then transitioned to new stocks (NOAA 2007).

In the early 1960's, fishing pressure increased with the discovery of haddock, hake, and herring off of Georges Bank and the introduction of foreign factory trawlers. Early in this time period, landings of the principal groundfish (cod, haddock, pollock, hake, and redfish) peaked at about 650,000 tons (589,670 mt). However, by the 1970's, landings decreased sharply to between 200,000 and 300,000 tons (181,437 and 272,155 mt) as the previously virgin GB stocks were exploited (NOAA 2007).

The exclusion of the foreign fishermen by the Fisheries Conservation and Management Act in 1976, coupled with technological advances, government loan programs, and some strong classes of cod and haddock, caused a rapid increase in the number and efficiency of U.S. vessels participating in the Northeast groundfish fishery in the late 1970's. This shift resulted in a temporary increase in domestic groundfish landings; however, overall landings (domestic plus foreign) continued to trend downward from about 200,000 tons (181,437 mt) to about 100,000 tons (90,718 mt) through the mid 1980's (NOAA 2007).

In 1986, the NEFMC implemented the Northeast Multispecies FMP with the goal of rebuilding stocks. Since Amendment 5 in 1994, the multispecies fishery has been administered as a limited access fishery managed through a variety of effort control measures including DAS, area closures, trip limits, minimum size limits, and gear restrictions. Partially in response to those regulations, landings decreased throughout the latter part of the 1980's until reaching a more or less constant level of around 40,000 tons (36,287 mt) annually since the mid 1990's.

In 2004, the final rule implementing Amendment 13 to the Northeast Multispecies FMP allowed for self-selecting groups of limited access groundfish permit holders to form sectors. These sectors developed a legally binding operations plan and operated under an allocation of GB cod. While approved sectors were subject to general requirements specified in Amendment 13, sector members were exempt from DAS and some of the other effort control measures that tended to limit the flexibility of fishermen. The rule

authorized implementation of the first sector, the GB Cod Hook Sector. A second sector, the GB Cod Fixed Gear Sector, was authorized in 2006.

Through Amendment 16, the NEFMC sought to rewrite groundfish sector policies with a scheduled implementation date of May 1, 2009. When that implementation date was delayed until FY2010, the NMFS Regional Administrator announced that, in addition to a previously stated 18% reduction in DAS, interim rules would be implemented to reduce fishing mortality during FY2009. These interim measures generally reduced opportunity among groundfish vessels through:

- Differential DAS counting;
- Elimination of the SNE/MA winter flounder SAP;
- Elimination of the state waters winter flounder exemption;
- Revisions to incidental catch allocations; and
- Reduction in some groundfish allocations (NOAA 2009).

In 2007, the Northeast multispecies fishery included 2,515 permits. Of these, about 1,400 were limited access. There were about 660 vessels that actively fished. Those vessels include a range of gear types: hook, bottom longline, gillnet, and trawl (NEFMC 2009a). In FY2009, between 40 and 50 of these vessels were members of the GB Cod Sectors. The passage of Amendment 16, implemented in FY2010, ushered in a new era of sector management in the New England groundfish fishery. Since FY2010, over 50% of eligible northeast groundfish multispecies permits and over 90% of landings history has been associated. The remaining vessels were common pool groundfish fishing vessels.

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 (46%) of the limited access groundfish permits opted to remain in the common pool. Common pool vessels act independently of one another, with each vessel 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. From 2010 to 2011, the number of groundfish limited access eligibilities belonging to a sector increased by 66, while the number of these permits in the common pool decreased

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.

by 85. At the start of FY2011, vessels operating within a sector were allocated about 98% of the total groundfish sub-ACL, based on historical catch levels. Those vessels that opted to remain in the common pool were given access to about 2% of the groundfish sub-ACL based on the historic catch. The same effort controls employed in 2010 were again used in 2011, to ensure the groundfish catch made by common pool vessels did not exceed the common pool's portion of the commercial groundfish sub-ACL.

In FY12, 60% of limited access permits enrolled in sectors. From FY2011 to FY2012, the number of groundfish limited access eligibilities belonging to a sector increased by 22, while the number of these permits in the common pool decreased by 36. Although some trends in the fishery are a result of management changes made to the fishery in the years prior to Amendment 16, many of these trends reflect the current system of catch share management.

In FY2013, the number of groundfish limited access eligibilities for sector members stayed relatively constant (increasing by 1) while the number of eligibilities for the common pool decreased by 29. Sectors again accounted for around 60% of all limited access permits with the sector sub-ACL accounting for 98% of the total commercial groundfish ACL.

6.5.2 Fleet Characteristics

The overall trend since the start of sector management has been a decline in the number of vessels with a limited access groundfish permit, with a low of 1,119 vessels in FY2013 (Table 37). Of those vessels, those with revenue from at least one groundfish trip have also declined, to only 327 in FY2013. The proportion of vessels affiliated with a sector has increased each year since FY2010. 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 other sector vessels harvest their allocation, changes in the number of inactive vessels may result from a transfer of allocation and not necessarily vessels exiting the fishery. Since FY2010, 34-39% of the vessels were inactive (no landings). Of these inactive vessels, 64-69% were affiliated with sectors.

Table 37 - Number of vessels by fishing year.

	2010	2011	2012	2013
	As of May 1 each Fishing Year:			
Total groundfish limited access eligibilities	**1,441**	**1,422**	**1,408**	**1,380**
Eligibilities held as Confirmation of Permit History	**94**	**168**	**228**	**273**
	During any part of the fishing year*:			
Total eligible vessels	1,409	1,321	1,223	1,154
Eligible vessels that did not renew a limited access groundfish permit	26	42	46	35
Vessels with a limited access groundfish permit	1,383	1,279	1,177	1,119
	While under a limited access groundfish permit:			
... those with revenue from any species**	855	777	763	735
... those with revenue from at least one groundfish trip	446	418	400	327
... those with no landings	529	502	414	384
Percent of inactive (no landings) vessels	(38%)	(39%)	(35%)	(34%)

*On May 1st of the fishing year the number of vessels will equal to the number of eligibilities not in Confirmation of Permit History (CPH). Over time the number of vessels will differ from the number of eligibilities because these eligibilities can be transferred from vessel to vessel during the fishing year. These numbers exclude groundfish limited access eligibilities held as Confirmation of Permit History (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.
**Active vessels in this report received revenue from any species while fishing under a limited access groundfish permit.

6.5.3 Effort

The groundfish fishery has traditionally been made up of a diverse fleet, comprised of a range of vessels sizes and gear types. Over the years, as vessels entered and exited the fishery, the typical characteristics defining the fleet changed as well. The number of active vessels has declined each year since at least FY2009. This decline has occurred across all vessel size categories (Table 38). Since FY2009, the 30' to < 50' vessel size category, which has the largest number of active groundfish vessels, experienced a 38% decline (305 to 159 active vessels). The <30' vessel size category, containing the least number of active groundfish vessels, experienced the largest (50%) reduction since FY2009 (34 to 17 vessels). The vessels in the largest (≥75') vessel size category experienced the least reduction (30%) since FY2009.

Table 38 - Vessel activity by size class.

	FY2009	FY2010	FY2011	FY2012	FY2013
Vessels with revenue from any species					
Less than 30	73	65	51	49	51
30 to < 50	478	459	403	398	384
50 to < 75	236	218	212	205	193
75 and above	129	113	111	111	107
Total	916	855	777	763	735
Vessels with revenue from at least one groundfish trip					
Less than 30	34	24	20	16	17
30 to < 50	305	242	218	207	159
50 to < 75	157	121	119	117	102
75 and above	70	59	61	60	49
Total	566	446	418	400	327

Source: Murphy et al. (2015, Tables 13 and 14).

Some of the proposed benefits of a catch share system of management are the potential efficiency gains associated with increasing operational flexibility (NOAA 2010). Being released from the former effort controls, but being held to ACLs, sector vessels were expected to increase their catch per unit effort by decreasing effort. Between 2009 and FY2010, the number of groundfish fishing trips[20] and total days absent on groundfish trips declined by 46% and 24%, respectively (Table 39).[21] During the second year of sector management, 2011, the number of groundfish fishing trips and total days absent on groundfish trips increased. Effort on groundfish trips generally decreased in FY2012. Vessels took fewer groundfish trips, with fewer total days absent of groundfish trips, though average trip length increased slightly over FY2011.

[20] "Groundfish trip" is defined as a trip where the vessel owner or operator declared, either through the vessel monitoring system or through the interactive voice response system, that the vessel was making a groundfish trip.
[21] The data is taken from different source materials (VMS, etc.) than other data in this document, and thus, may be slightly different than.

The groundfish fleet overall took slightly more non-groundfish trips, with a slight increase in total days absent on these trips, in 2013 than it did in 2012. The average trip length for non-groundfish trips taken by the fleet fell very slightly in 2013 from 2012, but was at its second highest point in the 2010-2013 time series (Table 38). The total number of non-groundfish trips taken by the fleet in 2013 was 33,317 trips, a 0.9% (+293 trips) increased from 2012. Overall, the number of non-groundfish trips taken by the fleet has decreased 13.5% over 2010-2013. The total number of days absent on non-groundfish trips in 2013 was higher than it was in 2012, with 288 (+1.0%) more days absent. However, the total number of days absent on non-groundfish trips taken by the fleet has decreased 6.1% over the 2010-2013 period. Average trip length on non-groundfish trips has increased overall from 2010-2013 by 4.7% (+0.04 days absent), but fell very slightly by 1.1% (-0.01 days absent) in 2013 from 2012 (Table 39).

Table 39 - Effort by active vessels.

	FY2009	FY2010	FY2011	FY2012	FY2013
Number of trips					
groundfish	25,897	13,859	16,138	14,328	10,056
non-groundfish	37,173	38,507	33,727	33,024	33,317
Number of days absent on trips					
groundfish	24,605	18,737	21,895	19,839	17,013
non-groundfish	31,606	31,354	28,032	29,151	29,439
Average trip length*					
groundfish	0.96	1.35	1.36	1.39	1.69
(std. dev.)	(1.74)	(2.13)	(2.19)	(2.20)	(2.40)
non-groundfish	0.92	0.86	0.86	0.91	0.90
(std. dev.)	(1.66)	(1.56)	(1.52)	(1.60)	(1.56)

Source: Murphy et al. (2015, Table 15).
*This is the average trip length of all individual trips that have non-missing values for days absent. Since some trip records have missing values for days absent, average trip length reported here may be higher than what is obtained by dividing the overall number of days absent by the overall number of trips.

6.5.4 Landings and Revenue

Total groundfish landings on trips made by vessels possessing a limited access groundfish permit in FY2013 were 42.2M pounds, which is the lowest landings since at least FY2009 (Table 40). Because only 16 groundfish stocks are limited by sector allocations, it is important to consider the landings of non-groundfish species and groundfish species separately as a means of describing any possible shift in effort to other fisheries. Non-groundfish landings made by limited access vessels increased from 178.1M pounds in FY2010 to 213.8M pounds in FY2011, and remained fairly steady at 212.0M pounds in FY2012. Declining groundfish landings were coupled with little growth in non-groundfish landings for the fleet in 2013. Total landings of all species on all trips were 256.4 million pounds in 2013, a 1.6% decrease from 2012 (260.5 million pounds). This compares to landings ranging from 232.9M – 274.5M pounds in the 2009–2011 fishing years. In 2013, groundfish accounted for only 16.5% of total landings by the groundfish fleet, sectors landed almost 70% of total landings and 98.5% of all groundfish landings.

Table 40 – Total landings and revenue from all trips by fishing year.

	FY2009	FY2010	FY2011	FY2012	FY2013
Landed Pounds					
Groundfish	68,416,222	58,712,494	62,284,826	47,424,690	42,247,934
Non-Groundfish	185,631,323	174,196,562	212,298,102	213,059,587	214,153,861
Total Pounds	254,047,546	232,909,055	274,582,928	260,484,276	256,401,794
Gross Revenue (in 2010 dollars)					
Groundfish	$83,386,467	$83,212,207	$88,821,349	$67,815,297	$55,220,469
Non-Groundfish	$182,312,457	$210,068,225	$235,565,188	$228,136,612	$214,665,116
Total Revenue	$265,698,924	$293,280,432	$324,386,537	$295,951,909	$269,885,585

Source: Murphy et al. (2015, Table 2).
* Deflated by the calendar year 2010 Q2 GDP Implicit Price Deflator.

Table 41 - Total landings and nominal revenue from groundfish trips by fishing year

	FY2009	FY2010	FY2011	FY2012	FY2013
Landed Pounds					
Groundfish	68,362,567	58,601,455	62,143,119	47,364,684	42,111,095
Non-Groundfish	30,965,367	23,509,706	29,041,581	27,229,162	19,130,060
Total Pounds	99,327,934	82,111,161	91,184,700	74,593,845	61,241,154
Gross Revenue (in 2010 dollars)					
Groundfish	$82,456,833	$83,000,074	$88,607,816	$67,696,520	$55,019,495
Non-Groundfish	$25,862,188	$23,642,678	$32,147,825	$25,079,842	$20,520,806
Total Revenue	$108,319,021	$106,642,752	$120,755,641	$92,776,361	$75,540,301

Source: Murphy et al. (2015, Table 3).

During the first year of sector management, groundfish revenues from vessels with limited access groundfish permits in FY2010, were $83.2M (Table 40). This was slightly lower than FY2009 revenues. In FY2011, the groundfish revenues from vessels with limited access groundfish permits were $98.8M. Groundfish revenue in FY2012 decreased to a four-year low of $67.8 million (22.9% lower than in 2011), decreasing even further in FY2013 to $55.2 million. Non-groundfish revenue decreased to $235.7 million (2% lower than in FY2011), but was still higher than in FY2009 and FY2010. In FY2013 sector vessels accounted for 68% of all revenue earned by limited access groundfish vessels. Sector vessels also accounted for 98% of groundfish revenue and 60% of non-groundfish revenue in 2013 (Table 41).

6.5.5 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).

6.5.6 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.

6.5.6.1 Primary and Secondary Fishing Ports

In recent amendments to the FMP (e.g., NEFMC 2009), communities dependent on the groundfish resource have been categorized into primary and secondary port groups, so that community data can be cross-referenced with other demographic information . Primary ports are those communities that are substantially engaged in the groundfish fishery, and which are likely to be the most impacted by groundfish management measures. Primary ports were selected based on groundfish landings greater than 1,000,000 lbs annually since FY1994 and/or the presence of significant groundfish infrastructure (e.g., auctions and co-ops). They have demonstrated a continued substantial engagement in the groundfish fishery.

Secondary ports are those communities that may not be substantially dependent or engaged in the groundfish fishery, but have demonstrated some participation in the groundfish fishery since FY1994. Because of the size and diversity of the groundfish fishery, it is not practical to examine each secondary port individually, which is why most secondary ports are grouped with others in the same county or in geographically adjacent counties. Using the above definitions provides a way to consider the impacts of management measures on every port in which some amount of groundfish has been landed since 1994, and identifies place-based fishing communities based on level of engagement. Because significant geographical shifts in the distribution of groundfish fishing activity have occurred, the characterization of some ports as “primary” or “secondary” may not reflect their historical participation in and dependence on the groundfish fishery.

Descriptions of communities involved in the multispecies fishery, and further descriptions of Northeast fishing communities in general, can be found on Northeast Fisheries Science Center’s website. There are snapshots of the human communities and fisheries of the Northeast with the most recent data available for key indicators of dependence on fisheries and other economic and demographic characteristics at http://www.nefsc.noaa.gov/read/socialsci/communitySnapshots.php. Detailed profiles regarding the historic, demographic, cultural, and economic context for understanding a community's involvement in fishing are at http://www.nefsc.noaa.gov/read/socialsci/communityProfiles.html

To help describe which port communities could be most affected by the alternatives under consideration, Table 43 identifies the landings by homeport for FY2013, using the primary ports identified in Table 42.

Table 42 - Primary and secondary multispecies port communities.

Region	Multispecies Port Community	
	Primary	Secondary
Downeast ME	-	Jonesport, West Jonesport, Beals Island, Milbridge, Machias, Eastport, Dyers Bay
Upper Mid-Coast ME 1	-	Winter Harbor, Southwest Harbor, Bar Harbor, Northeast Harbor, Northwest Harbor
Upper Mid-Coast ME 2	-	Stonington, Sunshine/Deer Isle
Upper Mid-Coast ME 3	-	Rockland, St. George (Port Clyde), South Thomaston (Sprucehead), Owls Head, Friendship, Camden, Vinalhaven
Lower Mid-Coast ME 1	-	Bristol, South Bristol, Boothbay Harbor, East Boothbay (Boothbay), Breman (Medomak), Southport, Westport Island
Lower Mid-Coast ME 2	-	Sebasco Estates, Small Point, West Point, Five Islands, Phippsburg
Lower Mid-Coast ME 3	Portland	Cundys Harbor, Orrs Island, Yarmouth, Harpswell, East Harpswell, South Harpswell, Bailey Island, Cape Elizabeth
Southern Maine	-	York, York Harbor, Camp Ellis, Kennebunkport, Kittery, Cape Porpoise, Ogunquit, Saco, Wells
New Hampshire	Portsmouth	Rye, Hampton, Seabrook
North Shore MA	Gloucester	Rockport, Newburyport, Beverly, Salem, Marblehead, Manchester, Swampscott
South Shore MA	Boston	Scituate, Plymouth, Marshfield (Green Harbor)
Cape Cod MA	Chatham/ Harwichport	Provincetown, Sandwich, Barnstable, Wellfleet, Woods Hole, Yarmouth, Orleans, Eastham
Islands MA	-	Nantucket, Oak Bluffs, Tisbury, Edgartown
South Coast MA	New Bedford/ Fairhaven	Dartmouth, Westport
Western RI	Point Judith	Charlestown, Westerly, South Kingstown (Wakefield), North Kingstown (Wickford)
Eastern RI	-	Newport, Tiverton, Portsmouth, Jamestown, Middletown, Little Compton
Connecticut	-	Stonington, New London, Noank, Lyme, Old Lyme, East Lyme, Groton, Waterford
Long Island NY	Montauk/ Hampton Bays/ Shinnecock/ Greenport	Mattituck, Islip, Freeport, Brooklyn, Other Nassau and Suffolk Counties
Northern NJ	-	Point Pleasant, Belford, Long Beach/Barnegat Light, Barnegat, Highlands, Belmar, Sea Bright, Manasquan
Southern NJ	-	Cape May, Wildwood, Burleigh, Sea Isle City, Ocean City, Stone Harbor, Avalon

Table 43 - FY2013 landings (lbs.) of selected groundfish stocks by homeports.

State	Port	GOM Cod	GB Haddock	GOM Haddock	GB Winter flounder	GOM Winter flounder	GB Yellowtail Flounder
ME	Portland	108,405	918,326	82,595	32,174	291	c
	Other	135,997	4,529	16,928	c	1,035	c
NH	Portsmouth	42,631	-	2,147	-	2,948	-
	Other	172,863	-	3,361	-	13,038	-
MA	Boston	210,337	1,167,423	42,480	272,787	127,881	2,958
	Chatham/Harwichport	c	24,767	c	c	c	-
	Gloucester	558,240	1,076,225	110,363	1,896	67,128	184
	New Bedford/Fairhaven	21,990	1,291,803	16,042	2,905,093	13,135	56,379
	Other	280,337	187,759	50,264	261,158	131,030	9,942
RI	Point Judith	-	4,247	-	c	-	c
	Other	c	5,687	c	105,730	c	1,365

C=confidential data
Data from NEFSC 2014

6.5.6.2 Vessel Activity in Primary Ports

All states have shown a decline in the number of active vessels with revenue from any species since at least FY2009 (Table 44). In FY2013, Massachusetts had the highest number of active vessels with a limited access groundfish permit and also the highest number of active vessels with revenue from at least one groundfish trip (53%, 172 vessels) (Table 45). From FY2009 to FY2013, the total number of active vessels with revenue from at least one groundfish trip declined 42% (566 to 327). While all states showed a decline in the number of vessels making groundfish trips, the largest percentage decline occurred in New Jersey (-61%).

Table 44 - Number of vessels with revenue from any species (all trips) by homeport and state

Home Port State/City		FY2009	FY2010	FY2011	FY2012	FY2013
CT		12	11	11	10	10
MA		459	423	378	371	355
	Boston	62	52	45	47	46
	Chatham	42	43	38	38	35
	Gloucester	110	107	92	88	83
	New Bedford	86	69	69	69	66
ME		112	101	88	95	87
	Portland	17	16	16	18	17
NH		53	50	45	41	38
NJ		61	56	48	46	47
NY		95	93	91	87	82
RI		93	86	82	77	78
	Point Judith	48	45	44	44	45
Other Northeast		34	36	34	34	36
Grand Total*		916	854	855	777	763

* Note: State vessel counts may exceed the grand total vessel count because vessels may change home port during the fishing year.

Table 45 - Number of vessels with revenue from at least one groundfish trip by homeport and state

Home Port State/City		FY2009	FY2010	FY2011	FY2012	FY2013
CT		8	7	5	5	5
MA		310	238	222	206	172
	Boston	46	35	30	28	25
	Chatham	28	26	25	23	20
	Gloucester	97	75	69	61	53
	New Bedford	51	33	37	36	31
ME		64	42	48	51	39
	Portland	15	14	15	16	14
NH		40	32	28	25	25
NJ		26	21	17	10	10
NY		47	40	42	42	29
RI		61	55	48	54	44
	Point Judith	33	31	28	33	30
Other Northeast		12	12	7	7	3
Grand Total*		566	446	418	400	327

* Note state vessel counts may exceed the grand total vessel count because vessels may change home port during the fishing year.

6.5.7 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 2010; 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.22 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 FY2013, vessels with limited access groundfish permits provided 2,046 crew positions, with 48% coming from vessels with homeports in Massachusetts (Table 46). Since at least FY2009, the total number of crew positions provided by limited access groundfish vessels has declined by 15.6%. Changes in crew positions vary across homeport states. Overall, most states lost crew positions in FY2013, although New Jersey added a few positions.

Table 46 - Number of crew positions and crew days on active vessels by homeport and state

Home Port State		FY2009	FY2010	FY2011	FY2012	FY2013
CT	Total crew positions	40	37	42	39	39
	Total crew days	3,700	4,020	3,002	4,478	3,551
MA	Total crew positions	1,231	1,140	1,071	1,050	987
	Total crew days	95,685	83,235	85,747	81,696	73,518
ME	Total crew positions	266	244	222	242	228
	Total crew days	15,539	15,596	14,910	16,524	15,237
NH	Total crew positions	110	108	106	95	86
	Total crew days	5,407	3,929	4,987	5,166	4,487
NJ	Total crew positions	162	150	144	149	153
	Total crew days	10,865	10,093	9,893	10,349	9,564
NY	Total crew positions	219	208	217	208	191
	Total crew days	16,997	15,763	16,046	15,028	14,372
RI	Total crew positions	267	256	247	232	226
	Total crew days	26,411	26,822	25,147	24,247	25,645
Other Northeast	Total crew positions	131	129	131	136	131
	Total crew days	12,615	11,818	11,610	11,640	11,227
Total	Total crew positions	2,424	2,275	2,179	2,145	2,046
	Total crew days	187,219	171,277	171,343	169,128	157,601

[22] Crew positions are measured by summing the average crew size of all active vessels on all trips.

A crew day[23] is another measure of employment opportunity 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 FY2013, vessels with limited access groundfish permits used 157,601 crew days, with 47% coming from vessels with homeports in Massachusetts (Table 46). Since at least FY2009, the total number of crew days used by limited access groundfish vessels across the Northeast has declined, though Rhode Island had an increase in crew days in FY2013.

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 an important occupation in many of the smaller port areas.

6.5.8 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 to 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 that they otherwise would not have pursued, 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). The scope of consolidation and redirection of effort that may be expected to result from sector operations in FY2014 is difficult to predict.

[23] 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.

6.5.9 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, Table 48, and Table 49 compare FY2013 catches to ACLs. As shown in , catches exceed ACLs for only three stocks: GOM haddock, GOM/GB windowpane flounder and SNE/MA windowpane flounder. summarizes catches by non-groundfish components of the ACLs. Assignment of catches to a specific FMP is difficult unless the FMP uses a specific gear (e.g. the scallop fishery) or has a trip activity declaration (e.g. groundfish and monkfish trips). For this reason, the assignment of catch to FMP should be viewed with caution

Table 47 – FY 2013 Catches of Regulated Groundfish Stocks (Metric Tons, Live Weight)

Stock	Components with ACLs and sub-ACLs; (with accountability measures (AMs))								sub-components: No AMs	
	Total Catch (mt)	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	1,616.3	1,572.9	1,540.6	32.3					9.2	34.2
GOM cod	1,418.8	1,380.1	732.0	8.8	639.3				35.8	2.9
GB Haddock	3,330.1	2,977.5	2,977.1	0.4		290.0			6.1	56.5
GOM Haddock	405.7	402.9	169.2	2.2	231.5	0.0			1.3	1.6
GB Yellowtail Flounder	93.3	55.8	55.8	0.0			37.5	2.5	0.0	0.0
SNE Yellowtail Flounder	466.1	373.3	281.9	91.4			48.6		14.5	29.8
CC/GOM Yellowtail	453.1	380.5	376.5	4.1					42.8	29.7
Plaice	1,444.6	1,395.2	1,391.6	3.6					19.6	29.8
Witch Flounder	745.2	642.3	638.9	3.4					27.1	75.8
GB Winter Flounder	1,763.1	1,722.0	1,722.0	0.0					0.0	41.0
GOM Winter Flounder	245.6	169.3	167.6	1.7					67.4	8.9
SNE/MA Winter Flounder	1,025.9	788.6	670.4	118.3					55.7	181.6
Redfish	4,023.5	4,000.6	3,996.2	4.4					19.0	3.9
White Hake	2,056.3	2,045.6	2,039.8	5.8					2.3	8.3
Pollock	7,029.1	4,915.0	4,878.4	36.5					981.7	1,132.4
Northern Windowpane	280.1	237.5	237.3	0.2					0.9	41.6
Southern Windowpane	554.7	115.9	86.0	30.0					37.3	272.4
Ocean Pout	59.3	33.2	27.3	5.9			129.1		1.5	24.6
Halibut	79.0	54.7	53.8	0.9					22.8	1.5
Wolffish	19.1	17.1	17.1	0.0					1.3	0.7

Notes: Data Source: NMFS Greater Atlantic Regional Office Northeast Multispecies Final Year-End Results from Fishing Year 2013. October 20th, 2014.

Catch includes any FY2011 carryover caught by sectors in FY2012. Data as of Nov. 5, 2013, Northeast Regional Office. Values for a non-allocated species may include landings of that stock; misreporting of species and/or stock area; and/or estimated landings (in lieu of missing reports) based on vessel histories.

*Recreational estimates based on Marine Recreational Information Program (MRIP) data. **Landings extrapolated from observer data.

Table 48 – FY2013 Catches as Percent of ACL

Stock	Components with ACLs and sub-ACLs; (with accountability measures (AMs))								sub-components: No AMs	
	Total Catch (%)	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	84.8	87.0	86.8	101.0					46.0	42.8
GOM cod	96.5	104.9	90.2	48.9	131.5				34.7	5.7
GB Haddock	11.9	11.4	11.4	0.5		106.2			2.1	4.8
GOM Haddock	147.9	154.4	91.2	108.9	312.2				30.4	25.3
GB Yellowtail Flounder	44.7	36.1	36.5	0.4			90.3	63.7	NA	0.6
SNE Yellowtail Flounder	70.1	63.7	57.8	93.1			111.4		206.5	106.3
CC/GOM Yellowtail	86.7	79.4	80.9	31.5					130.2	271.3
Plaice	97.5	98.3	99.8	14.3					63.0	95.7
Witch Flounder	99.2	105.3	106.6	30.6					115.5	64.5
GB Winter Flounder	48.4	48.8	49.1	0.0					NA	36.5
GOM Winter Flounder	23.6	23.7	24.4	6.6					24.8	16.5
SNE/MA Winter Flounder	63.6	65.2	62.4	87.0					23.7	108.1
Redfish	38.5	39.5	39.6	10.9					17.3	1.8
White Hake	51.7	53.1	53.4	21.6					5.5	9.9
Pollock	47.1	38.1	38.1	40.2					104.9	103.7
Northern Windowpane	195.0	242.4	NA	NA					62.2	95.0
Southern Windowpane	105.3	113.7	NA	NA			70.5		67.9	146.4
Ocean Pout	26.9	16.9	NA	NA					62.6	116.4
Halibut	82.1	105.2	NA	NA					57.5	31.0
Wolffish	29.3	27.6	NA	NA					185.0	26.3

Table 49 - FY2013 Catches by Non-Groundfish FMPs (Metric Tons, Live Weight)

Stock	Total	Scallop1	Fluke	Hagfish	Herring	Lobster/Crab	Menhaden	Monkfish	Research	Scup
GB cod	34.2	4.9	0.3	0	1.4	0.8	0.3	0.2	14.5	0.1
GOM cod	2.9	0.2	-	0	1.3	0.3	-	-	0.1	-
GB Haddock	56.5	3.5	0.1	0	5.2	0	0	0	0.5	0.1
GOM Haddock	1.6	0	-	-	0.3	-	-	-	0	-
GB Yellowtail Flounder	0	-	-	-	-	-	-	-	-	0
SNE Yellowtail Flounder	29.8	-	5.7	-	1.3	0	0	0	1.3	5.6
CC/GOM Yellowtail Flounder	29.7	23.2	-	-	1.3	-	-	-	2.1	-
Plaice	29.8	13.5	0.7	-	1.3	0	0	0	0.8	0.8
Witch Flounder	75.8	26.7	5.7	0	3.3	0.1	0.1	0	0.6	4.7
GB Winter Flounder	41	25	-	-	1.5	-	-	-	-	0.1
GOM Winter Flounder	8.9	6	-	0	0.2	0	-	-	0.1	-
SNE/MA Winter Flounder	181.6	78.2	10.8	-	4.7	0	0.1	0	19.9	9.7
Redfish	3.9	0	0	0	1	0.4	0.1	0	0	0
White Hake	8.3	1	0.1	0	2	1	0.3	0.1	0.1	0.2
Pollock	1,132.4	0	0	0	0.6	0.1	0	0	0.1	0
Northern Windowpane	41.6	40.7	-	0	0.2	0	-	-	0	0
Southern Windowpane	272.4	-	66.9	-	3	0.1	0.5	0	0	69.6
Ocean Pout	24.6	2.9	0.5	0	2	0	0	0	0	0.5
Halibut2	1.5	0.2	0	0	0.1	0.6	0	0	0	0
Wolffish	0.7	0.5	0	-	0	0	0	0	0	0

Notes:

Data Source: NMFS Greater Atlantic Regional Office Northeast Multispecies Final Year-End Results from Fishing Year 2013. October 20th, 2014.

Values are in metric tons of live weight.

1Scallop values based on scallop fishing year March 2013 through February, 2014.

2Note some Canadian landings of this stock are included in the most recent assessment for Atlantic halibut (2012 Assessment Update). However, Canadian landings for 2013 have not yet been reported to the Northwest Atlantic Fisheries Organization (NAFO), and, as a result, are not included here.

– Cont.

Stock	Shrimp	Squid	Squid/Whiting	Surfclam	Tilefish	Whelk/Conch	Whiting	Unknown	Rec.
GB cod	0	0.6	0.6	0	0	0.1	0	2.5	8
GOM cod	-	-	0.2	-	-	0	0.4	0.5	-
GB Haddock	0	14.8	15.5	0	0	0	0	16.7	-
GOM Haddock	-	-	0.3	-	-	-	0.5	0.5	-
GB Yellowtail Flounder	-	-	0	-	-	-	-	0	
SNE Yellowtail Flounder	0	2	2.2	-	-	-	0	11.7	
CC/GOM Yellowtail Flounder	-	-	0.6	-	-	-	1.3	1.3	
Plaice	0	3.6	3.9	-	-	-	0.1	5.1	
Witch Flounder	0	8.7	9.9	0	0	0	0.2	15.8	
GB Winter Flounder	-	0.5	12.7	-	-	-	-	1.3	
GOM Winter Flounder	-	-	0.1	-	-	0	0.2	2.3	0.1
SNE/MA Winter Flounder	0	14.5	11.2	-	-	-	0	32.4	0
Redfish	0	0.6	0.7	0	0	0	0	0.9	
White Hake	0	0.6	1.3	0	0	0	0	1.5	
Pollock	0	1	1	0	0	0.1	0	1.3	1128
Northern Windowpane	-	0	0.6	0	-	0	0	0.1	
Southern Windowpane	0	12.3	19	0	0	0	0	100.9	
Ocean Pout	0	5.6	5.9	0	0	0	0.1	6.9	
Halibut2	0	0.1	0.2	0	0	0	0	0.3	
Wolffish	0	0	0	-	-	-	0	0.1	

6.5.10 Fishery Sub-Components

6.5.10.1 Sector Harvesting Component

In FY2010, the sector vessels landed the overwhelming majority of the groundfish ACL. 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 are substantial shifts in commercial groundfish sub-ACLs for various stocks between FY2010 and FY2013 (Table 50). 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, 142.3 million (live) pounds of ACE were allotted to the sectors in 2013 but only 47.3 million (live) pounds were landed. Of the 16 ACEs allocated to sectors in 2013, 6 stocks approached the catch limit (>80% conversion) set by the total allocated ACE (Table 51). This represents a sizeable improvement from 2012 when the fleet caught over 80% of the allocation for only 1 stock. Overall, the fleet landed 33% of the total allocated ACE in 2013. As has been the case in previous years, Georges Bank haddock accounted for a majority of the unrealized landings. Collectively, East and West GB haddock, comprises almost 41% of total allocated ACE, yet only 14% of total catch. In general, total allocations have decreased since 2010 and total catch has never been above 41% of the allocation.

Table 50 - Commercial Groundfish Sub-ACL (sector and common pool), FY 2010 to FY 2013:

STOCK	Sub-ACL* FY2010 (in metric tons)	Sub-ACL* FY2011 (in metric tons)	Sub-ACL* FY2012 (in metric tons)	Sub-ACL* FY2013 (in metric tons)	Percentage Change from FY2010 to FY2013	Percentage Change from FY2012 to FY2013
GB Cod East	338	200	162	92	-72.8%	-43.2%
GB Cod	3,430	4,301	4,605	1,807	-47.3%	-60.8%
GOM Cod	4,567	4,825	3,699	830	-81.8%	-77.6%
GB Haddock East	11,988	9,640	6,880	3,754	-68.7%	-45.4%
GB Haddock	40,440	30,580	27,438	26,196	-35.2%	-4.5%
GOM Haddock	825	778	653	187	-77.3%	-71.4%
GB Yellowtail Flounder	823	1,142	368	155	-81.2%	-58.1%
SNE/MA Yellowtail Flounder	310	524	760	586	88.9%	-22.9%
CC/GOM Yellowtail Flounder	779	940	1,046	479	-38.5%	-54.2%
Plaice	2,848	3,108	3,278	1,420	-50.1%	-56.7%
Witch Flounder	852	1,236	1,448	610	-28.4%	-57.9%
GB Winter Flounder	1,852	2,007	3,387	3,528	90.5%	4.2%
GOM Winter Flounder	158	329	715	715	352.5%	0.0%
SNE Winter Flounder		726	303	1,210		299.3%
Redfish	6,846	7,541	8,325	10,132	48.0%	21.7%
White Hake	2,556	2,974	3,283	3,849	50.6%	17.2%
Pollock	16,553	13,952	12,612	12,893	-22.1%	2.2%

* Does not include Sector Carryover.
Source: http://www.greateratlantic.fisheries.noaa.gov/aps/monitoring/nemultispecies.html

Table 51 - Annual Catch Entitlement and catch (Live lbs.)

	2010			2011		
	Allocated ACE	**Catch**	**% caught**	**Allocated ACE***	**Catch**	**% caught**
Cod, GB East	717,441	562,610	78%	431,334	357,578	83%
Cod, GB West	6,563,099	5,492,557	84%	9,604,207	6,727,837	70%
Cod, GOM	9,540,389	7,991,172	84%	1,242,220	9,561,153	85%
Haddock, GB East	26,262,695	4,122,910	16%	21,122,565	2,336,964	11%
Haddock, GB West	62,331,182	13,982,173	22%	50,507,974	6,101,400	12%
Haddock, GOM	1,761,206	819,069	47%	1,796,740	1,061,841	59%
Plaice	6,058,149	3,305,950	55%	7,084,289	3,587,356	51%
Pollock	35,666,741	11,842,969	33%	32,350,451	16,297,273	50%
Redfish	14,894,618	4,647,978	31%	17,369,940	5,951,045	34%
White hake	5,522,677	4,687,905	85%	6,708,641	6,598,273	98%
Winter flounder, GB	4,018,496	3,036,352	76%	4,679,039	4,241,177	91%
Winter flounder, GOM	293,736	178,183	61%	750,606	343,152	46%
Winter flounder, SNE	Not allocated			Not allocated		
Witch flounder	1,824,125	1,528,215	84%	2,839,697	2,178,941	77%
Yellowtail flounder, CC/GOM	1,608,084	1,268,961	79%	2,185,802	1,743,168	80%
Yellowtail flounder, GB	1,770,451	1,625,963	92%	2,474,662	2,176,921	88%
Yellowtail flounder, SNE	517,372	340,662	66%	963,033	795,267	83%
Grand Total	**179,350,461**	**65,433,630**	**36%**	**172,111,201**	**70,059,346**	**41%**

	2012			2013		
	Allocated ACE*	Catch	% caught	Allocated ACE*	Catch	% caught
Cod, GB East	349,326	146,887	42%	199,323	73,389	37%
Cod, GB West	0,320,365	3,331,816	32%	3,752,891	3,316,562	88%
Cod, GOM	8,761,312	4,699,621	54%	1,804,615	1,582,637	88%
Haddock, GB East	5,074,308	777,622	5%	8,249,383	1,276,136	15%
Haddock, GB West	9,398,411	1,808,495	4%	49,856,979	5,225,246	10%
Haddock, GOM	1,784,067	522,917	29%	412,428	368,570	89%
Plaice	7,400,614	3,426,646	46%	3,102,789	3,062,787	99%
Pollock	9,305,283	13,688,091	47%	28,481,182	10,569,073	37%
Redfish	19,052,388	9,096,051	48%	22,454,069	8,782,342	39%
White hake	7,365,297	5,294,489	72%	8,500,901	4,469,611	53%
Winter flounder, GB	7,695,773	4,237,884	55%	7,805,363	3,796,436	49%
Winter flounder, GOM	1,561,490	562,334	36%	1,531,079	367,701	24%

Winter flounder, SNE	Not allocated			2,367,913	1,477,896	62%
Witch flounder	3,291,703	2,122,567	64%	1,333,163	1,398,494	105%
Yellowtail flounder, CC/GOM	2,433,611	2,067,901	85%	1,035,799	823,535	80%
Yellowtail flounder, GB	798,315	474,236	59%	336,532	122,911	37%
Yellowtail flounder, SNE	1,342,708	938,303	70%	1,084,646	621,470	57%
Grand Total	**165,934,970**	**53,195,859**	**32%**	**142,309,054**	**47,334,794**	**33%**

Includes Sector Carryover

6.5.10.2 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 FY2013 (Table 52). The largest common pool catch (pollock, 67.8 mt) was only 0.8% of the total groundfish fishery catch of this stock. Common pool vessels caught 0.8% of the GOM cod and 0.2% of the GOM haddock groundfish fishery catch.

Common pool vessels with limited access permits landed 1.3M lbs. (landed lbs.) of regulated groundfish in FY2010, worth over $2M in ex-vessel revenues (Table 52). Landings declined to 530K lbs., worth about $840,000 in FY2011and declined again in FY2012 to 355K lbs., worth $606,000. In FY2013, groundfish landings and revenue from common pool vessels rose to 636Klbs, worth just over $1M. Most common pool vessel groundfish fishing activity takes place in the state of Massachusetts. From FY2011 to FY2013, the activity from Maine, Massachusetts and New Hampshire ports declined dramatically (Table 54). The primary ports for this activity over the last 3 years (FY2011-2013) is Gloucester although the ports of Portland, New Bedford, Point Judith and Montauk have also been involved to varying degrees (Table 55).

Table 52 – Common Pool Revenue and Landings FY 2010 – FY 2013.

ALL TRIPS	2010	2011	2012	2013
Groundfish Gross Revenue	$2,046,238	$838,386	$606,102	$1,008,645
Non-groundfish Gross Revenue	$94,530,850	$93,669,874	$92,777,213	$84,984,976
Total Gross Revenue	$96,577,088	$94,508,260	$93,383,315	$85,993,622
Groundfish Landed	1,296,835	529,883	354,699	635,968
Non-groundfish landed	76,497,646	84,455,968	81,876,291	77,136,496
Total Pounds Landed	77,794,481	84,985,851	82,230,990	77,772,463
GROUNDFISH TRIPS				
Groundfish Gross Revenue	$2,035,934	$776,238	$567,606	$947,679
Non-groundfish Gross Revenue	$4,416,742	$5,570,486	$3,089,055	$1,440,920
Total Gross Revenue	$6,452,676	$6,346,725	$3,656,661	$2,388,599
Groundfish Landed	1,289,380	482,696	333,808	590,007
Non-groundfish landed	4,770,095	5,022,273	3,066,950	1,782,623
Total Pounds Landed	6,059,475	5,504,969	3,400,758	2,372,630

*All revenue listed in 2010 constant dollars. Landings are in landed pounds.

Table 53 - Common pool permits landing groundfish.

	A	C	D	E	HA	Total
2011	61	6	3	12	31	114
2012	58	6		8	25	99
2013	59	5		10	29	106

Notes: Confidential data excluded.

Table 54 - Common pool groundfish landings by state of trip (landed lbs.).

	FY2011	FY2012	FY2013
MA	381,606	163,846	94,358
ME	49,559	48,860	34,628
NH	25,912	28,448	6,537
NJ	19,060	20,628	56,271
NY	38,843	58,594	64,941
RI	12,248	31,944	287,011

Note: Confidential data removed

Table 55 - Common pool groundfish landings by port (landed lbs.).

Port	FY2011	FY2012	FY2013
Gloucester, MA	269,671	144,615	50,166
Point Judith, RI	4,708	13,161	270,684
Montauk, NY	19,622	54,475	61,857
Portland, ME	40,520	34,054	c
New Bedford, MA	39,884	c	c

The primary groundfish stocks landed by common pool vessels in 2011 include GOM cod, GB cod, and pollock. In 2013 primary stocks included SNE yellowtail flounder and SNE winter flounder (Table 56). GB haddock was an important component in FY2010 but not in FY2011 or FY2012. Vessels using HA permits on groundfish trips primarily target GB and GOM cod, GOM haddock, and pollock.

For the common pool permits that landed at least one pound of regulated groundfish in FY2011, FY2012 or FY2013, groundfish revenues were a major portion of revenues on groundfish fishing trips. In FY2011 and FY2013 Groundfish revenues were 60% or more of the trip revenues for 55% of these vessels; in FY2012 this was only true for 38% of these vessels.

Table 56 - Common pool landings (landed lbs.) by permit category and stock.

FY2011 Landings	A	C	D	E	HA	Total
GB Cod W	102,450	3,186	168		15,577	121,381
GB Cod E						
GOM Cod	53,984	18,816	2,666		54,982	130,448
GB Haddock W	33,053				85	33,138
GOM Haddock	1,945	161			763	2,869
GB Yellowtail Flounder	3,944			1,521		5,465
SNE Yellowtail Flounder	25,272					25,272
CC/GOM Yellowtail Flounder	23,408	66		19		23,493
Plaice	10,213	686				10,899
Witch Flounder	9,448	972				10,420
GB Winter Flounder	2,411					2,411
GOM Winter Flounder	5,257	374				5,631
SNE/MA Winter Flounder	816					816
Redfish	7,208	38			147	7,393
White Hake	19,901	2,890			177	22,968
Pollock	89,533	4,653			7,644	101,830
Northern Windowpane	850					850
Southern Windowpane	8,607					8,607
Halibut					1,065	1,065
Total	398,3000	31,842	2,834	1,540	79,375	513,891
FY2012 Landings	A	C	D	E	HA	Total
GB Cod W	38,725	266			9,428	48,419
GOM Cod	13,209	22,379			8,983	44,571
GB Haddock W	13,373					13,373
GOM Haddock	1,117	420			470	2,007
GB Yellowtail Flounder	758			1,550		2,308
SNE Yellowtail Flounder	77,293			285		77,578
CC/GOM Yellowtail Flounder	876	799				1,675
Plaice	4,028	1,443				5,471
Witch Flounder	3,671	795				4,466
GB Winter Flounder	1,626					1,626
GOM Winter Flounder	669	1,775				2,444
SNE Winter Flounder	278					278
Redfish	11,678	253			25	11,956
White Hake	19,936	10,586			160	30,682
Pollock	92,614	14,221			3,122	109,957
Southern Windowpane	940					940
Ocean Pout		18				18
Halibut	218					218
Total	281,010	52,955		1,835	22,188	357,987

FY2013 Landings	A	C	D	E	HA	Total
GB Cod W	45,708	77			8,947	54,732
GOM Cod	2,588	6,437			4,327	13,352
GB Haddock W	28,946				111	29,057
GOM Haddock	46	40			2,367	2,453
GB Yellowtail Flounder				396		398
SNE Yellowtail Flounder	199,543			186		199,729
CC/GOM Yellowtail Flounder	6,640	71		28		6,739
Plaice	2,065	3,973				6,038
Witch Flounder	5,066	1,290				6,356
GB Winter Flounder						
GOM Winter Flounder	782	157				939
SNE Winter Flounder	250,266					250,266
Redfish	7,360	222			98	7,680
White Hake	7,719	1,410			76	9,205
Pollock	26,773	1,880			5,802	34,455
Southern Windowpane	89				82	171
Ocean Pout						
Halibut	161	106				267
Total	583,752	15,663		610	21,810	621,835

Note: Confidential data removed. Totals do not include confidential data

6.5.10.3 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, and GOM winter flounder. GB cod and haddock are targeted as well, but to a lesser extent. SNE/MA winter flounder is also a target species. Amendment 16 (Section 6.2.5, NEFMC 2009) included a detailed overview of recreational fishing activity.

Recreational removals of GOM cod declined by 25% from FY2012 to FY2013, and declined again by 19% in FY2014 (Table 57). Removals of GOM haddock were more equivalent through the time series, increasing slightly in both FY2013 and FY2014 (Table 57). The number of angler trips remained relatively stable in FY2012 and FY2013 then declining by 7% in FY2014 (Table 58). There were 122 active party or charter vessels catching cod or haddock in the Gulf of Maine in 2013, down from of 188-195 vessels between 2004 - 2010.

Table 57 - Recent recreational fishing activity for GOM cod and GOM haddock[1]

	FY2012	FY2013	FY2014[3]
Angler Trips[2]	194,589	194,912	181,622
Cod Catch (numbers, a+b1+b2)	957,497	729,541	680,445
Cod Kept (numbers, a+b1)	367,485	273,181	183,477
Cod Released (numbers, b2)	590,012	456,360	496,968
Cod Removals (numbers, a+b1+(0.3*b2))	544,489	410,089	332,567
Cod Removals (weight[4], mt)	758	610	561
Haddock Catch (numbers, a+b1+b2)	455,898	601,846	810,643
Haddock Kept (numbers, a+b1)	215,458	121,863	129,978
Haddock Released (numbers, b2)	240,440	479,983	680,665
Haddock Removals (numbers, a+b1+(0.5*b2))	335,678	361,855	470,311
Haddock Removals (weight[4], mt)	420	422	505

[1] Source: Available MRIP data as of Jan. 2, 2015 (from NEFSC SSB)
[2]Angler trips=number of trips that targeted and/or caught cod or haddock
[3]Data available for wave's 3,4, and 5 in FY 2014. Data from wave 2, 2014 and wave 6, 2013 used as proxies.
[4]All weights are based on round weights calculated from MRIP length frequencies and length to weight equations used in the assessments.

Table 58 – For-hire recreational vessels catching cod or haddock from the Gulf of Maine

Calendar Year	Party	Charter	Total
1999	53	100	153
2000	48	103	151
2001	59	116	175
2002	43	130	173
2003	53	128	181
2004	64	124	188
2005	60	135	195
2006	62	126	188
2007	52	133	185
2008	54	128	182
2009	48	131	179
2010	60	135	195
2011	47	128	175
2012	44	108	152
2013	31	89	120

Notes: Includes catch (kept and discarded) from any of the Gulf of Maine statistical areas.
Source: GARFO, January 2014.

6.5.11 Relevant Analyses

This section provides analyses performed throughout the development of the Framework 53 adjustment action.

Table 59 describes annual catch limits for all groundfish stocks from 2010 through 2014. Annual catch limits associated with the options 1 and 2 from Section 4.1.2 are shown in gray, as is the percent change of the 2015 values under consideration in this Framework from the ACLs that were in place for FY 2014 on May 1st.

Table 59 - Comparison of recent ACLs (FY 2010 - FY 2014) and proposed ACLs for FY 2015 (Option 1/No Action and Option 2)

Stock	FY 2010 Total ACL (mt)	FY 2011 Total ACL (mt)	FY 2012 Total ACL (mt)	FY 2013 Total ACL (mt)	FY 2014 Total ACL (mt)	FY 2015 Total ACL (mt)			
						Option 1/ No Action	% change wrt FY 2014	Option 2	% change wrt FY 2014
GB cod	3,620	4,540	4,861	1,907	1,867	2,387	28%	1,886	1%
GOM cod	8,088	8,545	6,700	1,470	1,470	1,470	0%	366	-75%
GB Haddock	42,768	32,611	29,260	27,936	18,312	41,526	127%	23,204	27%
GOM Haddock	1,197	1,141	958	274	323	412	28%	1,376	326%
GB Yellowtail Flounder	1,021	1416	547.8	208.5	318.1	-	-	240	-25%
SNE Yellowtail Flounder	470	641	936	665	665	665	0%	665	0%
CC/GOM Yellowtail Flounder	822	992	1,104	523	523	523	0%	524	0%
Plaice	3,006	3,280	3,459	1,482	1,442	1,470	2%	1,470	2%
Witch Flounder	899	1,304	1,563	751	751	751	0%	751	0%
GB Winter Flounder	1,955	2,118	3,575	3,641	3,493	-	-	1,952	-44%
GOM Winter Flounder	231	524	1,040	1,040	1,040	-	-	489	-53%
SNE/MA Winter Flounder	605	842	603	1,612	1,612	1,612	0%	1,607	0%
Redfish	7,226	7,959	8,786	10,462	10,909	11,393	4%	11,393	4%
White Hake	2,697	3,138	3,465	3,974	4,417	4,484	2%	4,484	2%
Pollock	18,929	16,166	14,736	14,921	15,304	-	-	15,878	4%
Northern Windowpane	161	161	163	144	144	144	0%	144	0%
Southern Windowpane	225	225	381	527	527	527	0%	527	0%
Ocean Pout	253	253	240	220	220	220	0%	220	0%
Halibut	69	76	83	96	106	116	9%	97	-8%
Wolffish	77	77	77	65	65	65	0%	65	0%

Sources:
FY2010-FY2013 ACLs from year-end catch reports. FY2014 ACLs from Framework 51 final rule and revisions.

Table 60- FY 2010-2013 northern windowpane flounder catch.

Fishing Year	OFL	U.S. ABC	Total Catch Limit	Catch (mt)				% of Catch Limit Caught
				Total	Groundfish Fishery	State Waters	Other sub-Components	
2010	225	169	161	163	154	0	9	101%
2011	225	169	161	191	157	0	35	119%
2012	230	173	163	209	130	2	77	128%
2013	202	151	144	280	237	1	42	195%

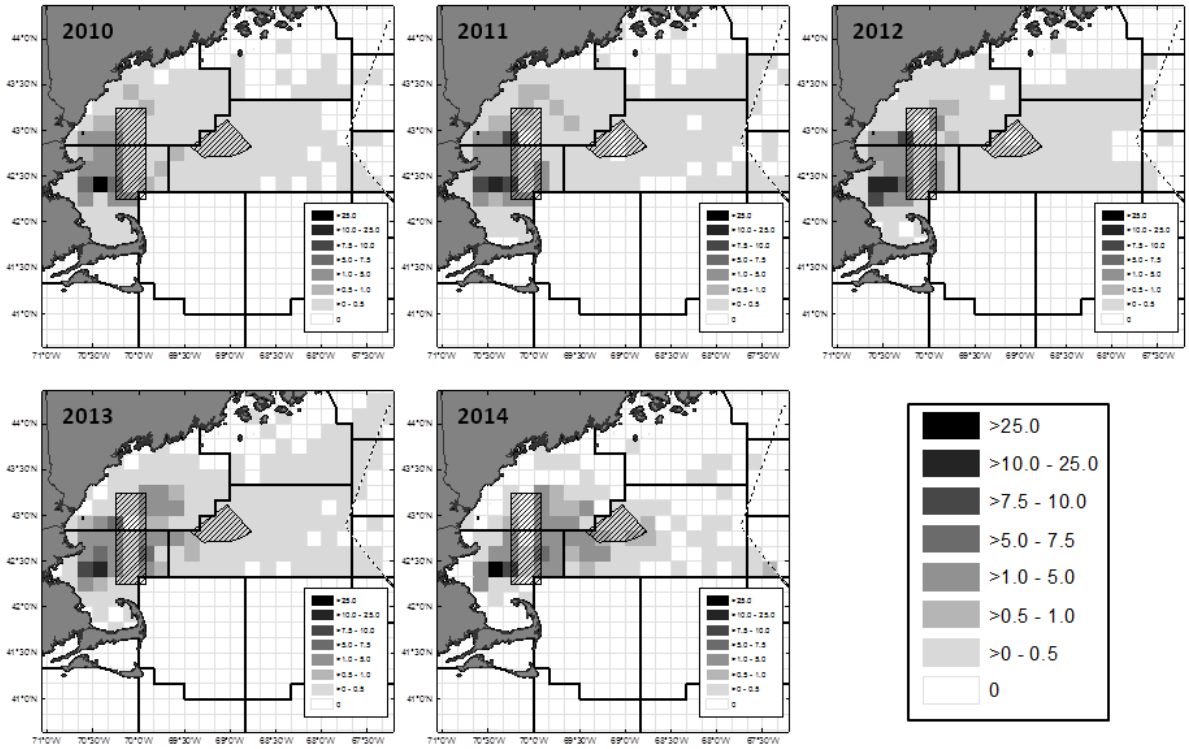
Table 61- Other sub-component catch detail for northern windowpane flounder.

Fishing Year	U.S. ABC (mt)	Other sub-Component		% of sub-Component Caught	Other sub-Component Catch (mt)					
		% of ABC	Value (mt)		TOTAL	Scallop	Herring	Squid/ Whiting	Whiting	Unknown
2010	169	29%	49	19%	9.1	8.2	0.1	0.7	0.0	0.1
2011	169	29%	49	71%	34.8	33.0	0.2	1.4	0.1	0.1
2012	173	19%	33	233%	77.0	75.7	0.2	0.9	0.1	0.0
2013	151	29%	44	95%	41.6	40.7	0.2	0.6	0.0	0.1

Gulf of Maine Cod Management Measures:

Section 4.2.1, GOM Cod Management Measures, includes a suite of alternatives that aim to address the poor status of GOM cod stock. Cod landings have been associated with catches from several key inshore areas. While analysis indicates that the distribution of GOM cod catch has shifted some to the east in 2013 and through summer 2014, the inshore areas have historically been important areas of catch and spawning. Figure 24 shows the changes of catch distribution of GOM cod for 2010 through July 2014. The importance of the inshore area, west of the WGOM Closure Area, can be seen from these distribution maps.

Figure 24 - Annual percentage of Gulf of Maine cod landings by ten minutes square, CY 2010-2014.



Source: Palmer (2014).

Note: 2014 is a partial year (this plot only contains data through July).

Default Specifications:

Several default specifications/rollover analyses (4.2.2) were conducted for FW53, including a white paper on the use of rollover and default specifications in other FMPs in the Greater Atlantic Region. The Council considered a percentage based approach to default specifications in section 4.2.2. Data illustrating the range of ACL values associated with varying percentages of default specifications, as well as the percent change from one FY to the next is presented in Table 62, Table 63, and Table 64. Instances where a particular percentage of the prior year's ACL would be larger than the ABC for the upcoming fishing year are highlighted and shown in red in Table 62 and Table 64.

Table 62 – Default Specifications Comparison of FY 2014 and FY 2015 (Option 2).

FY2014-FY2015 (Option 2) Comparison										
Stock	Total ACL 2014	35% Rollover of 2014 Total ACL	30% Rollover of 2014 Total ACL	25% Rollover of 2014 Total ACL	20% Rollover of 2014 Total ACL	15% Rollover of 2014 Total ACL	10% Rollover of 2014 Total ACL	*Option 2:* Total U.S. ABC 2015	*Option 2:* Total ACL 2015	% Change in ACL: 2014 to 2015
GB cod	1,867	**653**	**560**	**467**	**373**	**280**	**187**	1,980	1,886	**1%**
GOM cod	1,470	**515**	**441**	**368**	**294**	**221**	**147**	386	366	**-75%**
GB Haddock	18,312	**6,409**	**5,494**	**4,578**	**3,662**	**2,747**	**1,831**	24,366	23,204	**27%**
GOM Haddock	323	**113**	**97**	**81**	**65**	**48**	**32**	1,454	1,375	**326%**
GB Yellowtail Flounder	318	**111**	**95**	**80**	**64**	**48**	**32**	248	240	**-25%**
SNE Yellowtail Flounder	665	**233**	**200**	**166**	**133**	**100**	**67**	700	666	**0%**
CC/GOM Yellowtail Flounder	523	**183**	**157**	**131**	**105**	**78**	**52**	548	524	**0%**
Plaice	1,442	**505**	**433**	**361**	**288**	**216**	**144**	1,544	1470	**2%**
Witch Flounder	751	**263**	**225**	**188**	**150**	**113**	**75**	783	751	**0%**
GB Winter Flounder	3,493	**1,223**	**1,048**	**873**	**699**	**524**	**349**	2,124	1,952	**-44%**
GOM Winter Flounder	1,040	**364**	**312**	**260**	**208**	**156**	**104**	510	489	**-53%**
SNE/MA Winter Flounder	1,612	**564**	**484**	**403**	**322**	**242**	**161**	1,676	1,607	**0%**
Redfish	10,909	**3,818**	**3,273**	**2,727**	**2,182**	**1,636**	**1,091**	11,974	11,393	**4%**
White Hake	4,417	**1,546**	**1,325**	**1,104**	**883**	**663**	**442**	4,713	4,484	**2%**
Pollock	15,304	**5,356**	**4,591**	**3,826**	**3,061**	**2,296**	**1,530**	16,600	15,878	**4%**
Northern Windowpane	144	**50**	**43**	**36**	**29**	**22**	**14**	151	144	**0%**
Southern Windowpane	527	**184**	**158**	**132**	**105**	**79**	**53**	548	527	**0%**
Ocean Pout	220	**77**	**66**	**55**	**44**	**33**	**22**	235	220	**0%**
Halibut	106	**37**	**32**	**27**	**21**	**16**	**11**	109	97	**-8%**
Wolffish	65	**23**	**20**	**16**	**13**	**10**	**7**	70	65	**0%**

Source: 2014 ACLs from FW51 Final Rule and Revisions.

Table 63 - Default Specifications Comparison of FY 2013 and FY 2014.

FY2013-FY2014 Comparison										
Stock	Total ACL 2013	35% Rollover of 2013 Total ACL	30% Rollover of 2013 Total ACL	25% Rollover of 2013 Total ACL	20% Rollover of 2013 Total ACL	15% Rollover of 2013 Total ACL	10% Rollover of 2013 Total ACL	Total U.S. ABC 2014	Total ACL 2014	% Change in ACL: 2013 to 2014
GB cod	1,907	**667**	**572**	**477**	**381**	**286**	**191**	1,960	1,867	**-2%**
GOM cod	1,470	**515**	**441**	**368**	**294**	**221**	**147**	1,550	1,470	**0%**
GB Haddock	27,936	**9,778**	**8,381**	**6,984**	**5,587**	**4,190**	**2,794**	19,229	18,312	**-34%**
GOM Haddock	274	**96**	**82**	**69**	**55**	**41**	**27**	341	323	**18%**
GB Yellowtail Flounder	208.5	**73**	**63**	**52**	**42**	**31**	**21**	328	318	**53%**
SNE Yellowtail Flounder	665	**233**	**200**	**166**	**133**	**100**	**67**	700	665	**0%**
CC/GOM Yellowtail Flounder	523	**183**	**157**	**131**	**105**	**78**	**52**	548	523	**0%**
Plaice	1,482	**519**	**445**	**371**	**296**	**222**	**148**	1,515	1,442	**-3%**
Witch Flounder	751	**263**	**225**	**188**	**150**	**113**	**75**	783	751	**0%**
GB Winter Flounder	3,641	**1,274**	**1,092**	**910**	**728**	**546**	**364**	3,598	3,493	**-4%**
GOM Winter Flounder	1,040	**364**	**312**	**260**	**208**	**156**	**104**	1,078	1,040	**0%**
SNE/MA Winter Flounder	1,612	**564**	**484**	**403**	**322**	**242**	**161**	1,676	1,612	**0%**
Redfish	10,462	**3,662**	**3,139**	**2,615**	**2,092**	**1,569**	**1,046**	11,465	10,909	**4%**
White Hake	3,974	**1,391**	**1,192**	**994**	**795**	**596**	**397**	4,642	4,417	**11%**
Pollock	14,921	**5,222**	**4,476**	**3,730**	**2,984**	**2,238**	**1,492**	16,000	15,304	**3%**
Northern Windowpane	144	**50**	**43**	**36**	**29**	**22**	**14**	151	144	**0%**
Southern Windowpane	527	**184**	**158**	**132**	**105**	**79**	**53**	548	527	**0%**
Ocean Pout	220	**77**	**66**	**55**	**44**	**33**	**22**	235	220	**0%**
Halibut	96	**34**	**29**	**24**	**19**	**14**	**10**	109	106	**10%**
Wolffish	65	**23**	**20**	**16**	**13**	**10**	**7**	70	65	**-1%**

Source: 2014 ACLs from FW51 Final Rule and Revisions, 2013 ACLs from NMFS Final Year End Results for FY2013, October 20, 2014.

Table 64 – Default Specifications Comparison of FY 2012 and FY 2013.

FY2012-FY2013 Comparison										
Stock	Total ACL 2012	35% Rollover of 2012 Total ACL	30% Rollover of 2012 Total ACL	25% Rollover of 2012 Total ACL	20% Rollover of 2012 Total ACL	15% Rollover of 2012 Total ACL	10% Rollover of 2012 Total ACL	Total U.S. ABC 2013	Total ACL 2013	% Change in ACL: 2012 to 2013
GB cod	4,861	**1,701**	**1,458**	**1,215**	**972**	**729**	**486**	2,002	1,907	**-61%**
GOM cod	6,700	**2,345**	**2,010**	**1,675**	**1,340**	**1,005**	**670**	1,550	1,470	**-78%**
GB Haddock	29,260	**10,241**	**8,778**	**7,315**	**5,852**	**4,389**	**2,926**	29,335	27,936	**-5%**
GOM Haddock	958	**335**	**287**	**240**	**192**	**144**	**96**	290	274	**-71%**
GB Yellowtail Flounder	547.8	**192**	**164**	**137**	**110**	**82**	**55**	215	208.5	**-62%**
SNE Yellowtail Flounder	936	**328**	**281**	**234**	**187**	**140**	**94**	700	665	**-29%**
CC/GOM Yellowtail Flounder	1,104	**386**	**331**	**276**	**221**	**166**	**110**	548	523	**-53%**
Plaice	3,459	**1,211**	**1,038**	**865**	**692**	**519**	**346**	1,557	1,482	**-57%**
Witch Flounder	1,563	**547**	**469**	**391**	**313**	**234**	**156**	783	751	**-52%**
GB Winter Flounder	3,575	**1,251**	**1,073**	**894**	**715**	**536**	**358**	3,750	3,641	**2%**
GOM Winter Flounder	1,040	**364**	**312**	**260**	**208**	**156**	**104**	1,078	1,040	**0%**
SNE/MA Winter Flounder	603	**211**	**181**	**151**	**121**	**90**	**60**	1,676	1,612	**167%**
Redfish	8,786	**3,075**	**2,636**	**2,197**	**1,757**	**1,318**	**879**	10,995	10,462	**19%**
White Hake	3,465	**1,213**	**1,040**	**866**	**693**	**520**	**347**	4,177	3,974	**15%**
Pollock	14,736	**5,158**	**4,421**	**3,684**	**2,947**	**2,210**	**1,474**	15,600	14,921	**1%**
Northern Windowpane	163	**57**	**49**	**41**	**33**	**24**	**16**	151	144	**-12%**
Southern Windowpane	381	**133**	**114**	**95**	**76**	**57**	**38**	548	527	**38%**
Ocean Pout	240	**84**	**72**	**60**	**48**	**36**	**24**	235	220	**-8%**
Halibut	83	**29**	**25**	**21**	**17**	**12**	**8**	99	96	**16%**
Wolffish	77	**27**	**23**	**19**	**15**	**12**	**8**	70	65	**-15%**

Source: 2013 ACLs from NMFS Final Year End Results for FY2013, October 20, 2014. 2012 ACLs from NMFS Final Year End Results for FY2012, November 5th, 2013.

Table 65 – Preliminary commercial groundfish catch data as a percent of the stock-specific ACLs and time elapsed in the fishing year for FY 2012, FY 2013, and FY 2014.

Preliminary Groundfish Commercial Catch Data (Sectors and Common Pool) From NMFS: FY 2012 - FY2014

	Data Reported Through	8/14/2012	8/15/2013	8/20/2014
	% FY Complete	***29%***	***29%***	***31%***
Allocated Stocks	GB Cod East	26.9%	11.8%	7.80%
	GB Cod	14.1%	17.7%	26.60%
	GOM Cod	15.0%	19.1%	29.10%
	GB Haddock East	2.8%	1.8%	4.40%
	GB Haddock	1.9%	1.5%	11.40%
	GOM Haddock	8.5%	22.5%	35.40%
	GB Yellowtail Flounder	6.6%	10.5%	10.30%
	SNE/MA Yellowtail Flounder	0.5%	6.0%	20.70%
	CC/GOM Yellowtail Flounder	23.2%	19.6%	21.70%
	Plaice	14.9%	27.4%	32.10%
	Witch Flounder	19.3%	28.4%	28%
	GB Winter Flounder	30.7%	27.2%	22.30%
	GOM Winter Flounder	7.7%	8.1%	7.10%
	SNE/MA Winter Flounder	11.8%	23.5%	23.80%
	Redfish	16.4%	11.0%	20%
	White Hake	21.9%	16.6%	14.80%
	Pollock	19.2%	10.5%	11.80%

	Data Reported Through	8/14/2012	8/15/2012	8/20/2014
	% FY Complete	***29%***	***29%***	***31%***
Non-Allocated Stocks	Northern Windowpane Flounder	20.6%	162.8%	75.0%
	Southern Windowpane Flounder	17.9%	33.0%	24.4%
	Ocean Pout	9.1%	8.7%	13.9%
	Halibut	45.3%	31.5%	28.1%
	Wolffish	34.0%	3.6%	14.4%

Data gathered from: http://www.greateratlantic.fisheries.noaa.gov/aps/monitoring/nemultispecies.html

Estimated catches on report date that exceed the percentage of the FY complete are shown as:

Estimate catches on report date within 5% of the percentage of the FY complete are shown as:

7.0 Environmental Consequences – Analysis of Impacts

Evaluation Criteria

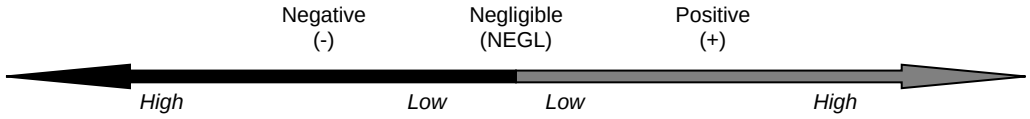
This EA evaluates the potential impacts using the criteria outlined in Table 66. Impacts from all alternatives are judged relative to the baseline conditions, as described in Section 6.0, and compared to each other.

Table 66 – Description of Valued Ecosystem Components analyzed in Environmental Consequences.

	Direction		
VEC	**Positive (+)**	**Negative (-)**	**Negligible/Neutral**
Allocated target species, other landed species, and protected resources	Actions that increase stock/population size	Actions that decrease stock/population size	Actions that have little or no positive or negative impacts to stocks/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 Biological Impacts

Biological impacts discussed below focus on expected changes in fishing mortality for regulated multispecies stocks. Changes in fishing mortality may result in changes in stock size. Impacts on essential fish habitat and endangered or threatened species are discussed in separate sections. Impacts are discussed in relation to impacts on regulated multispecies and other species. The impacts associated with the measures are anticipated to not be significant.

Throughout this section, impacts are often evaluated using an analytic technique that projects future stock size based on a recent age-based assessment. These projections are known to capture only part of the uncertainties that are associated with the assessments projections. There is evidence, that in the case of

multispecies stocks, that the projections tend to be optimistic when they extend beyond a short-term period (i.e., 1-3 years). This means that the projections tend to over-estimate future stock sizes and under-estimate future fishing mortality. Attempts to find a way to make the projections more accurate have so far proven unsuccessful. These factors should be considered when reviewing impacts that use this tool.

7.1.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits

7.1.1.1 Revised Status Determination Criteria

7.1.1.1.1 Option 1: No Action

Impacts on regulated groundfish

The No Action alternative would maintain the SDC for GB yellowtail flounder as adopted in Amendment 16. These values were based on the GARM III assessments completed in 2008. Since a new benchmark assessment has been completed for GB yellowtail flounder, the use of GARM III values would conflict with M-S Act requirements to use the best available science.

It is difficult to directly compare the Amendment 16 SDCs with updated biomass target values and the maximum fishing mortality threshold to determine the impacts if the older values are retained because of differences between assessments. During the 2014 GB yellowtail flounder assessment, the TRAC agreed to no longer use the VPA assessment model, and instead, to use an empirical approach based on resource survey catches as the basis of catch advice. Because a stock assessment model framework is lacking for this stock, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. As well, status determination relative to reference points is not possible because reference points cannot be defined. Therefore, the biomass target of B_{MSY}, minimum biomass threshold, and maximum fishing mortality threshold for GB yellowtail flounder would not be defined by either Option 1/No Action or Option 2.

Impacts on other species

Adopting this option would not be expected to have direct impacts on non-groundfish species such as monkfish, dogfish, skates, and sea scallops. This measure is primarily administrative in that it establishes the criteria used to determine if overfishing is occurring or the stock is overfished.

GB yellowtail flounder is allocated to the scallop fishery. Maximum fishing mortality threshold would not be defined by Option 1/No Action or Option 2. How this might impact scallops is unclear and there are a number of other factors that influence scallop fishing activity (such as access area openings, trip limits, DAS allocations, etc.).

7.1.1.1.2 Option 2: Revised Status Determination Criteria

Impacts on regulated groundfish

Adoption of Option 2 would change the SDC for GB yellowtail flounder using the criteria developed at the most recent benchmark assessments and would be based on the best available science, consistent with the M-S Act.

It is difficult to directly compare the Amendment 16 SDC with updated biomass target values and the maximum fishing mortality threshold to determine the impacts if the older values are retained because of differences between assessments. During the 2014 GB yellowtail flounder assessment, the TRAC agreed to no longer use the VPA assessment model, and instead, to use an empirical approach based on resource survey catches as the basis of catch advice. Because a stock assessment model framework is lacking for this stock, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated. As well, status determination relative to reference points is not possible because reference points cannot be defined. Therefore, the biomass target of B_{MSY}, minimum biomass threshold, and maximum fishing mortality threshold for GB yellowtail flounder would not be defined by either Option 1/No Action or Option 2.

Impacts on other species

Adopting this option would not be expected to have direct impacts on non-groundfish species such as monkfish, dogfish, skates, and sea scallops. This measure is primarily administrative in that it establishes the criteria used to determine if overfishing is occurring or if the stock is overfished.

GB yellowtail flounder is allocated to the scallop fishery. Maximum fishing mortality threshold would not be defined by Option 1/No Action or Option 2. How this might impact scallops is unclear and there are a number of other factors that influence scallop fishing activity (such as access area openings, trip limits, DAS allocations, etc.).

7.1.1.2 Annual Catch Limits

7.1.1.2.1 Option 1: No Action

Impacts on regulated groundfish

A number of groundfish stocks do not have FY 2015 specifications defined in previous actions. This option would not set specifications for these stocks in FY 2015; stocks with FY 2015 specifications from previous actions would be maintained and are not discussed further. The distribution of Annual Catch Limits (ACLs) to other fishery sub-components would be maintained.

An Overfishing Level (OFL), Acceptable Biological Catch (ABC) or ACLs would not be defined for certain stocks in the multispecies fishery. Without specification of an ACL, a catch would not be allocated to the groundfish fishery (sectors or common pool vessels) and targeted groundfish fishing activity would not occur for these stocks. Catches would not be eliminated because there would probably be incidental catches or bycatch from other fisheries. The lack of an OFL makes it difficult to determine whether overfishing is likely to occur, however, with limited fishing activity the probability of overfishing would be low. Accountability Measures (AMs) in the multispecies fishery would be maintained but are expected to have a low probability of being triggered without allocations.

In addition to the lack of targeted groundfish fishing activity on stocks without an ACL, certain provisions of the sector management system make it likely that fishing activity could be constrained even for stocks with an ACL that is specified. Current management measures require that a sector stop fishing in a stock area if it does not have ACE for a stock. Fishing can continue on stocks for which the sector continues to have ACE only if the sector can demonstrate it will not catch the ACE-limited stock. In practice, this mean is that in most cases there will be little opportunity for sector vessels to fish on stocks that already have an ACL under this option because of this requirement. Since there would be no allocations for GB yellowtail flounder, GB winter flounder, GOM winter flounder, and pollock from

FY2015-FY2017, most groundfish fishing activity would not occur. As a result, in general this option would be expected to result in dramatically lower fishing mortality and more rapid stock rebuilding than would be the case for Option 2.

For stocks that have an age-based assessment, an age-based projection model was used to estimate the short-term impacts on stock size of setting the ABCs. These models project the estimated median stock sizes expected to result by limiting catches to the ABC. Recent experience suggests that the projections tend to be biased high, predicting stocks sizes that are larger than realized and fishing mortality rates that are higher than expected (Groundfish Plan Development Team, pers. comm.). The effect of no groundfish allocations was explored in stock projections for the following stocks:

- Gulf of Maine Cod
- Gulf of Maine Haddock
- Georges Bank Winter Flounder
- Pollock

Since there may be catches of these stocks in other fisheries the projections used an estimate of other sub-components catches to approximate the catches that might occur (Table 67).

Table 67 - Estimated catches that might occur in FY2015-FY2017 under Option 1/No Action. "No Action Assumed Catch" used in the stock projections.

Stock	Non-Groundfish Assumed Catch (mt)		
	2015	2016	2017
GOM Cod	154	38	38
GOM Haddock	19	55	66
GB Winter Flounder	60	67	69
Pollock	2,158	2,158	2,158

Notes on the "Non-Groundfish Assumed Catch"

Since there may be catches of these stocks in other fisheries the No Action/Option 1 SSB projections used an estimate of other sub-components catches to approximate the catches that might occur.

"Non-Groundfish" includes the other sub-component, state waters sub-component, scallops, small-mesh sub-ACL, and mid-water trawl sub-ACL as in Table 9 (of the Alternatives, Option 2) for FY 2015, FY2016 and FY 2017.

However for FY 2015, GOM cod and GOM haddock have specifications under the No Action/Option 1 and these were used to approximate non-groundfish catches based on Table 6 (of the Alternatives).

GOM Cod
Under Option 1, GOM cod projections indicate an increase in SSB occurs but it remains well below SSB_{MSY} (Figure 25, Figure 26, and Figure 27). For Option 1, three scenarios were run dependent on the natural mortality assumption, base (m=0.2) and ramp (m=0.2 and m-0.4); each show an increase in SSB after 2015 but it remains well below SSB_{MSY} (Figure 25, Figure 26, and Figure 27). Option 1 does not differ greatly from the projections from Option 2. A very low ACL for GOM cod is similar to non-target catch of GOM cod in the projections because both values are low and the stock is in such poor condition. SSB increases are projected to be greater under Option 1 than Option 2.

GOM Haddock
Under Option 1, GOM haddock projections indicate a further increase in SSB above the SSB_{MSY} under this scenario (Figure 28). The stock is above the SSB_{MSY} and is expected to increase during the projected years under Option 1. Option 1 would allow for greater increases in SSB than Option 2.

GB Winter Flounder
Under Option 1, GB winter flounder biomass projections indicate that SSB will increase after 2015 and there is some indication that the stock may increase above the SSB_{MSY} biomass (Figure 29). Option 1 would allow for greater increases in SSB than Option 2.

Pollock
Under Option 1, pollock SSB projections indicate a further increase in SSB above the SSB_{MSY} (Figure 30). The SSB also increases under Option 2 but it is lower than in Option 1.

It is not possible to project stock sizes for the following stocks:

- GB Yellowtail Flounder
- GOM Winter Flounder

For index-assessed stocks an estimate of the probability of overfishing cannot be determined but the proposed ABC is based on an exploitation rate (GB yellowtail flounder) or the SSC's default control rule of 75% F_{MSY} (GOM winter flounder) applied to the most recent estimate of stock size. As a result, if stock size does not decline then the proposed ABC would not be expected to result in overfishing. This is an unrealistic assumption – stock size could increase or decrease but is unlikely to remain constant.

Figure 25- Projected GOM cod stock size under Option 1/No Action, using M=0.2 model

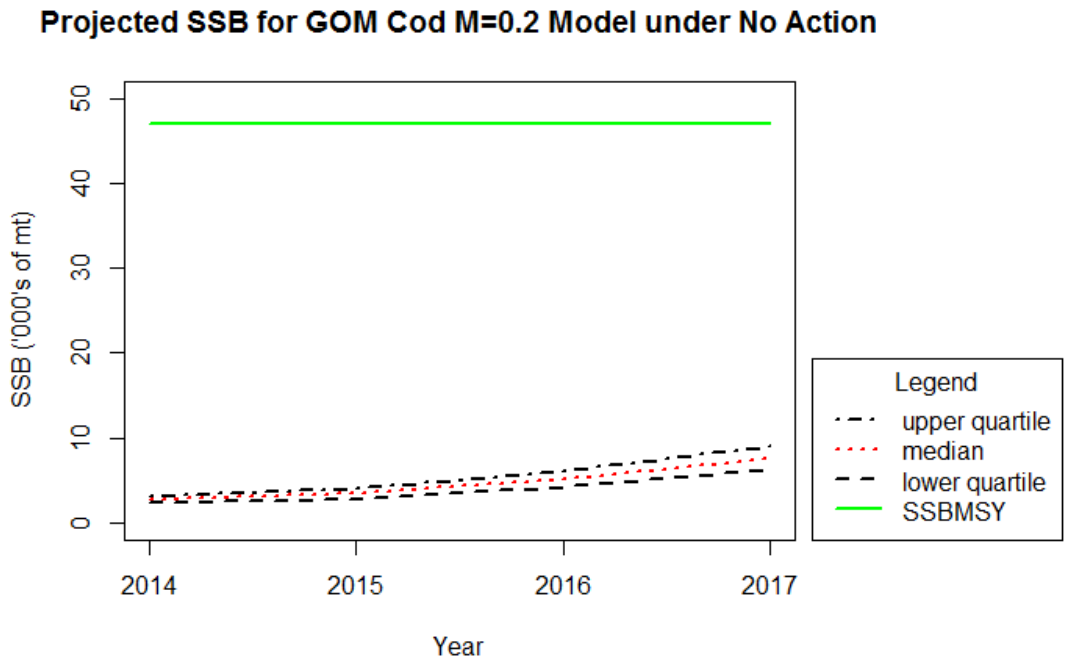


Figure 26- Projected GOM cod stock size under Option 1/No Action, using M-ramp/M=0.2 model.

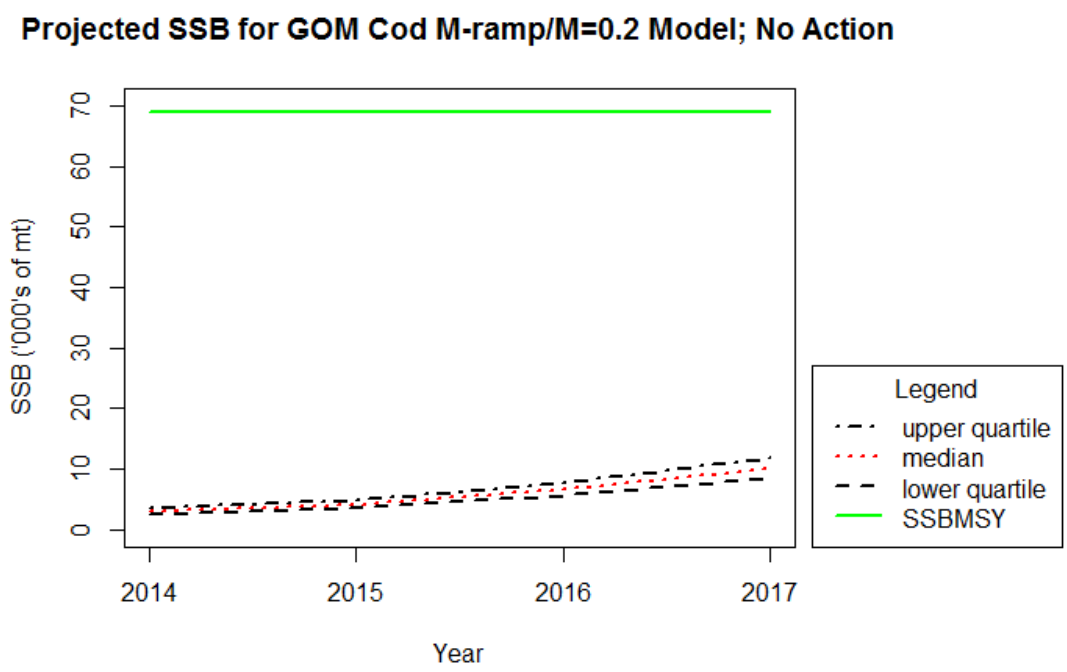


Figure 27- Projected GOM cod stock size under Option 1/No Action, using M-ramp/M=0.4.

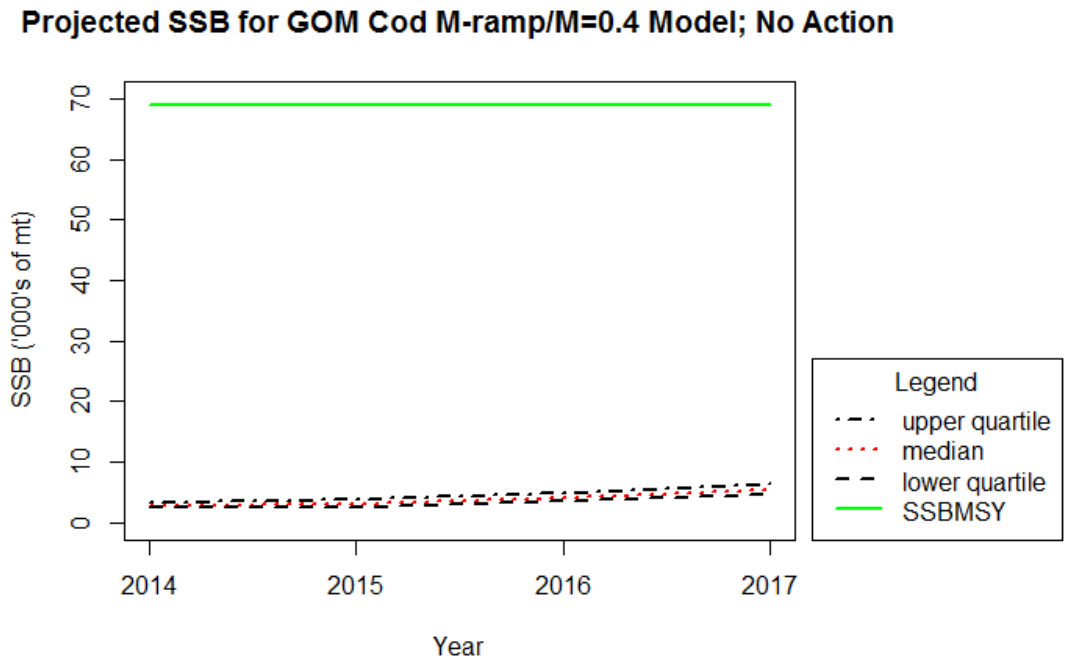


Figure 28- Projected GOM haddock stock size under Option 1/No Action.

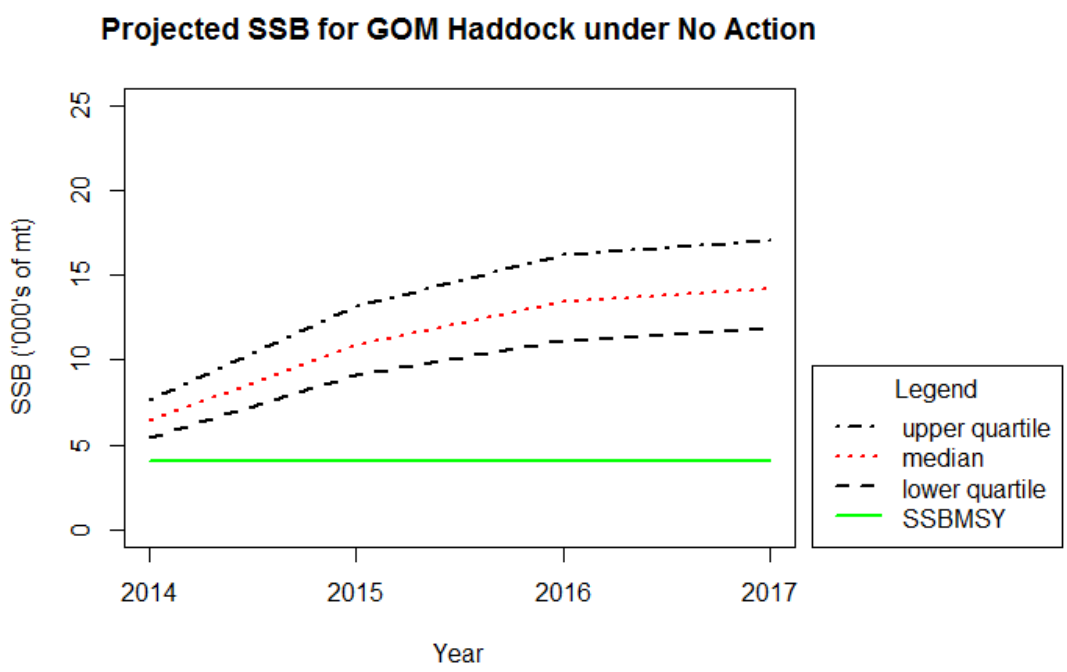


Figure 29- Projected GB winter flounder stock size under Option 1/No Action.

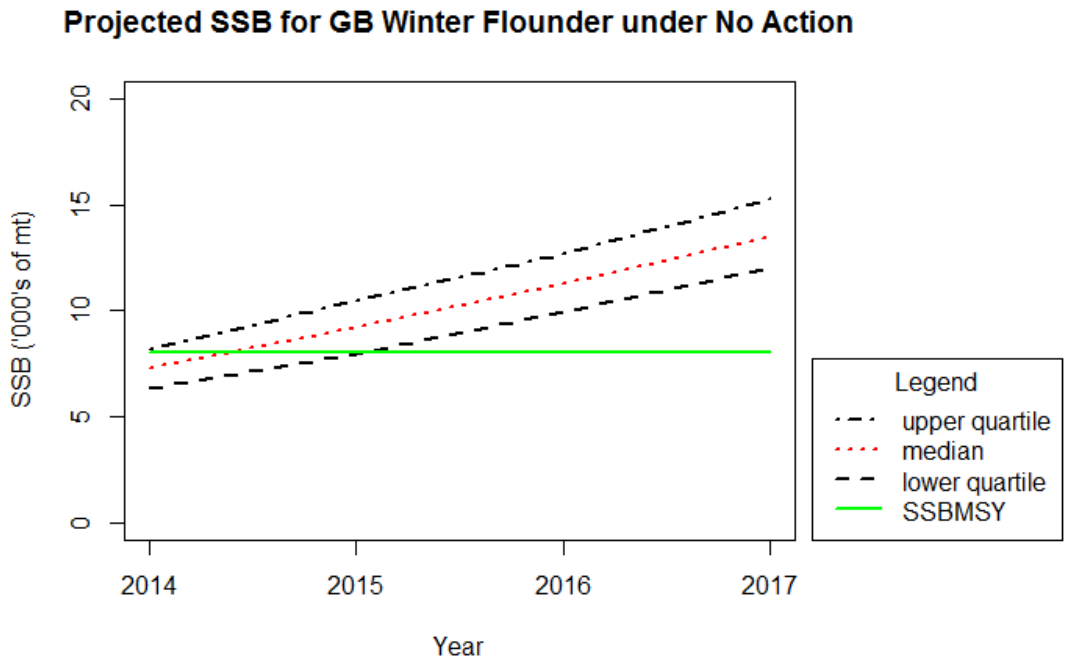
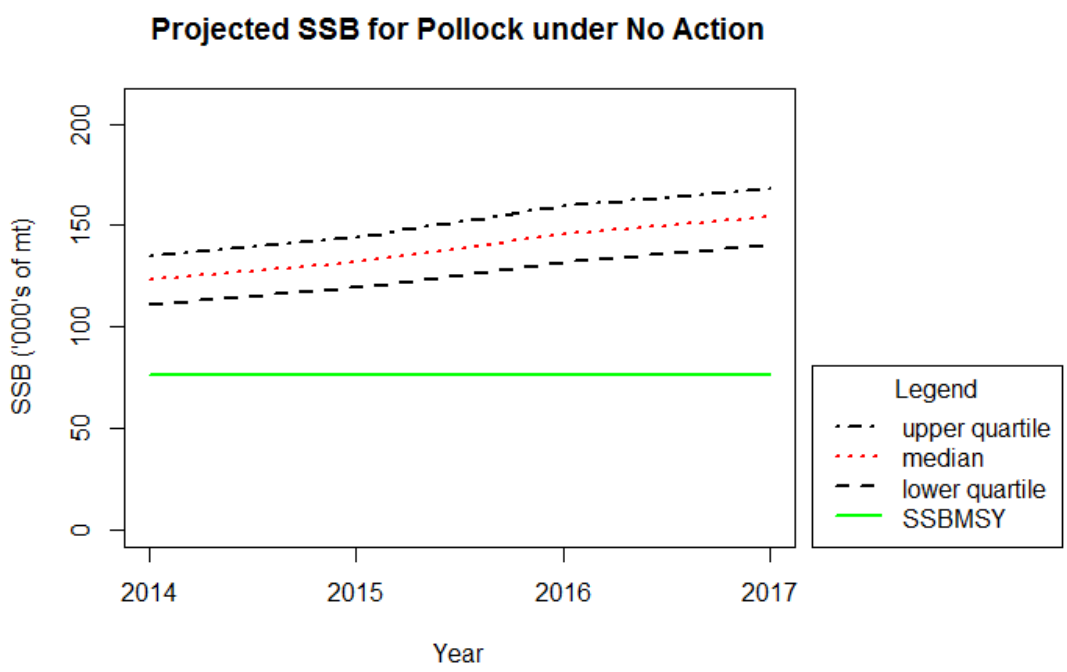


Figure 30- Projected pollock stock size under Option 1/No Action.



Impacts on other species

Adopting the Option 1/No Action specifications is not expected to have direct impacts on non-groundfish species. Indirect effects are generally likely to be beneficial given the expected reduced groundfish

fishing activity. Catches of other species that occur on groundfish trips would decline as a result. There are only limited opportunities for groundfish vessels to target other stocks in other fisheries, so the shifting of effort into other fisheries is not likely to occur on a large scale. These other fisheries will also have ACLs and AMs so while such effort shifts may have economic effects the biological impacts should not be negative. Considering the differences between the ACLs of Option 1/No Action and Option 2, the fishing mortality on other stocks would probably be lower under Option 1/No Action.

7.1.1.2.2 Option 2: Revised Annual Catch Limit Specifications (*Preferred Alternative*)

Impacts on regulated groundfish

Option 2 would adopt new ABCs consistent with the best available science for GOM cod, GOM haddock, GB yellowtail flounder, GB winter flounder, GOM winter flounder, and pollock. The ABCs for other stocks were set in previous actions and not discussed here. Generally, increases in SSB are lower under Option 2 than those under Option 1/No Action.

Because this option would adopt FY 2015 - 2017 ABCs for the stocks listed above, and all the stocks have recent assessment updates or benchmark assessments, short-term projections can be used to estimate the probability of overfishing and short-term changes in stock size. These projections use catches equal to the ABCs that would be adopted if this option is selected. Since the management goal is to keep catches at or below ACLs, and ACLs are always less than the ABC, the projection results would be expected to slightly over-estimate the risk of overfishing and under-estimate future stock size. However, experience demonstrates that projections tend to be overly optimistic, and therefore, concerns about over-estimating the risk of overfishing and under-estimating future stock size are expected to be minimal.

Projected stock sizes are shown in Figure 31 through Figure 36 for these stocks and the probability of overfishing is listed in Table 68. This table compares projected future stock size to both 2016 and 2017. A comparison of probability of overfishing between the two options is difficult as Option 1/No Action has no OFLs defined for some stocks.

GOM Cod
The recent update assessment for GOM cod indicates that the stock is well below SSB_{MSY}. Under Option 2, the projections indicate an increase in SSB after 2015. Under Option 2, the SSB is projected to increase marginally after 2015 but the SSB_{MSY} is still well above the projected SSB size. For Option 2, three scenarios were run dependent on the natural mortality assumption, base (m=0.2) and ramp (m=0.2 and m-0.4); each show an increase in SSB after 2015 but it remains well below SSB_{MSY} (Figure 31, Figure 32, and Figure 33). Option 1 does not differ greatly from the projections from Option 2. A very low ACL for GOM cod is similar to non-target catch of GOM cod in the projections because both values are low and the stock is in such poor condition. SSB increases are projected to be greater under Option 1 than Option 2.

GOM Haddock
GOM haddock SSB projections indicate a further increase in SSB above the SSB_{MSY} under this scenario (Figure 34). The stock is above the SSB_{MSY} and is expected to increase during the projected years under Option 1. The SSB also increases under Option 2 but it is lower than in Option 1.

GB Winter Flounder
GB winter flounder projections indicate that SSB will increase after 2015 and there is some indication that the stock may increase above the SSB_{MSY} (Figure 35). The SSB also increases under Option 2 but it is lower than in Option 1.

Pollock
Pollock SSB projections indicate a further increase in SSB above the SSB_{MSY} under this scenario (Figure 36).The stock is above the SSB_{MSY} and is expected to increase during the projected years under Option 1. The SSB also increases under Option 2 but it is lower than in Option 1.

Figure 31- Projected GOM cod stock size under Option 2, using M=0.2 model

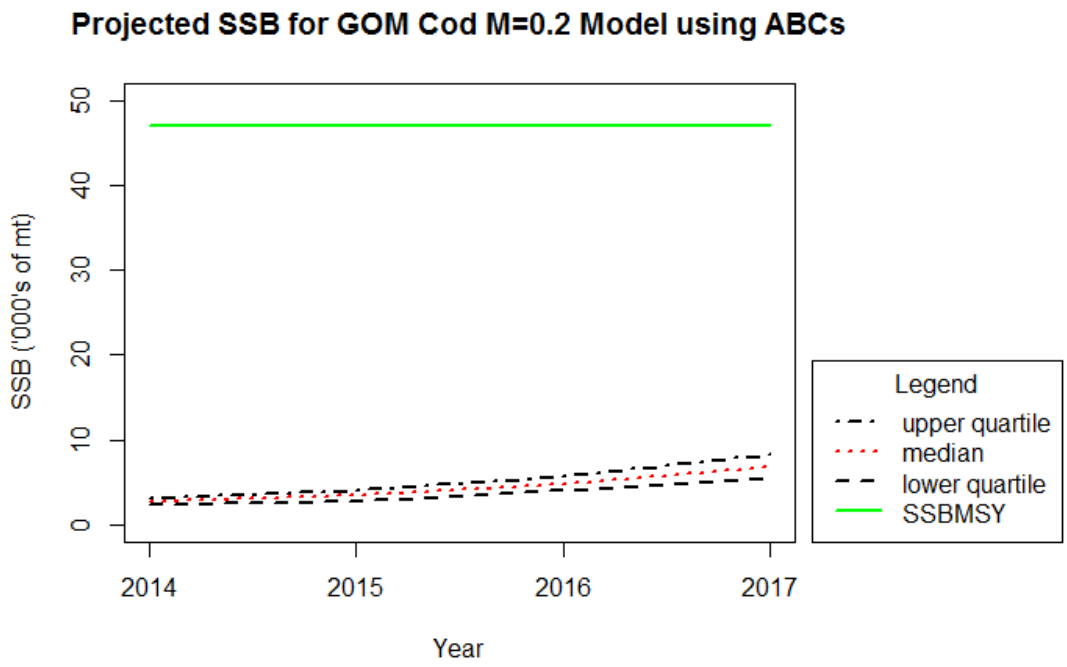


Figure 32- Projected GOM cod stock size under Option 2, using M-ramp/M=0.2 model.

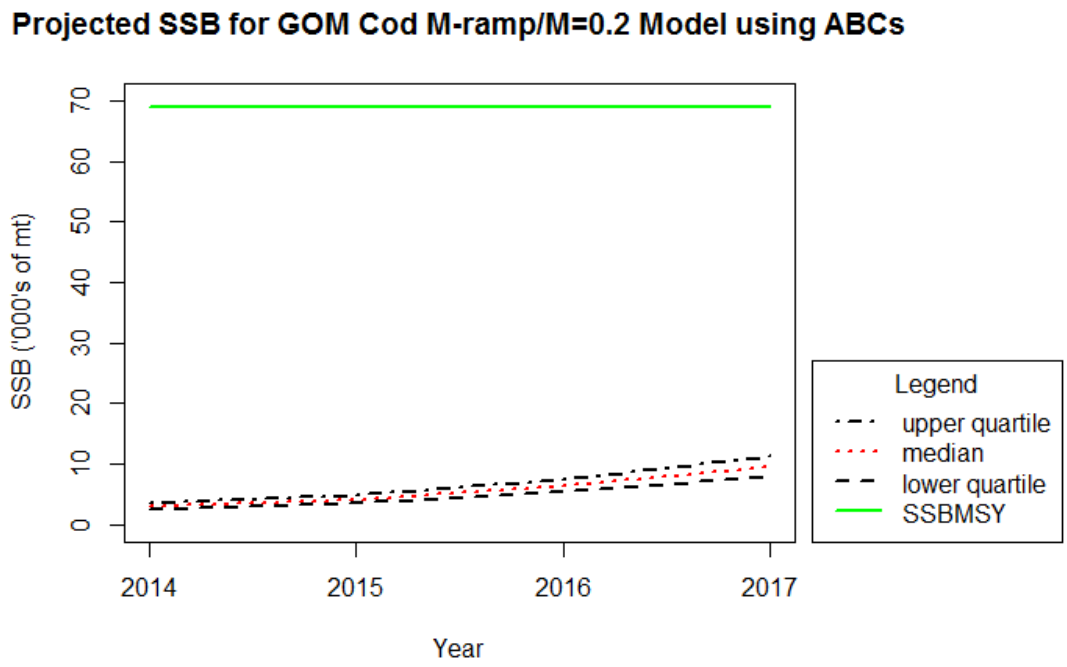


Figure 33- Projected GOM cod stock size under Option 2, using M-ramp/M=0.4.

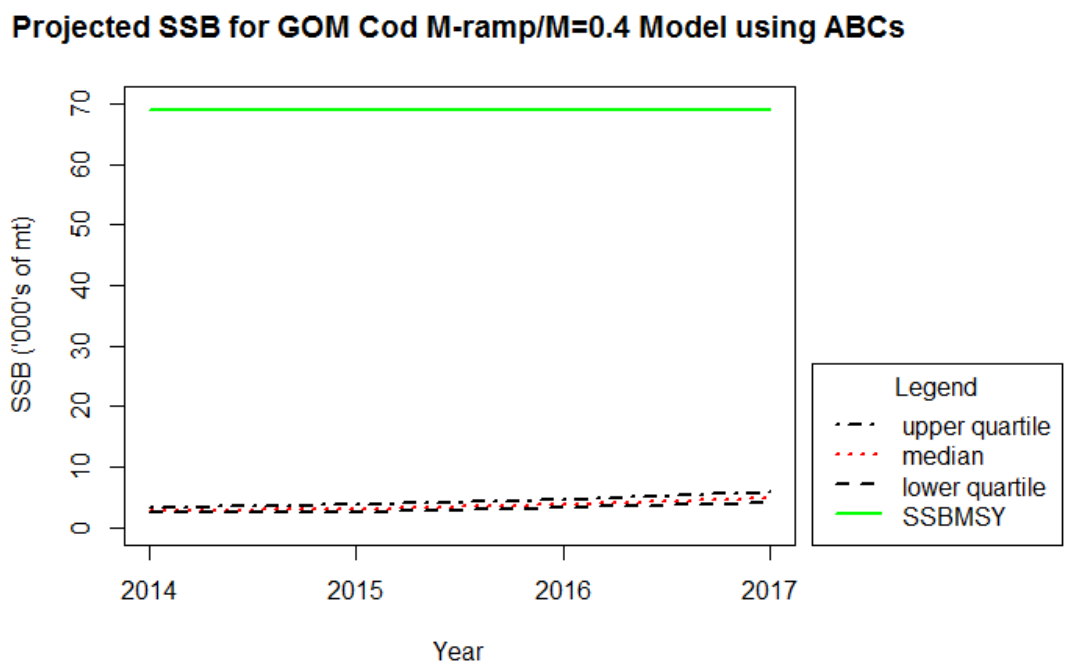


Figure 34- Projected GOM haddock stock size under Option 2.

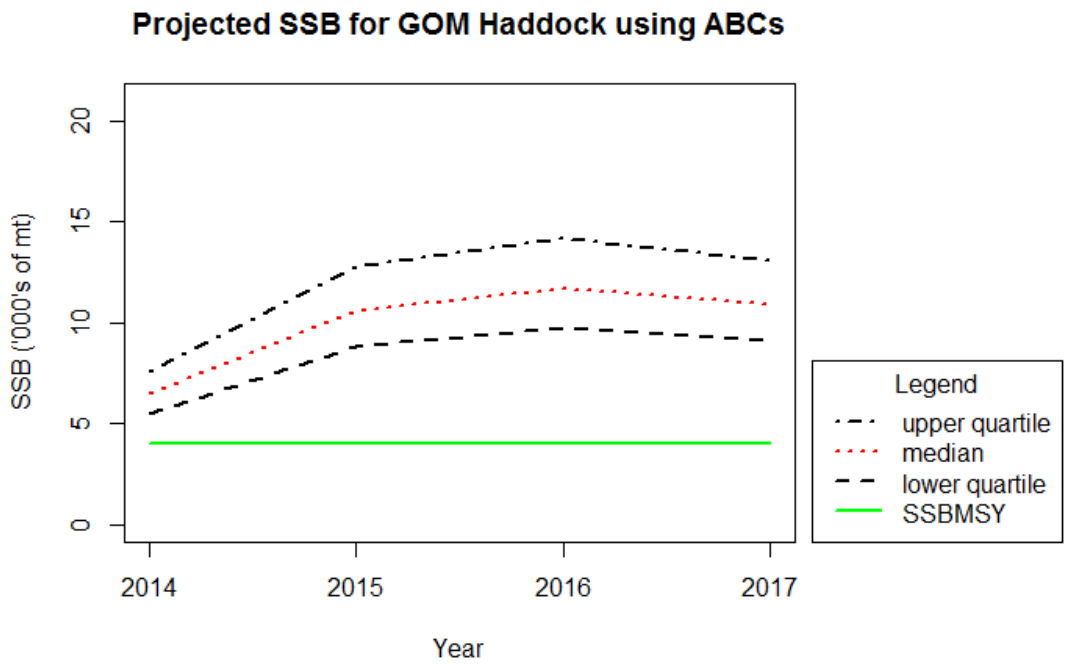


Figure 35- Projected GB winter flounder stock size under Option 2.

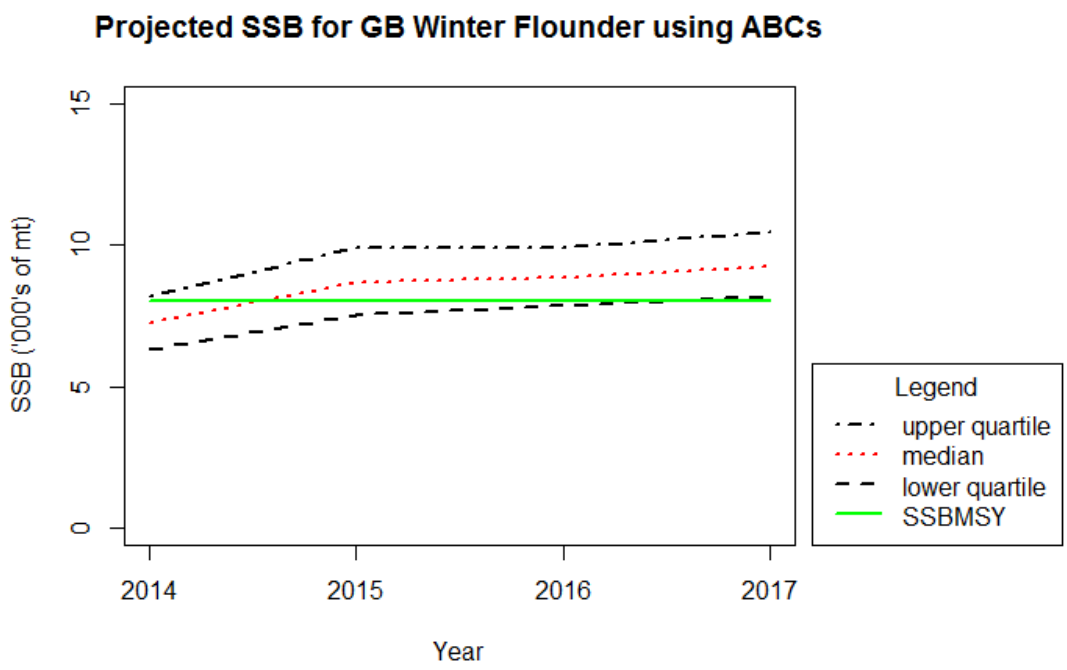


Figure 36- Projected pollock stock size under Option 2.

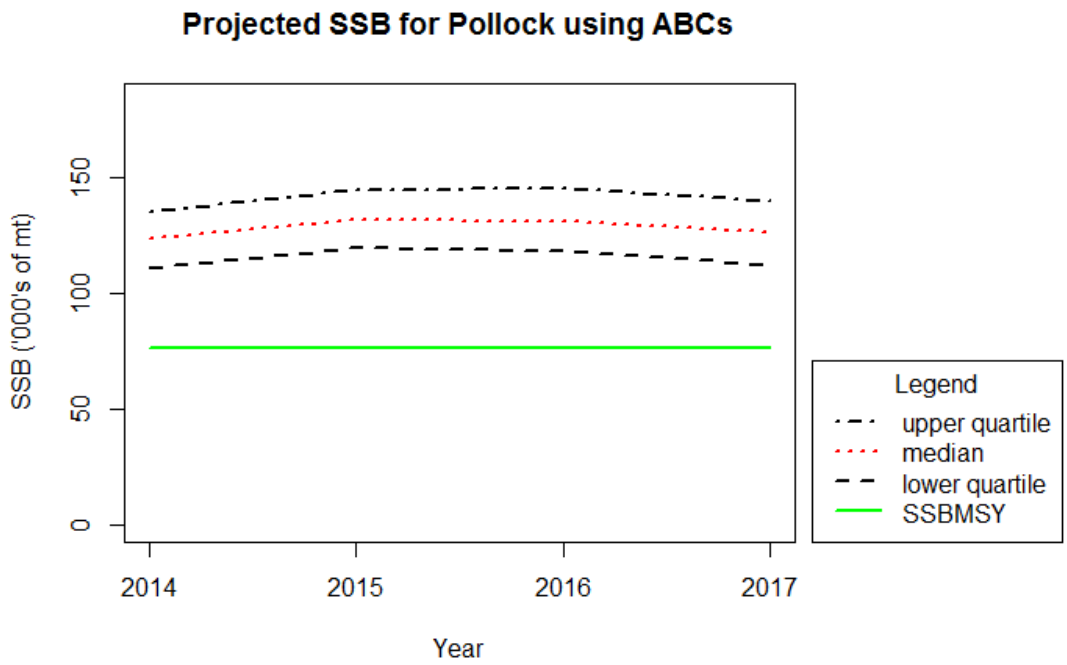


Table 68- Estimated probability of overfishing if catch is equal to ABC.

Species	Stock	Probability of Overfishing		
		2015	2016	2017
Cod (m=0.2 model)	GOM	0.18	0.02	0.00
Cod (mramp m=0.2)	GOM	0.06	0.00	0.00
Cod (mramp m=0.4)	GOM	0.33	0.13	0.02
Haddock	GOM	0.18	0.20	0.25
Yellowtail Flounder	GB	*NE*	*NE*	*NE*
Winter Flounder	GB	0.02	0.03	0.04
Winter Flounder	GOM	*NE*	*NE*	*NE*
Pollock		0.04	0.040	0.02

NE = Not Estimated

Impacts on other species

In general, the specification of groundfish ABCs and ACLs by this option would not be expected to have direct impacts on most other species. Other species are caught on groundfish fishing trips and the ABCs/ACLs could indirectly affect species if they result in changes in groundfish fishing activity. When compared to Option 1/No Action, this option would be expected to result in more groundfish fishing effort and as a result catches of other species would be expected to be higher. This would be expected to result in higher fishing mortality rates for those species when compared to the No Action alternative. Species such as monkfish, skates, and spiny dogfish are among those most likely to be affected. All of these species are subject to management controls, and it is not likely that fishing mortality will exceed targets. Indeed, when compared to recent years, the reduction in some groundfish ABCs/ACLs as proposed in this action would be expected to result in reduced catches of other species.

An additional species that could be affected by this option would be Atlantic sea scallops. The ABCs and ACLs that are proposed include specification of sub-ACLs of GB yellowtail flounder. These sub-ACLs are designed to limit the incidental catch of yellowtail flounder by the scallop fishery, and exceeding the allocations results in triggering AMs in subsequent years. The sub-ACLs can affect fishing mortality and stock size of sea scallops through this mechanism. Also, the Council considered allocating northern windowpane flounder to the scallop fishery as a sub-ACL examining a range of 2-14% percent of the U.S. ABC. However, the Council decided to not allocate Northern windowpane flounder in this action (see Section 5.0).

7.1.2 Commercial and Recreational Fishery Measures

7.1.2.1 GOM Cod Management Measures

7.1.2.1.1 GOM Cod Spawning Area Closures

The GOM stock of Atlantic cod is comprised of two genetically distinct groups whose spawning activity overlaps in space, but not in time (i.e., “winter” and “spring” spawners) (Kovach et al., 2010; Zemeckis et al., 2014). Within these broad groups are several smaller sub-components that form spawning aggregations at predictable times and locations. At one time, numerous aggregations of spawning cod could be found all along the GOM coast (Ames 2004). Unfortunately, most of these spawning grounds are now vacant, and current cod spawning activity appears restricted to a narrow range of coastline from NH to MA. Cod exhibit high fidelity to their spawning sites, and recent studies on spring spawning GOM cod have shown that tagged females are capable of returning to the same precise spawning location (within <10 m) over multiple years (Dean et al., 2014; Zemeckis et al., 2014b). This spatial and temporal predictability makes individual spawning groups particularly vulnerable to depletion, and there is little indication that once a site-specific spawning component is lost that the area can be recolonized.

Some of the remaining GOM cod spawning aggregations are well documented and small seasonal fishery closures have been implemented in an attempt to protect them from disruption and depletion (Armstrong et al., 2013). However, these examples as well as similar experiences in other cod stocks have pointed to a need for broader-scale measures (i.e., at the scale of 30-min blocks) to prevent further loss of population structure and enhance the potential for recruitment success in the future (Zemeckis et al., 2014a).

It is possible that fishing on these spawning aggregations may have impacts on spawning activity other than just the removal of fish, such that:

- Fishing activity may disrupt spawning signals and thereby reduce spawning success (Rountree et al. 2006);
- Fishing activity may disturb spawning habitat or habitat essential for early life history stages;
- Spawning fish are stressed and may be less able to survive handling, or capture may reduce egg production, even if fish are released (Taylor et al. 2001);
- Fishing increases mortality which reduces the number of older fish spawning. This may have adverse impacts as there is evidence (at least for cod) that first time spawners perform poorly compared to repeat spawners (Trippel, 1998).

7.1.2.1.1.1 Option 1: No Action (*Preferred Alternative*)

Impacts on regulated groundfish

Option 1/No Action would maintain the existing GOM cod spawning closure area (Whaleback) implemented in Framework Adjustment 45. It is reasonable to expect that this area would continue to result in positive impacts to GOM cod and other regulated groundfish as it limits commercial and recreational fishing during the designated timeframes of the closure (i.e., June 1-June 30:Commercial vessels; April 1-June 30: recreational vessels). Specifically, use of gear capable of catching groundfish is prohibited in this area during the closure. Although Option 1/No Action is likely to continue to provide positive impacts to GOM cod and regulated groundfish species, as the Option 1/No Action area closure is shorter in duration and encompasses a smaller area than the areas proposed in Sub-Options A and B, Option 1/No Action would have less of a positive impact on GOM cod and other regulated groundfish than either option. As a result, Option 1/No Action is likely to have positive impacts on regulated groundfish species.

Impacts on other species

It is reasonable to expect that this area would continue to result in positive impacts to other species that may be co-caught with other regulated groundfish as it limits commercial and recreational fishing during the designated timeframes of the closure (i.e., June-June 30:Commercial vessels; April-June: recreational vessels). Although Option 1/No Action is likely to continue to provide positive impacts to other species, as the Option 1/No Action area closure is shorter in duration and encompasses a smaller area than the areas proposed in Sub-Options A and B, Option1/No Action would have less of a positive impact on other species than either option. As a result, Option 1/No Action Alternative is likely to have a positive impact on other species.

7.1.2.1.1.2 Option 2: Additional GOM cod Spawning Protection Measures

The Council considered selecting Sub-Option A or Sub-Option B.

During particular months, Sub-Options A and B would provide protection for both remaining spawning components (winter and spring) for the GOM cod stock. Protection of spawning is needed to ensure that the low SSB of this stock has the opportunity for successful spawning events which is essential to prevent failures in future year classes through recruitment success. Spawning success from a low stock biomass does have the potential for rapid stock rebuilding. However further declines in SSB and disruption of spawning behavior will further reduce the probability of rebuilding an important future cod resource.

Sub-Options A and B include 30 minute blocks that would be closed for specific months throughout the year to protect spawning cod. Appendix II (Dean and Correia 2014, *Identifying location and times of spawning for Gulf of Maine cod*) summarizes the analysis to examine GOM cod spawning[24].
In particular, multiple independent data sources and analytical approaches were used to identify the areas important to spawning cod in the GOM, at the scale of the 30-min month-block. Notable discrepancies exist between these analyses and Sub-Options A and Sub-Option B, including:

1) Significant GOM cod spawning occurs in February and July, both of which are absent from Sub-Option A and Sub-Option B
2) The northward shift in closure areas (from May to June) under both Sub-Option A and Sub-Option B does not match existing data on the latitudinal progression of GOM cod spawning. 30-min blocks 124 and 125 continue to be important in June.
3) Sub-Option B would protect a small fraction of the area that is important to spring spawning GOM cod.

Analysis suggests that to more fully protect spawning GOM cod, while at the same time allow access to areas that do not support aggregations of spawning cod these times/areas are important: 30-min blocks 124, 125, 132, 133 for the months of November through February, and blocks 124, 125, 132, 133, 139, 140 for the months of April through July.

7.1.2.1.1.2.1 Sub-Option A:

Sub-Option A would create discrete GOM cod closure areas in May, June, November, December, January, and April that would restrict commercial and recreational groundfish fishing. The May spawning closure restricts fishing in areas of the Western Gulf of Maine (WGOM). This spawning area includes areas of Ipswich Bay, and Massachusetts Bay, including Stellwagen Bank National Marine Sanctuary. The April spawning area covers the northern portion of the WGOM. The November through January closure restricts fishing from Massachusetts Bay east to Stellwagen Bank. The April spawning closure area would prohibit fishing in Ipswich Bay, Massachusetts Bay, including Stellwagen Bank. Furthermore, CATT analysis suggests that spawning activity for haddock and yellowtail flounder occur in the spring closure areas (NEFMC 2013).

Impacts on regulated groundfish

Seasonally in the following 30-minute blocks during these months:

- May: 124, 125, 132, 133, 139, 140
- June: 132, 133, 139, 140, 147
- November – January: 124-125
- April: 124, 125, 132, 133

Portions of blocks 124, 132, and 139 that overlap the Western GOM Closed Area would not be considered as GOM cod spawning closures.

Sub-Option A would expand fairly significantly upon existing time/area restrictions on commercial groundfish fishing. Specifically, for sector vessels, which comprise the bulk of groundfishing effort,

[24] Sub-Option A and Sub-Option B documented in Appendix II were the versions developed by the Council at their September 2014 meeting. The final versions of the sub-options in this action from the November Council meeting reflected the use of Appendix II to further refine the sub-options, notably, to remove March and the WGOM from consideration as spawning closures.

blocks 124 and 125 would be closed in May, blocks 132 and 133 would be closed in June, and the above indicated blocks would be closed during the months of November, December, and January, when there are currently no rolling closures in effect that apply to sector vessels. The schedule above is similar to existing common pool time/area restrictions, with some increases in time/area closures, including closures during December and January. Sub-Option A would also lead to new restrictions on recreational fishing in the areas/times noted above, as these vessels are not currently subject to the existing rolling closures.

In general, Sub-Option A would provide additional protection for spawning GOM cod and thus positive biological benefits when compared to No Action, and greater positive benefits when compared to Sub-Option B. These spawning closures would be in addition to sector and common pool closures in May, June, October, November, March, and April (Figure 2 and Figure 4). Sub-Option A would likely reduce fishing effort in May, June, November, December, January, and April in specific areas and subsequently reduce fishing mortality on GOM cod and other regulated groundfish (see Dean and Correia 2014, Appendix II). Significant GOM cod spawning occurs in February and July, both of which are absent from Sub-Option A and Sub-Option B. The northward shift in closure areas (from May to June) under both Sub-Option A and Sub-Option B does not match existing data on the latitudinal progression of GOM cod spawning. 30-min blocks 124 and 125 continue to be important in June. Furthermore, the analysis suggests that to more fully protect spawning GOM cod, while at the same time allow access to areas that do not support aggregations of spawning cod these times/areas are important: 30-min blocks 124, 125, 132, 133 for the months of November through February, and blocks 124, 125, 132, 133, 139, 140 for the months of April through July. Sub-Option A would provide greater protection for spring and winter spawning GOM cod than Sub-Option A. Therefore, when compared to Sub-Option B, Sub-Option A would protect a greater fraction of the area that is important to spring and winter spawning GOM cod.

In summary, it is expected that effort shifts may occur as result of Sub-Option A's seasonal closures. Sub-Option A is likely to reduce fishing effort, and ultimately fishing mortality on GOM cod and other regulated groundfish more than Sub-Option B because Sub-Option B closes a smaller overall area than Sub-Option A during the same months. Therefore, Sub-Option A would have a greater positive impact on GOM cod and other regulated groundfish species when compared to Sub-Option B. Both sub-options could be expected to positively impact regulated groundfish species when compared to the No Action alternative.

Impacts on other species

Sub-Option A would likely reduce fishing effort, and subsequently reduce fishing mortality. It is expected that effort shifts may occur as result of Sub-Option A's seasonal closures. Sub-Option A is likely to reduce fishing effort, and ultimately fishing mortality more than Sub-Option B because Sub-Option B closes a smaller overall area than Sub-Option A during the same months. Therefore, Sub-Option A would have a greater positive impact on other species co-caught with regulated groundfish species when compared to Sub-Option B. Both sub-options could be expected to positively impact other species when compared to the No Action alternative.

7.1.2.1.1.2.2 Sub-Option B:

Sub-Option B would create discrete GOM cod closure areas in May, June, November, December, January, and April to restrict commercial and recreational groundfish fishing. The Sub-Option B May spawning closure is smaller than the Sub-Option A May closure in Massachusetts Bay and Ipswich Bay. The April spawning closure area covers a portion of the inshore GOM, including Ipswich Bay, and overlaps with the existing GOM cod spawning closure area. The November through January closure restricts fishing in Massachusetts Bay, and on Stellwagen Bank. The April spawning closure area covers

the same inshore area as the May closure. Furthermore, CATT analysis suggests that spawning activity for haddock and yellowtail flounder occur in the spring closure areas (NEFMC 2013).

Impacts on regulated groundfish

- May: 125, 133
- June: 133
- November – January: 124 with an eastern boundary defined at 70-15, 125
- April: 125, 133

Sub-Option B is a smaller set of time/area closures as compared to Sub-Option A, but there are still expanded fishing effort restrictions relative to No Action. Of the times/areas listed above, the only ones currently in effect for sector vessels are block 133 in May and blocks 125 and 133 in April. Common pool vessels would experience additional fishing restrictions in December and January. All of these restrictions would be new restrictions on the recreational fishery.

Similar to Sub-Option A, Sub-Option B is also expected to reduce fishing effort in inshore areas of the Gulf of Maine. Because this sub-option includes only the most inshore blocks, it would be easier for vessels to shift their effort offshore of the indicated blocks, unless prevented from doing so by the existing rolling or year-round closures.

In general, Sub-Option B would provide additional protection for spawning GOM and thus positive biological benefits when compared to No Action, but less positive benefits when compared to Sub-Option A. These spawning closures would be in addition to sector and common pool closures in May, June, October, November, March, and April (Figure 3 and Figure 4). Sub-Option A would likely reduce fishing effort in May, June, November, December, January, and April in specific areas and subsequently reduce fishing mortality on GOM cod and other regulated groundfish (see Dean and Correia 2014, Appendix II). Significant GOM cod spawning occurs in February and July, both of which are absent from Sub-Option A and Sub-Option B. The northward shift in closure areas (from May to June) under both Sub-Option A and Sub-Option B does not match existing data on the latitudinal progression of GOM cod spawning. 30-min blocks 124 and 125 continue to be important in June. Furthermore, the analysis suggests that to more fully protect spawning GOM cod, while at the same time allow access to areas that do not support aggregations of spawning cod these times/areas are important: 30-min blocks 124, 125, 132, 133 for the months of November through February, and blocks 124, 125, 132, 133, 139, 140 for the months of April through July. Sub-Option B would provide less protection for spring and winter spawning GOM cod when compared with Sub-Option A. Therefore, when compared to Sub-Option A, Sub-Option B would protect a smaller fraction of the area that is important to spring and winter spawning GOM cod.

In summary, it is expected that effort shifts may occur as result of Sub-Option B's seasonal closures. Sub-Option B is likely to reduce fishing effort, and ultimately fishing mortality on GOM cod and other regulated groundfish less than Sub-Option A because Sub-Option A closes a larger overall area than Sub-Option B during the same months. Therefore, Sub-Option B would have a lesser positive impact on GOM cod and other regulated groundfish species when compared to Sub-Option A. Both sub-options could be expected to positively impact regulated groundfish species when compared to the No Action alternative.

Impacts on other species

Sub-Option B would likely reduce fishing effort, and subsequently reduce fishing mortality. It is expected that effort shifts may occur as result of Sub-Option B's seasonal closures. When compared to the No

Action/Option 1, Sub-Option B would likely positively affect other species co-caught with regulated groundfish species by reducing fishing effort in inshore areas at times of the year when cod are particularly vulnerable. Both sub-options could be expected to positively impact other species when compared to the No Action alternative.

7.1.2.1.2 Prohibition on the Possession of GOM cod

7.1.2.1.2.1 Option 1: No Action (*Preferred Alternative*)

Impacts on regulated groundfish

Under the No Action, there would be no revision to the retention regulations of GOM cod. This would continue to require sector vessels to retain and land all legal sized cod. Common-pool vessels would continue to be subject to DAS possession limits and trip limits and recreational fishermen would continue to be subject to a bag limit. Each component of the fishery would continue to operate under strict catch limits and AMs. ACLs are set according to the best available science and provide a level of harvest that will rebuild the stock according to MSA requirements. Option 1 is not expected to change behavior in the fishery, in and of itself, and therefore is expected to have a neutral impact on regulated groundfish.

Impacts on other species

This option would not be expected to have any direct impacts on other species. This option would not be expected to lead to any changes in catches of other species, and would not affect the management of those species.

7.1.2.1.2.2 Option 2: Prohibition on the possession of GOM cod

Impacts on regulated groundfish

This option would prohibit possession of GOM cod by all commercial and recreational vessels (i.e. all vessels would be required to discard all GOM cod). Option 2 retains allocations of GOM cod for the groundfish fishery, and fishing effort is expected to be a function of the allocated ACL. In theory, this measure would not allow fishing effort to increase because commercial and recreational fisheries would continue to operate under strict catch limits and AMs. While landings and possession would be prohibited, all catch, in theory, would be accounted for, however there are additional considerations.

The prohibition on the possession of GOM cod is likely to have differing effects for commercial and recreational fisheries (see Economic Impacts section 7.4.2.1.3). Under Option 2, there is a potential loss of information on GOM cod (i.e., collection of biological samples from landed fish) and zero possession could increase uncertainty of catch estimates. The general lack of biological data and increases in the discards could result in higher uncertainty with the removals and degrade the stock assessment and knowledge with regards to potential changes in future stock status. No possession will likely further increase the concerns with observer effects and unaccounted for mortality. In addition, large discard events on unobserved trips may have a similar effect on discard estimates as trimming large tows from the data (http://nefsc.noaa.gov/groundfish/discard/). The discard estimation methodology review did not recommend omitting observed large or low discard tow information from the data stream in the discard estimator when monitoring the discards. The biological impacts may be similar on paper between Option 1/No Action and Option 2 since the theoretical catch limit is the same, but under no possession as in Option 2 the uncertainty on whether the mortality target will be achieved increases since there are

increases in the uncertainty associated with the estimated catch. Uncertainty increases in Option 2, because what would have been known landings under Option 1/No Action are now being converted into a discard estimate. In addition, there is uncertainty in the assumed discard mortality rates associated with the different gear types. The true mortality associated with discarding from different gear types is not well known since there are very few survival rate studies on GOM cod. Uncertainty with regards to the true mortality on GOM cod will be higher in Option 2 relative to Option 1/No Action. Therefore, Option 2 would have negative impacts on GOM cod when compared to Option 1/No Action.

Approximately 85-90% of GOM cod and haddock recreational mortality generally occurs in Federal waters. The larger unknown, however, is the level of noncompliance that would occur in federal waters under no possession. Even marginal differences in state and federal regulations may increase noncompliance which could further reduce the conservation benefit of no possession.

However, it is possible that Option 2 may deter fishing on the GOM cod stock by both commercial and recreational fishermen in federal waters. If fishermen and anglers are able to adjust their behavior and move to areas with lower concentrations of GOM cod, fishing mortality would be reduced. If that occurs, Option 2 would be expected to have low positive impacts on GOM cod when compared with Option 1/No Action. Likewise if fishermen and anglers avoid GOM cod, Option 2 is expected to have low positive impacts on other regulated groundfish species co-caught with GOM cod when compared to Option 1/No Action.

Impacts on other species

This option would not be expected to have any direct impacts on other species. This option would not be expected to lead to any changes in catches of other species, and would not affect the management of those species.

7.1.2.1.3 GOM Cod Protection Measures

The Preferred Alternative (Option 2) for the GOM cod protection measures would modify the existing groundfish rolling closures for the commercial groundfish fishery, and prohibit possession of GOM cod by the recreational fishery. These GOM cod protection measures aim to: 1) to protect spawning GOM cod, 2) reduce fishing mortality of GOM cod in the identified times and areas, and 3) minimize impacts to fishing fleets by allowing for economic opportunities to fish for healthy groundfish stocks, especially in the spring. Several PDT analyses were completed in order to examine the biological impacts of Option 1/No Action and Option 2. They are located in Appendix II and include:

- M. Dean. 2014. *Estimating the Conservation Benefit of Gulf of Maine (GOM) Cod Protection Measures- Revised Commercial Groundfish Fishery Rolling Closures- to Spawning Cod.*
- S. Sherman and J. Cournane. 2015. *Examining Gulf of Maine (GOM) Cod Spawning Activity in the Coastal Waters of Maine and New Hampshire.*
- P. Nitschke and J. Cournane. 2015. *Examination of seven spring spawning groundfish stocks in the NEFSC bottom trawl survey for comparison to spatial management measures under consideration in Framework Adjustment 53.*
- P. Nitschke, M. Palmer, and J. Cournane. 2015. *Examining the mortality objective of the Gulf of Maine cod protection measures using fishery-dependent data*

Here, the main results and conclusions are summarized in a discussion of the biological impacts of these measures. Detailed information on these analyses can be found in *Appendix II: Analytic Techniques: Gulf of Maine Cod and Other Groundfish Analysis*.

7.1.2.1.3.1 Option 1: No Action

Impacts on regulated groundfish

Closures:
Dean 2014 used the Massachusetts Division of Marine Fisheries Cod Industry Based Survey (IBS) to estimate the conservation benefit of the GOM cod protection closure in Option 2 compared to the Option 1/No Action. The results of the analysis indicate that the Option 2 closures offer additional protection to winter spawners from November to January, with the largest increase in December compared to No Action. Across the entire season, the Option 2 protects 35% more winter spawning biomass than the No Action. For the spring spawning component, Option 2 offers additional protection in May and June, but decreased protection in April. When aggregated across all three months, 8% less of the spring spawning biomass receives protection under the Preferred Alternative as compared to the Option 2. The IBS observed more spawning cod biomass in the spring than in winter, despite less coverage of the spring spawning season. If we assume that spawner biomass in June is roughly equal to that of May, the spring spawning component appears to be more than double the size of the winter spawning component. Option 1/No Action provides positive impacts in the spring/summer (April) for spawning GOM cod and negative impacts in the winter for GOM cod. Option 2 provides positive impacts in winter (November, December and January) for spawning GOM cod, some positive impact for spring spawners (May and June) with negative impact on spring spawners (April). It is difficult to ascertain which spawning component is more important for protection given the information, as both components may need protection in order for GOM cod to recover.

Sherman and Cournane (2015) examined GOM cod spawning activity in the coastal waters of Maine and New Hampshire using data from the MENH trawl survey conducted in Spring (May) and Fall (October), and therefore only those months can be examined. The MENH surveys do not cover blocks 124, 125, 129, 130, 131, 136, and 137, so this information cannot be used to examine the potential impact of modifying the time/area closures for those blocks in May and October. Based on the survey coverage, the proposed GOM cod protection closures in May and October under Option 2 would continue to provide the same protection for aggregating and spawning cod that is currently afforded by the sector rolling closures provided these animals continue to exhibit behavior observed in the recent period. The impact of opening common-pool rolling closures in areas that would not be closed under Option 2 cannot be discerned from the MENH data as the survey does not cover these blocks. In addition, waters in Downeast Maine (blocks 153 and 154) do not have federal spatial management measures in place, but appear to be important areas for cod. In the fall (October), impacts are expected to be neutral. Overall in May and October, the No Action and the GOM cod protection closures in Option 2 would both provide positive benefits for cod. However, this information cannot be used to examine the impact of April being open under Option 2.
In order to consider the impacts on other regulated groundfish species, Nitschke and Cournane (2015) examined NEFSC bottom-trawl catch and spawning data for seven groundfish stocks. This information was used to compare the Option 1\No Action and Option 2 GOM cod protection closures during April and May. In April, the No Action alternative closes blocks 124,125,132, and 133, and would provide spawning protection for cod, winter flounder, yellowtail flounder, American plaice, and haddock and to a lesser extent witch flounder and windowpane flounder during that time. Compared to the No Action, Option 2 would negatively impact the same species of spawning fish that the No Action currently affords protection to by opening of blocks 124,125,132, and 133 in April. In May, Option 2 in blocks 124 and 125 south of 42° 20' to the common pool, and adds a closure for sector vessels in block 125 north of 42° 20'. This May opening for the common pool, like the April opening for all vessels, would be expected to have a negative impact for cod, winter flounder, yellowtail flounder, American plaice, and haddock and to a lesser extent witch flounder and windowpane flounder when compared to the No Action. Although not

summarized in the appendix, ocean pout may receive positive benefits from the November- January closure in Option 2 relative to No Action.

Nitschke, Palmer, and Cournane (2015) examined the mortality objective of the GOM cod protection measures in Option 2 using vessel trip reports (VTRs) submitted between January 2010 August 2014 for commercial and recreational landings. The No Action alternative maintains the existing rolling closures for sector and common pool vessels. The impact of these management measures on landings is evident in the proportion and total monthly landings plots for Gulf of Maine (GOM) cod from 2010-2014. The VTR data indicates that most of the GOM cod landings were taken from blocks 124 and 132 across the year except for the months when these blocks are closed due to the rolling closures (124 in April and 132 in April and May for all vessels; 124 is closed to the common pool in April). The April rolling closures appear to have shifted fishing effort further offshore with relative increases in cod catch from the other category and block 138. Additionally, block 125 has higher relative cod catch during the winter spawning season from November to January and block 133 has higher relative catch during the spring spawn in June and July. These results are analogous to what was determined in the PDT spring and winter spawning area analysis (see Dean and Correia in Appendix II). Most of the recreational catch is also taken from blocks 124 and 132. In addition, the recreational catch also suggests that block 133 becomes more important during the spring spawning season.

The removal of the April rolling closures for all vessels under Option 2 would allow fishing effort to shift into blocks where cod catch has been concentrated (124 & 132). This additional fishing opportunity in these productive areas would likely produce an increased incentive for observer bias, and unaccounted for cod mortality under the low cod ACL if GOM cod are caught as bycatch when targeting other groundfish stocks such as winter flounder, yellowtail flounder, American plaice, and haddock in these blocks. It appears that the core of the GOM cod population is within blocks 124 and 132 throughout the year even though commercial landing information cannot be used to definitively make this conclusion since there are existing rolling closures in these areas. However, the spring survey's positive cod tows conducted in April and May suggest that the highest cod abundance is within stratum 26 which roughly covers blocks 124 and 132 (2014 GOM cod operational assessment; Figure 1.26). Spring Gini indices and survey distribution plots from the assessment also suggest GOM cod distributions are concentrated in the western Gulf of Maine. In June, there may be some increased protection of cod from the 132 closure if this closure does not result in a shift in effort into blocks with high cod concentrations (i.e., block 124). The closure in block 125 north of 42° 20' would likely afford minimal mortality protection since small amounts of catch come from 125 in May and June. There would be increased spawning protection from November to January, though there is a possibility that displaced effort could shift to other areas where VTR data suggests there are concentrations of cod such as Stellwagen Bank or block 132. Mortality reductions of the closures may not be realized with a potential shift in effort when blocks with high cod concentrations remain open (124 and 132). Mortality changes may be a tradeoff with the closure of one area and the opening of another or protection of cod from a closure may result in a shift in effort into other blocks that have relatively high cod concentrations. Therefore it is uncertain whether the cod protection measures alone will result in a reduction in GOM cod mortality. Conversely, the opening of block 145 in June may have minimal impact on cod since few cod were taken from this block in the past.

This analysis suggests that should the GOM cod stock remain concentrated in the core 30 minute block areas of 124 and 132 the Option 2 closure areas provide little additional mortality protection relative to the No Action. Some protection may be provided in June with the closure of 132 but in April protection of cod in the core area of 124 and 132 is lost. It is unlikely that reductions in fishing mortality will be met since displaced effort will probably shift into areas with relatively high cod concentrations (132 and 124) on unobserved trips.

In summary, Option 1/No Action would maintain the existing management measures for GOM cod. The No Action alternative would maintain a suite of sector and common pool rolling closures in the commercial fishery. Based on the analyses provided in Appendix II and summarized above, it is reasonable to expect that these measures would continue to result in positive impacts to GOM cod and other regulated groundfish, though the Dean analysis reveals that some winter spawning groups are largely unprotected by the No Action. Option 2 provides positive impacts in winter (November, December and January) for spawning GOM cod, some positive impact for spring spawners (May and June) with negative impact on spring spawners (April). It is difficult to ascertain which spawning component is more important for protection given the information, as both components may need protection in order for GOM cod to recover. In the fall (October), impacts are expected to be neutral. Overall in May and October in the coastal waters of Maine and New Hampshire, the No Action and the GOM cod protection closures in Option 2 would both provide positive benefits for cod. Comparing Option 1/No Action to Option 2, changes in mortality may be a tradeoff with the closure of one area and the opening of another or protection of cod from a closure may result in a shift in effort into other blocks that have relatively high cod concentrations. Therefore it is uncertain whether the cod protection measures alone will result in a reduction in GOM cod mortality. Analysis suggests the GOM cod stock remains concentrated in the core 30 minute block areas of 124 and 132, Option 2 closure areas provide little additional mortality protection relative to Option1/No Action.

When compared to Option 2, the No Action would provide positive impacts on winter flounder, yellowtail flounder, American plaice, and haddock and to a lesser extent witch flounder and windowpane flounder because these animals are known to be present and in spawning condition during times that are closed by the No Action and open under Option 2, mainly in the spring and summer. Compared to Option 1/No Action, Option 2 may have a positive impact for ocean pout because they spawn in the fall and the winter and therefore the closure might provide some protection.

Both No Action and Option 2 do not restrict exempted gear or exempted fisheries. For fisheries with exempted gear, these gears are considered not capable of catching groundfish and therefore are expected to have little to no impact of regulated groundfish species. Fishing effort from fisheries with exempted gear and exempted fisheries is not expected to change as a result of Option 2, since the No Action/Option 1 and Option 2 are only applicable to the commercial groundfish fishery. Therefore, negative biological impacts on regulated groundfish, if any, would not be expected to increase. However under both No Action/Option 1 and Option 2, any potential negative biological impact on GOM cod from these other fisheries would likely result from the activity of fishing disrupting spawning, not increased or uncontrolled fishing mortality. In general, the impacts of these other fisheries on regulated groundfish would be neutral.

No possession of GOM cod:
Under the No Action, there would be no revision to the retention regulations of GOM cod. This would continue to require sector vessels to retain and land all legal sized cod, and common-pool and recreational fishermen to retain and land all legal sized cod up to a trip or bag limit, respectively. Each component of the fishery would continue to operate under strict catch limits and AMs. Option 1 is not expected to change behavior in the fishery, in and of itself, and therefore is expected to have a neutral impact on regulated groundfish.

Summary:
Option 1\No Action would provide positive benefits for regulated groundfish species when compared to Option 2. Option 2 would provide mixed (positive, neutral, and negative) impacts for regulated groundfish species.

Impacts on other species

Closures:
The No Action alternative would maintain a suite of sector and common pool rolling closures in the commercial fishery. Furthermore, Option 1 would continue to provide some positive impacts while Option 2 would have mixed impacts (positive, neutral, and negative) for other species co-caught with groundfish species because of the increased protection in the winter and reduction in the spring.

No possession of GOM cod:
Option 1/No Action would not be expected to have any direct impacts on other species. This option would not be expected to lead to any changes in catches of other species co-caught with groundfish species, and would not affect the management of those species.

Summary:
Option 1\No Action would provide positive benefits for other species when compared to Option 2. Option 2 would provide mixed (positive, neutral, and negative) impacts for other species.

7.1.2.1.3.2 Option 2: Gulf of Maine Cod Protection Measures (*Preferred Alternative*)

Impacts on regulated groundfish

Closures:

Like the No Action alternative, Option 2 would employ a suite of time/area closures in the GOM for the commercial groundfish fishery. Option 2 would modify existing rolling closures in May for all vessels, closing blocks 132, 133, 138, 139, 140 and 125 north of 42° 20'. This configuration expands the overall closure area for sector vessels by adding the northern half of block 125, and contracts the number of blocks closed to the common pool, primarily in the central GOM. October and March closures remain the same for common pool vessels in both the GOM cod protection closures and the No Action alternatives. This alternative also closes block 125 and a portion of block 124 from November to January to all vessels, which represents an expansion of closures during those months when compared to the No Action.

Summary of changes in groundfish stock protection for Option 2 relative to Option 1\No Action:

May:
- Increase stock protection from sector vessels in block 125 north of 42° 20'.
- Decrease stock protection from common pool vessels in block 125 south of 42° 20' and in blocks 124, 129, 130, 131, 136, 137.

June:
- Increase stock protection from sector vessels in block 125 north of 42° 20' and block 132.
- Decrease stock protection from sector vessels in blocks 145, and 152.
- Increase stock protection from common pool vessel in block 125 north of 42° 20'.
- Decrease stock protection from common pool vessel in blocks 132, 145, 152, 144, 143, 142.

November-January:
- Increase stock protection from sector vessels in block 125, and an area of 124 defined by the following coordinates:
    - 42° 00' N…70° 30' W

- 42° 00' N…70° 24' W
- 42° 15' N…70° 24' W
- 42° 15' N…70° 30° W

- Increase in stock protection from common pool vessels in December and January in block 125, and an area of 124 defined by the coordinates above.
- Decrease in stock protection from common pool vessels in November in block 124 outside of the above coordinates.

April:

- Decrease stock protection from sector vessels in blocks 124, 125, 132, 133.
- Decrease stock protection from common pool vessels is blocks 121, 122, 123, 124, 125, 129, 130, 131, 132, 133.

Compared to Option 1\No Action, Option 2 would have mixed impacts (positive, neutral, and negative) for GOM cod because of the increased protection in the winter and reduced closure areas in the spring, and status quo closures for the common pool in October and March. Option 2 provides positive impacts in winter (November, December and January) for spawning GOM cod, some positive impact for spring spawners (May and June) with negative impact on spring spawners (April). It is difficult to ascertain which spawning component is more important for protection given the information, as both components may need protection in order for GOM cod to recover. In the fall (October), impacts are expected to be neutral. Overall in May and October in the coastal waters of Maine and New Hampshire, the No Action and the GOM cod protection closures in Option 2 would both provide positive benefits for cod. Comparing Option 1/No Action to Option 2, changes in mortality may be a tradeoff with the closure of one area and the opening of another or protection of cod from a closure may result in a shift in effort into other blocks that have relatively high cod concentrations. Therefore it is uncertain whether the cod protection measures alone will result in a reduction in GOM cod mortality. Analysis suggests the GOM cod stock remains concentrated in the core 30 minute block areas of 124 and 132, Option 2 closure areas provide little additional mortality protection relative to Option1/No Action.

When compared to the No Action, Option 2 would have mixed impacts (positive, neutral, and negative) for other groundfish stocks including low negative impacts on winter flounder, yellowtail flounder, American plaice, and haddock and to a lesser extent witch flounder and windowpane flounder and low positive impacts for ocean pout, because these animals are known to be present and in spawning condition during times that are closed by the No Action and open under Option 2. Compared to Option 1/No Action, Option 2 may have a positive impact for ocean pout because they spawn in the fall and the winter and therefore the closure might provide some protection.

Both No Action and Option 2 do not restrict exempted gear or exempted fisheries. For fisheries with exempted gear, these gears are considered not capable of catching groundfish and therefore are expected to have little to no impact of regulated groundfish species. Fishing effort from fisheries with exempted gear and exempted fisheries is not expected to change as a result of Option 2, since the No Action/Option 1 and Option 2 are only applicable to the commercial groundfish fishery. Therefore, negative biological impacts on regulated groundfish, if any, would not be expected to increase. However under both No Action/Option 1 and Option 2, any potential negative biological impact on GOM cod from these other fisheries would likely result from the activity of fishing disrupting spawning, not increased or uncontrolled fishing mortality. In general, the impacts of these other fisheries on regulated groundfish would be neutral.

No possession of GOM cod:

This option would prohibit possession of GOM cod by recreational vessels (i.e. all vessels would be required to discard all GOM cod). Option 2 retains ABCs and ACLs for GOM cod for the recreational groundfish fishery, and fishing effort is expected to be a function of the allocated ACL. In theory, this measure would not allow fishing effort to increase because the recreational fishery would continue to operate under strict catch limits and AMs. Assuming absolute catch is known and the fishery does not exceed the ACL, discard mortality assumptions would suggest that a prohibition on possession of GOM cod would have a positive impact on the resource when compared to No Action. While there would be zero possession of GOM cod in the recreational fishery, party/charter vessels fishing in the GB stock area outside of the GOM Regulated Mesh Area would continue to have no limit on the number of cod they could retain, and private anglers would continue to be permitted to keep 10 fish per person per day. Differences between cod bag limits in the GOM and GB is not a new scenario, though with zero possession of GOM cod, opportunity to retain cod on Georges Bank may lead to a redirection of fishing effort on the GB cod stock that is also in poor condition (see 6.2.1.2). This disparity in bag limits/possession could lead to difficulty in accurately attributing cod removals from the GOM and GB as vessels sailing from ports in the GOM can easily reach the GB stock area (particularly statistical area 521). It is also possible that Option 2 may deter fishing on the GOM cod stock by recreational fishermen in federal waters. If fishermen and anglers are able to adjust their behavior and move to areas with lower concentrations of GOM cod, fishing mortality would be reduced. If that occurs, Option 2 would be expected to have low positive impacts on GOM cod when compared with Option 1/No Action. Likewise if fishermen and angler avoid GOM cod, Option 2 is expected to have low positive impacts on other regulated groundfish species co-caught with GOM cod when compared to Option 1/No Action.

Summary:
Option 2 would provide mixed (positive, neutral, and negative) impacts for regulated groundfish species. Option 1\No Action would provide positive benefits for regulated groundfish species when compared to Option 2.

Impacts on other species

Closures:
Like the No Action alternative, Option 2 employs a suite of time/area closures in the GOM for the commercial groundfish fishery. When compared to No Action, Option 2 would have mixed impacts (positive, neutral, and negative) for other species co-caught with groundfish species because of an increase in protection closures in the winter and a reduction of closures in the spring.

Compared to No Action, Option 2 may continue to provide low positive benefits to monkfish since higher concentration of spawning monkfish occur in the GOM in May within the Option 2 compared to those in March and April (see Richards et al., 2008). Relative to Option 1/No Action, low negative impacts on April spawning monkfish may occur since Option 2 would remove rolling closures April.

Furthermore, both the No Action and Option 2 have neutral impacts on the Atlantic sea scallop resource. Vessels on a scallop trip are not impacted by these seasonal closures, and these areas do not overlap with high densities of scallops that could be negatively impacted by incidental mortality from fishing gear. Overall the proportion of scallop biomass and scallop fishing activity in the GOM is a very small fraction of the total so no direct impacts are expected from these measures. Some groundfish vessels also have incidental scallop permits (allowance of up to 40 pounds of scallop meats per trip), but modifying the seasonal restrictions in these areas should not affect whether vessels catch scallops incidentally; those scallops could be harvested year round, provided the area is not closed due to the NGOM hard TAC being reached (70,000 pounds).

Lastly for Atlantic herring, the biological impacts are expected to be neutral for No Action and Option 2. Inshore GOM is more important for the herring population in the late summer and into fall and in particular September and October for spawning herring. In addition, ASMFC already has spawning restrictions (closures) in place for the herring fishery that will continue to occur regardless of whether they are allowed in the GOM closure areas or not.

No possession of GOM cod:
This option would not be expected to have any direct impacts on other species. This option would not be expected to lead to any changes in catches of other species co-caught with groundfish species, and would not affect the management of those species.

Summary:
Option 2 would provide mixed (positive, neutral, and negative) impacts for other species. Option 1\No Action would provide positive benefits for other species when compared to Option 2.

7.1.2.2 Default Groundfish Specifications

7.1.2.2.1 Option 1: No Action

Impacts on regulated groundfish

In the absence of specifications for a stock due to a delay in rulemaking, fishing would not be allowed in the broad stock area for that stock. There are currently no provisions within the Northeast Multispecies FMP that allow for default specifications to be rolled forward into the next fishing year to enable fishing to begin of time at the start of the fishing year (e.g. from FY 2014 to FY 2015). In the event of a delay in rulemaking, the No Action would decrease fishing effort in all broad stock reporting areas (GOM, GB, SNE) at the start of the fishing year, which is expected to reduce overall fishing morality on regulated groundfish, and would have a positive impact on the resource.

Impacts on other species

In the event of a delay in rulemaking, the No Action would decrease fishing effort in all broad stock reporting areas (GOM, GB, SNE) at the start of the fishing year, which is expected to reduce overall fishing morality on regulated groundfish, and would have a positive impact on other species co-caught with regulated groundfish.

7.1.2.2.2 Option 2: Percentage Rollover Provisions for Default Specifications (*Preferred Alternative*)

The Council considered selecting either sub-option A, B, or C.

Option 2 would allow the FY to begin on time in the event of a delay in rulemaking by rolling forward specification values from one fishing year into the next (e.g. from FY 2014 to FY 2015). Sub-options A, B, and C would roll forward a percentage of the prior year's stock specific ACL up to a value that may not exceed the stock's acceptable biological catch (ABC) for the upcoming fishing year. The default rollover ACL would be replaced by new, updated specifications upon rulemaking. This is an administrative measure that, in and of itself, is not expected to impact fishing effort or behavior over the course of an entire fishing year. However, varying percentages would allow varying levels of fishing effort – and subsequent fishing mortality – in the event of a major delay in rulemaking.

7.1.2.2.2.1 Sub-Option A: Default Rollover 35% of all groundfish stocks to the following FY *(Preferred Alternative)*

Impacts on regulated groundfish

Sub-Option A is less conservative than Sub-Options B and C. These default rollover measures would have slightly negative impacts on regulated groundfish species when compared to No Action if the No Action resulted in no specifications and a reduction in fishing activity. However, the default specifications are not designed to exceed the Council's recommendations. Therefore, Sub-Option A would have neutral impacts on regulated groundfish species, since when compared to the status quo, specifications have been in place in time for the groundfish fishery to begin.

Impacts on other species

Sub-Option A is less conservative than Sub-Options B and C. These default rollover measures may have slightly negative impacts on other species co-caught with regulated groundfish when compared to No Action if the No Action resulted in no specifications for regulated groundfish species and a reduction in fishing activity. However, Sub-Option A is expected to have neutral impacts on regulated groundfish species and therefore neutral impact on other species co-caught with regulated groundfish species, since when compared to the status quo, specifications have been in place in time for the groundfish fishery to begin.

7.1.2.2.2.2 Sub-Option B: Default Rollover 20% of all groundfish stocks to the following FY.

Impacts on regulated groundfish

Sub-Option B is more conservative than Sub-Option A, but less conservative than Sub-Option C. These default rollover measures may have slightly negative impacts on regulated groundfish species when compared to No Action if the No Action resulted in no specifications and a reduction in fishing activity. However, the default specifications are not designed to exceed the Council's recommendations. Therefore, Sub-Option B would have neutral impacts on regulated groundfish species, since when compared to the status quo, specifications have been in place in time for the groundfish fishery to begin.

Impacts on other species

Sub-Option B is more conservative than Sub-Option A, but less conservative than Sub-Option C. These default rollover measures may have slightly negative impacts on other species co-caught with regulated groundfish when compared to No Action if the No Action resulted in no specifications for regulated groundfish species and a reduction in fishing activity. However, Sub-Option B is expected to have neutral impacts on regulated groundfish species and therefore neutral impact on other species co-caught with regulated groundfish species, since when compared to the status quo, specifications have been in place in time for the groundfish fishery to begin.

7.1.2.2.2.3 Sub-Option C: Default Rollover 10% of all groundfish stocks to the following FY.

Impacts on regulated groundfish

Sub-Option C is the most conservative of the default rollover measures under consideration. These default rollover measures may have slightly negative impacts on regulated groundfish species when compared to

No Action if the No Action resulted in no specifications and a reduction in fishing activity. However, the default specifications are not designed to exceed the Council's recommendations. Therefore, Sub-Option C would have neutral impacts on regulated groundfish species, when compared to the status quo, specifications have been in place in time for the groundfish fishery to begin.

Impacts on other species

Sub-Option C is the most conservative of the default rollover measures under consideration. These default rollover measures may have slightly negative impacts on other species co-caught with regulated groundfish when compared to No Action if the No Action resulted in no specifications for regulated groundfish species and a reduction in fishing activity. However, Sub-Option C is expected to have neutral impacts on regulated groundfish species and therefore neutral impact on other species co-caught with regulated groundfish species, since when compared to status quo, specifications have been in place in time for the groundfish fishery to begin.

7.1.2.3 Sector ACE Carryover

7.1.2.3.1 Option 1: No Action

Impacts on regulated groundfish

The No Action alternative would continue to allow groundfish sectors to carry over up to 10% of their unused sector ACE, as outlined in Amendment 16. However, the 10% could not be implemented based on the U.S. District Court for the District of Columbia's April 4, 2014 ruling on NMFS' carryover-related measures included in the Framework Adjustment 50 rulemaking, which invalidated and vacated the FY 2013 carryover measures. The ruling also specified that a 'total potential catch' (the total ACL plus 10% unused ACE carryover) cannot exceed the ABC for any stock. This revision is necessary to cap the amount of carryover that can be harvested to ensure that the 'total potential catch' (i.e., total ACL + max. carryover) does not exceed the ABC for the fishing year in which the carried over ACE may be harvested.

Option 1/No Action may lead to changes in catches of regulated groundfish species if carryover on regulated groundfish stocks is not implemented and fishing is reduced as a consequence. Therefore, No Action would have low positive impacts on regulated groundfish stocks when compared with Option 2.

Impacts on other species

This option would not be expected to have any direct impacts on other species. This option may lead to any changes in catches of other species if carryover on regulated groundfish stocks is not implemented and fishing is reduced as a consequence. Therefore, No Action would have low positive impacts on other species when compared with Option 2.

7.1.2.3.2 Option 2: Modification to Sector ACE carryover

Impacts on regulated groundfish

Option 2 would modify Sector carryover provisions in Amendment 16. Carryover effectively increases the total amount of allocation a sector can catch in the following fishing year.

Option 2 would allow groundfish sectors to carry forward up to 10% of unused ACE provided that the total unused sector ACE carried forward for all sectors from the previous FY does not exceed the ABC level minus the ACL for the fishing year in which the carryover would be landed. This provision keeps catches within the prescribed acceptable biological catch, and in and of itself, is not expected to change fishing effort or behavior. With a reduced, and unknown (e.g., will it be 10% or less this year?), possibility to carry over quota, sectors may be more inclined to attempt to fully fish their ACE, including any reserve, to avoid the risk of losing quota. However, the existing AM is not changing (i.e., if total ACL is exceeded, sectors have to payback any carryover caught). So, this option reduces the risk of that happening by not allowing total potential catch to exceed ABC.

Option 2 reduces the overall amount of ACE that may be carried over from one fishing year to the next, and may lead to reductions in fishing effort, and therefore may reduce impacts on regulated groundfish. Therefore, Option 2 would have low negative impacts on regulated groundfish when compared with Option 1/No Action.

Impacts on other species

Option 2 reduces the overall amount of ACE that may be carried over from one fishing year to the next, and may lead to reductions in fishing effort, and therefore may reducing impacts on other species. Therefore, Option 2 would have low negative impacts on other species when compared with No Action/Option 1.

7.2 Essential Fish Habitat Impacts

The Essential Fish Habitat impacts discussions below focus 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.

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. The Preferred Alternative action implements updated ACLs, which are lower in some cases relative to the status quo ACLs, as well as cod protection closures in the Gulf of Maine. Combined, these two alternatives will likely reduce fishing effort and thereby habitat impacts overall in the fishery relative to current conditions. Furthermore, the Preferred Alternatives do not allow for access to the existing habitat closed areas on GB that were implemented in Amendment 13 to the Multispecies FMP and Amendment 10 to the Scallop FMP and therefore they continue to minimize the adverse impacts of bottom trawling and dredging on EFH.

7.2.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits

7.2.1.1 Revised Status Determination Criteria

7.2.1.1.1 Option 1: No Action

Adoption of the No Action alternative would maintain the status determination criteria (SDC) for all groundfish stocks as they currently exist.

From a habitat perspective, the SDC themselves are less important than the catch limits that result from implementing those criteria to generate annual catch limits (ACL). Qualitatively, it is assumed that criteria that are not based on the most recent scientific advice may not result in increases in stock size over the long term. This could lead to reduced CPUE and a resulting increase in seabed area swept, particularly when compared to Option 2. However, many factors interact to produce the amount and location of seabed area swept in a particular fishery, such that the effect of SDC on the amount of habitat impacts is uncertain at best.

7.2.1.1.2 Option 2: Revised Status Determination Criteria (*Preferred Alternative*)

Adoption of Option 2 would update the SDC for GB yellowtail flounder, changing both the biomass target and the minimum biomass threshold values to unknown, consistent with the 2014 TRAC assessment. Previously these values were SSB/R and ½ Btarget. Option 2 also updates the numerical estimates of MSY for GOM cod, GOM haddock, GB winter flounder, and pollock, based on 2014 assessments. No MSY values are specified from GOM winter flounder and GB yellowtail, as the SDC are unknown.

From a habitat perspective, the SDC themselves are less important than the catch limits that result from implementing those criteria to generate annual catch limits (ACL). Qualitatively, it is assumed that revised criteria based on the most recent scientific advice will result in increases in stock size over the long term, which hopefully should lead to increased catch per unit effort (CPUE), and therefore reduce seabed area swept. However, many factors interact to produce the amount and location of seabed area swept in a particular fishery, such that the effect of changing SDC on the amount of habitat impacts is uncertain at best. In this specific case, setting the GB yellowtail SDC to unknown may or may not lead to increased precaution in setting catch limits for the stock, so long-term conservation benefits are difficult to determine.

7.2.1.2 Annual Catch Limits

7.2.1.2.1 Option 1: No Action

Under No Action, stocks with FY 2015 specifications from previous actions would be maintained at that level. However, a number of groundfish stocks do not have FY 2015 specifications defined in previous actions, specifically GOM winter flounder, GB winter flounder, pollock, and GB yellowtail flounder. This option would not set specifications for these stocks in FY 2015. Without specification of an ACL, a catch would not be allocated to the groundfish fishery and targeted groundfish fishing activity would not occur for these stocks. In addition, certain provisions of the sector management system make it likely that fishing activity could be constrained even for stocks with an ACL. Current management measures require that a sector stop fishing in a stock area if it does not have ACE for a stock. Fishing can continue on stocks for which the sector continues to have ACE only if the sector can demonstrate it would not catch the ACE-limited stock. What these provisions mean is that in most cases there would be little opportunity for sector vessels to fish on stocks that have an ACL under no action, most groundfish fishing activity would not occur. As a result, in general this option would be expected to result in dramatically lower fishing mortality and dramatically lower impacts to EFH and benthic habitats as compared to the alternative specifications (Option 2).

Table 69 – Comparison between 2014 and proposed No Action 2015 total ACLs for groundfish stocks. Only those stocks being updated via this framework are listed.

Stock	2014 **total ACL (mt)**	No Action 2015 **total ACL (mt)**
GB cod	1,867	2,387
GOM cod	1,470	1,470
GB haddock	18,312	41,526
GOM haddock	323	412
GB yellowtail flounder	318.1	None specified
GB winter flounder	3,493	None specified
GOM winter flounder	1,040	None specified
Pollock	15,304	None specified

7.2.1.2.2 Option 2: Revised Annual Catch Limit Specifications (*Preferred Alternative*)

Option 2 would adopt new ACLs for GB cod, GOM cod, GB haddock, GOM haddock, GB yellowtail flounder, GB winter flounder, GOM winter flounder, and pollock (total ACLs summarized in Table 70). The ACLs for other stocks were set in previous actions.

The majority of the proposed 2015 ACLs are lower than those allocated in 2014. The exceptions to this are GB haddock, where the ACL is roughly 25% higher, GOM haddock, where the ACL is roughly 325% higher, and pollock, where the ACL is slightly higher. The fishery has not caught the GB haddock and pollock ACLs recently for various reasons, so the ACL changes alone are not likely to result in increased fishing effort and increased impacts to EFH. In FY2013 the GOM haddock sub-ACL was exceeded. If Option 2 is adopted the GOM haddock ACL would increase, which could potentially increase fishing effort on this stock. However, despite the availability of GOM haddock ACL, the decrease in available GOM cod ACL may reduce opportunity to fish in the GOM stock area, which would also decrease EFH impacts. The lower catch limits for the various other stocks are likely to decrease fishing, and therefore EFH impacts, across the groundfish fishery as a whole in comparison to 2014 levels. However, compared to Option 1/No Action, the alternative specifications below will likely have greater impacts to EFH since many stocks are not allocated under No Action. It is difficult to predict how fishing effort may change in later years of this framework, i.e. fishing years 2016 and 2017, because ACLs for some key stocks (GB cod, haddock, and yellowtail) have not yet been determined. Effort would be expected to be higher than if Option 1/No Action is adopted, but will probably be lower than the status quo.

Table 70 – Comparison of 2014 and Proposed 2015 total ACLs for groundfish stocks. Only those stocks being updated via this framework are listed.

Stock	2014 **total ACL (mt)**	Proposed 2015 **total ACL (mt)**
GB cod	1,867	1,886
GOM cod	1,470	366
GB haddock	18,312	23,204
GOM haddock	323	1,375
GB yellowtail flounder	318.1	240
GB winter flounder	3,493	1,952
GOM winter flounder	1,040	489
Pollock	15,304	15,878

7.2.2 Commercial and Recreational Fishery Measures

7.2.2.1 GOM Cod Management Measures

7.2.2.1.1 GOM Cod Spawning Area Closures

7.2.2.1.1.1 Option 1: No Action

Under Option 1/No Action, no additional spawning area closures would be implemented. The Gulf of Maine Cod Spawning Protection Area would be maintained. The EFH impacts associated with this management area are likely negligible. On the one hand, a wide variety of fishing activities are restricted within the area between April and June, which would reduce local impacts during that time period. However, the area is fishable during other times of the year, such that any benthic features with longer recovery times would be subject to gear impacts during other seasons. During the closure period, effort would be displaced outside of the area, such that overall fishing activity is simply displaced, rather than the area leading to a net reduction in effort.

7.2.2.1.1.2 Option 2: Additional GOM cod Spawning Protection Measures

Under Option 2, new spawning area closures would be implemented. These closures would be in addition to existing management areas, such as the Gulf of Maine Cod Spawning Protection Area, rolling closures, and year-round closures. The Council may select Sub-Option A or Sub-Option B. Both sub-options would restrict both commercial and recreational groundfishing.

7.2.2.1.1.2.1 Sub-Option A:

- Seasonally in the following 30-minute blocks during these months:
  - May: 124, 125, 132, 133, 139, 140
  - June: 132, 133, 139, 140, 147
  - November – January: 124-125
  - April: 124, 125, 132, 133

Portions of blocks 124, 132, and 139 that overlap the Western GOM Closed Area would not be considered as GOM cod spawning closures.

Sub-Option A would expand fairly significantly upon existing time/area restrictions on commercial groundfish fishing. Specifically, for sector vessels, which comprise the bulk of groundfishing effort, blocks 124 and 125 would be closed in May, blocks 132 and 133 would be closed in June, and the above indicated blocks would be closed during the months of November, December, and January, when there are currently no rolling closures in effect that apply to sector vessels. The schedule above is similar to existing common pool time/area restrictions, with some increases in time/area closures, including closures during December and January. Sub-Option A would also lead to new restrictions on recreational fishing in the areas/times noted above, as these vessels are not currently subject to the existing rolling closures.

In sum, Sub-Option A is expected to reduce fishing effort in the inshore areas of the Gulf of Maine between April-June and November-January. Some of this effort could be redistributed further offshore in the Gulf of Maine, or onto Georges Bank, but effort from smaller groundfish vessels that focus their fishing activities inshore are more likely to be reduced than redistributed. These reductions in effort will reduce habitat impacts relative to No Action.

7.2.2.1.1.2.2 Sub-Option B:

- May: 125, 133
- June: 133
- November – January: 124 with an eastern boundary defined at 70-15, 125
- April: 125, 133

Sub-Option B is a smaller set of time/area closures as compared to Sub-Option A, but there are still expanded fishing effort restrictions relative to No Action. Of the times/areas listed above, the only ones currently in effect for sector vessels are block 133 in May and blocks 125 and 133 in April. Common pool vessels would experience additional fishing restrictions in December and January. All of these restrictions would be new restrictions on the recreational fishery.

Similar to Sub-Option A, Sub-Option B is also expected to reduce fishing effort in inshore areas of the Gulf of Maine. Because this sub-option includes only the most inshore blocks, it would be easier for vessels to shift their effort offshore of the indicated blocks, unless prevented from doing so by the existing rolling or year-round closures. These reductions in effort will reduce habitat impacts relative to No Action, although a smaller reduction is expected relative to Sub-Option A.

7.2.2.1.2 Prohibition on the Possession of GOM cod

7.2.2.1.2.1 Option 1: No Action

Option 1 would continue to allow possession of GOM cod. Sectors would still be subject to the AM if catch is sufficient to exceed the sub-ACL. Because the fishery would still be quota limited this is not expected to alter fishing effort and would have negligible EFH impacts, unless future specifications increase the GOM cod sub-ACL. Option 1 would have similar negligible EFH impacts when compared to Option 2.

7.2.2.1.2.2 Option 2: Prohibition on the possession of GOM cod

Option 2 would prohibit possession of GOM cod. Sectors would still be subject to the AM if bycatch is sufficient to exceed the sub-ACL. Because the fishery would still be quota limited this is not expected to alter fishing effort and would have negligible EFH impacts, unless future specifications increase the GOM cod sub-ACL. Option 2 would have similar negligible EFH impacts when compared to Option 1.

7.2.2.1.3 GOM Cod Protection Measures

7.2.2.1.3.1 Option 1: No Action

No Action would maintain the current seasonal possession prohibition for GOM cod by recreational vessels. No Action would also maintain the GOM rolling closures for sector and common pool vessels.

Because recreational hook and line gear does not contact the bottom, direct impacts to EFH from this gear type are not expected. Therefore, continuing the seasonal possession prohibition for this gear type does not have an influence, positive or negative, on the fishery's overall level of impacts to EFH.

The Gulf of Maine rolling closures restrict fishing by gears capable of catching groundfish across broad areas in the Gulf of Maine. To the extent that this reduces rather than displaces fishing effort to other times or areas, the rolling closures may be leading to lower impacts of the fishery on EFH. However, if

fishing is merely redistributed in space and time, but the overall amount of effort does not change, the rolling closures would have a more neutral effect on fish habitats. Regardless, any benthic features with longer recovery times would be subject to gear impacts during other seasons.

Also, some gear types that adversely affect seabed habitats, specifically scallop dredges and hydraulic surf clam and ocean quahog dredges, are exempt from the rolling closures. Use of these dredges would limit any positive impacts associated with fishing reductions in rolling closure blocks. Until recently, hydraulic dredges had not been used in the Gulf of Maine, although this could change since the Northern Temporary PSP closure was rescinded for clam and mussel harvest as of October 1, 2014[25].

In general, the rolling closures probably have slight positive benefits for EFH, limited by redistribution of fishing effort outside the areas, and the seasonal nature of the closures.

7.2.2.1.3.2 Option 2: GOM Cod Protection Measures

Option 2 would modify existing GOM rolling closures and implement new closures. Option 2 would also prohibit the possession of GOM cod by the recreational groundfish fishery; however, Cod Protection Closures and rolling closures would not apply to recreational vessels.

GOM Cod Protection Closures would apply to all commercial gears and fisheries (except for exempted gears or exempted fisheries) in the following 30-Minute Blocks:

- May: 132, 133, 138, 139, 140, and 125 north of 42° 20’
- June: 132, 139, 140, 146, 147, and 125 north of 42° 20’
- November – January: 125, and an area of 124 defined by the following coordinates:
    - 42° 00’ N…70° 30’ W
    - 42° 00’ N…70° 24’ W
    - 42° 15’ N…70° 24’ W
    - 42° 15’ N…70° 30° W, and

Common pool rolling closures would continue to apply in the following 30-Minute Blocks:

- October: 124 and 125
- March: 121, 122, 123

The Cod Protection Closures are similar to the “additional GOM Cod Spawning Protection Measures” described in a previous section, in that both sets of closures enact November-January closures, although the specific blocks vary between the Protection Closures and Spawning Protection Measures. However, the Cod Protection closures remove all rolling closures for sector and common pool vessels in the month on April.

Relative to the No Action rolling closures that apply to sector vessels, the Cod Protection Closures eliminate any closures in April, but add closures in November and January. The Cod Protection Closures also add the northern part of 125 in May and June, add 132 in June, and eliminate 145 in June. As compared to No Action, this alternative is expected to reduce fishing effort overall, and therefore will reduce impacts to EFH.

[25] http://www.greateratlantic.fisheries.noaa.gov/nr/2014/September/14scoqreopentemppspphl.pdf

7.2.2.2 Default Groundfish Specifications

7.2.2.2.1 Option 1: No Action

Option 1 would prohibit the rollover of groundfish specifications if rulemaking was delayed for any reason. Without specification of an ACL, a catch would not be allocated to the groundfish fishery and targeted groundfish fishing activity would not occur for these stocks. This would likely decrease fishing effort during the time before rulemaking was finalized. Because effort is ultimately restricted by the overall quota, fishing effort cannot exceed those levels set by rulemaking. Option 1 would not be expected to negatively impact EFH because overall effort would not change, although depending on how long rulemaking was delayed, it may concentrate fishing effort into a shorter time period.

7.2.2.2.2 Option 2: Percentage Rollover Provisions for Default Specifications (*Preferred Alternative*)

These Sub-Options would allow for rollover of current fishing year quota into the next fishing year if rulemaking is delayed beyond May 1. Default specifications would expire on August 1st, and would not exceed the anticipated ABC for the upcoming FY. The Council considered selecting from sub-options A, B, and C, which correspond to 35%, 20%, or 10% rollover.

For all sub-options (A, B and C), if rulemaking was delayed, current fishing year quota could be rolled over into the following FY. In the absence of default rollover, a catch would not be allocated to the groundfish fishery and targeted groundfish fishing activity would not occur for the stocks in question. Rollover would allow limited fishing effort to occur before final rulemaking. Because effort is ultimately restricted by the overall quota, fishing effort cannot exceed those levels set by rulemaking. Therefore when compared to Option 1/No Action, none of the rollover sub-options A, B, or C would be expected to negatively impact EFH because overall effort would not change.

7.2.2.3 Sector ACE Carryover

7.2.2.3.1 Option 1: No Action

No Action allows for up to 10% carryover of unused ACE. Option 1\No Action would likely lead to more fishing effort and more negative impacts on EFH than Option 2.

7.2.2.3.2 Option 2: Modification to Sector ACE carryover (*Preferred Alternative*)

Option 2 limits the 10% carryover in cases where the carryover plus the total ACL would exceed ABC for a particular stock. This option will lead to carryover values of 10% or less, which would lead to fishing effort levels that are the same as, or less than, the No Action carryover approach. Thus, Option 2 will likely reduce effort and negative EFH impacts relative to Option 1\No Action.

7.3 Impacts on Endangered and Other Protected Species

The FW 53 alternatives are evaluated for their impacts on species protected under the Endangered Species Act of 1973 (ESA) and/or the Marine Mammal Protection Act of 1972 (MMPA). Section of 6.4.1 of the Affected Environment Section contains a complete list of protected species (i.e., ESA and non-ESA listed species) that inhabit the areas of operation for the Northeast multispecies fishery (Table 21). 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 (e.g. gillnet, hook, and mobile gear).

7.3.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits

7.3.1.1 Revised Status Determination Criteria

Updating the SDC is an administrative measure, and will not have a direct impact on protected species because it does not, in and of itself, change fishing effort or fishing behavior. Whatever impact indirectly precipitates from changes to SDC or mortality targets will be discussed in the context of other alternatives – including ACLs- that the Council adopts in order to meet mortality targets derived from the new SDC and control rules.

7.3.1.2 Annual Catch Limits

7.3.1.2.1 Option 1: No Action

Under Option 1, the ACLs specified for FY 2015 would be unchanged from those adopted through FW 51. The following stocks would not have ACLs: GB yellowtail flounder, GB winter flounder, GOM winter flounder, and pollock. Pollock is a unit stock – meaning that its stock area includes the GOM, GB, and SNE/MA. There would also be no quotas for the stocks managed under the U.S./Canada Resource Sharing Understanding: EGB cod, EGB haddock and GB yellowtail flounder. In the absence of stock specific specifications, commercial groundfish vessels would be unable to fish in the respective broad stock areas without an allocation. Other fisheries with incidental catch of groundfish would continue to operate in the GOM, GB, and SNE/MA. Effort may increase in other fisheries as commercial groundfish vessels would be unable to conduct a directed groundfish fishery.

Based on the above information, Option 1 would be expected to significantly reduce commercial groundfish fishing effort in the GOM, GB, and SNE/MA, thereby reducing the amount of trawl or gillnet gear in the water. Gillnet and trawl gear pose the greatest risk to serious injury and mortality to protected species. As Option 1 will result in the reduction of these gear types in broad stock waters, the potential for protected species interactions with gillnet or trawl gear and therefore, serious injury or mortality, will be reduced. For these reasons, and based on the fact that the No Action Alternative would still require compliance with protected species take reduction plans (e.g., Atlantic Large Whale Take Reduction Plan (ALWTRP), Harbor Porpoise Take Reduction Plan (HPTRP)) and sea turtle resuscitation guidelines, Option 1 is expected to have positive impacts on protected species.

For the reasons described above, the No Action Alternative is likely to have positive impacts on protected species compared to Option 2. Option 2 will result in allocations to all stocks which would facilitate directed commercial groundfish fishing in all broad stock areas. As a result, the positive impacts to protected species that Option 1 would provide would be removed and thus, protected species interactions with commercial fishing gear are more likely to occur under Option 2.

7.3.1.2.2 Option 2: Revised Annual Catch Limit Specifications *(Preferred Alternative)*

Option 2 would adopt new specifications for GOM cod, GOM haddock, GOM winter flounder, GB winter flounder, GB yellowtail flounder, and pollock, based on the most recent scientific data. This measure includes the identification of ACLs, ABCs, and OFLs as required by the M-S Act and as implemented by Amendment 16. It also incorporates adoption of the incidental catch TACs for the special management programs that use Category B DAS. Implementation of ACLs is required by the Magnuson-Stevens Act and may have protected species impacts that are difficult to define. The protected species impacts of ACL-setting in general are discussed in detail in Amendment 16.

For the US/Canada stocks, the U.S. TAC for GB cod, and GB yellowtail flounder would decrease in Option 2, while the U.S. TAC for GB haddock would increase. This could lead to a shift in effort to the eastern area for EGB haddock, though it is likely that the EGB cod TAC would constrain the full utilization of the EGB haddock quota (e.g. US EGB haddock TAC of 17,760 mt, and US EGB cod TAC of 124 mt). The quantitative consequences of these changes are unknown, although it is unlikely that full EGB haddock quota allocation will be achieved due to the constraints experienced by the EGB cod quota. As a result, fishing effort to its fullest potential will likely not be experienced and therefore, any effort increases are likely minimal in this area.

Option 2 would increase FY 2015 ACLs for GOM haddock and pollock, and decrease FY 2015 ACLs for GOM cod, GOM winter flounder, and GB winter flounder when compared to the specifications in place for those species in FY 2014 (FW51) (see Table 59 in the Affected Environment). The increase in ACLs for GOM haddock and pollock; however, are not expected to cause large changes to fishing behavior, particularly as the ACL for GOM cod would be significantly reduced if Option 2 is selected and therefore, constrain fishing behavior for these stocks. The largest increases in ACLs under Option 2 are for GOM and GB haddock. While the ACLs for these stocks are increasing, the new ACLs would be similar to or less than ACLs the fishery has operated under over the past four fishing years. The ACL for GB haddock has not been caught under sectors and thus, the quota is not a true reflection of fishing behaviors for this stock. That is, a higher quota does not necessarily equate to increases in fishing effort. For instance, in FY 2013, when the ACL was roughly 28,000 mt, approximately 5,000 mt higher than what is proposed, the fishery caught roughly 12% of the GB haddock quota and therefore, did not fish at its full potential. As a result, quota increases to the ACL do not necessary equate to increases fishing effort and therefore, Option 2 is likely to have a negligible to low negative impact on protected species.

Based on the above information, it is anticipated that Option 2 would result in minimal, if any effort shifts. Any effort increases would occur in areas that are already subject to fishing by bottom trawls and gillnets in the GOM, GB, and SNE and therefore, in areas which have been considered by NMFS in its assessment of fishery effects to protected resources (i.e., ESA listed species and non-ESA listed species; see Section 6.4.1, Table 21). In regards to non-ESA listed species, which consist of species of cetaceans and pinnipeds (marine mammals), although impacts to these species from Option 2 are somewhat uncertain, as quantitative analysis has not been performed; we have considered, to the best of our ability, available information on marine mammal interactions with commercial fisheries, of which, the multispecies is a component (Waring *et al*. 2014). Aside from harbor porpoise and several stocks of bottlenose dolphin, there has been no indication that takes of non-ESA listed species of marine mammals in commercial fisheries has gone above and beyond levels which would result in the inability of each species population to sustain itself over the last 5 years (Waring *et al*. 2014). Specifically, aside from harbor porpoise and several stocks of bottlenose dolphin, potential biological removal (PBR) has not been exceeded for any of the non-ESA listed marine mammal species identified in Table 25, Section 6.4 (Waring *et al*. 2014). Although harbor porpoise and several stocks of bottlenose dolphin have experienced

levels of take that have resulted in the exceedance of each species PBR, take reduction plans have been implemented to reduce bycatch in the fisheries affecting these species (Harbor Porpoise Take Reduction Plan (HPTRP), effective January 1, 1999 (63 FR 71041); Bottlenose Dolphin Take Reduction Plan (BDTRP), effective April 26, 2006 (71 FR 24776)). These plans are still in place and are continuing to assist in decreasing bycatch levels for these species. Although the information presented is a collective representation of commercial fisheries interactions with non-ESA listed species of marine mammals, and does not address the effects of the multispecies fisheries specifically, the information does demonstrate that changes in allocations in the multispecies, or any other fisheries, whether higher or lower, has not resulted in a collective level of take that threatens the continued existence of non-ESA listed marine mammal populations. Based on this information, and the fact that the multispecies fisheries must comply with specific take reduction plans (i.e., HPTRP, the BDTRP, ALWTRP); that there is continual monitoring of non-ESA listed marine mammal species bycatch; and that voluntary measures exist that reduce serious injury and mortality to marine mammal species incidentally caught in trawl fisheries (see the Atlantic Trawl Gear Take Reduction Team), it is not expected that the proposed specifications under Option 2 would result in levels of take that would affect the continued existence of non- ESA listed species of marine mammals. For these reasons, Option 2 would have negligible to low negative impacts on non- ESA listed species of marine mammals.

Although the impacts to ESA listed species from Option 2 are somewhat uncertain, as quantitative analysis has not been performed, we have considered, to the best of our ability, how the fishery has operated in regards to listed species from 2010, when major changes to the FMP had been experienced from the recent adoption of Amendment 16 on October 16, 2009, to the present. During this time, NMFS issued a biological opinion on the multispecies fishery in 2010 (NMFS 2010), with a subsequent replacement of this Opinion in 2013 (NMFS 2013). The biological opinion (Opinion) issued on October 29, 2010, included an incidental take statement authorizing the take of specific numbers of ESA listed species of sea turtles. Until December 16, 2013, when NMFS issued a new biological opinion on the operation of seven commercial fisheries, including the multispecies fishery, the multispecies fishery has been covered by the incidental take statement authorized and issued with the 2010 Opinion. It should be noted that the 2010 biological opinion did not authorize the incidental take of ESA listed Atlantic salmon. Take of Atlantic salmon in the multispecies fishery was not expected; however, analysis of information since the 2010 Opinion was completed changed this determination and as a result, in NMFS most recent batched biological opinion issued on December 16, 2013, incidental take of Atlantic salmon is authorized (see NMFS 2013). In addition, as Atlantic sturgeon were not listed at the time the 2010 biological opinion was written, this species was not considered in the opinion; however, since this species listing in 2012 (77 FR 5880 and 77 FR 5914, February 6, 2012), it has been included in the most biological opinion issued by NMFS on December 16, 2013.

The 2010 biological opinion concluded that the fishery may affect, but would not jeopardize the continued existence of any ESA listed species of sea turtles or whales. Since 2010, the allocations for all stocks in the multispecies fisheries have increased, decreased, or remained stable. The allocations being proposed in Option 2 for the specified stocks are no greater than or are within the range of the allocations that have been authorized by the fishery over the last 5 years (since 2010). Collectively, the proposed allocations, combined with the other allocations for this fishery, did not, and have not, resulted in the exceedance of NMFS authorized take of any ESA listed species from 2010 to the present (NMFS 2010; NMFS 2013). In addition, since 2010, the multispecies fishery has not exceeded authorized listed species takes, and to date has not resulted in the exceedance of authorized take. As a result, the proposed specifications are not expected to result in the multispecies fishery introducing any new risks or additional takes to ESA listed species that have not already been considered and authorized by NMFS to date (NMFS 2013) and therefore, the proposed specifications under Option 2 are not, as concluded in the 2013 Opinion, expected to result in levels of take that would jeopardize the continued existence of ESA listed

species. For these reasons, and due to the fact that this alternative would not provide any new, additional, access to year-round closed areas, and would still require compliance with the ALWTRP and sea turtle resuscitation guidelines, Option 2 would likely have negligible to low negative impacts on protected resources.

Compared to the No Action alternative (Option 1), which would have a very low potential to adversely affect protected species because of a zero groundfish ACL for these stocks, this alternative could result in incidental take of protected species and therefore, adversely affect the protected species present in the areas in which groundfish ACLs will be set. As a result, when compared to Option 1, Option 2 would likely have a low negative impact on protected species.

7.3.2 Commercial and Recreational Fishery Measures

7.3.2.1 GOM Cod Management Measures

7.3.2.1.1 GOM Cod Spawning Area Closures

7.3.2.1.1.1 Option 1: No Action *(Preferred Alternative)*

No Action would maintain an existing GOM cod spawning closure area (Whaleback) implemented in FW 45. It is reasonable to expect that this area would continue to result in low positive to neutral impacts to protected species as it likely limits potential interactions with gear (i.e., trawl and gillnet) in the fishery during the designated timeframes of the closure (i.e., April 1st – June 30th all vessels). Specifically, use of gear capable of catching groundfish (e.g., trawl and gillnet) is prohibited in this area during the closure. Gillnet and trawl gear are known to pose the greatest risk to serious injury or mortality to protected species and therefore, restricting the use of these gear types during the designated closure may reduce harm and mortality to protected species that occur in the Ipswich Bay area of GOM from April to June. In addition, No Action would still require compliance with protected species take reduction plans (e.g., Large Whale Take Reduction Plan, Harbor Porpoise Take Reduction Plan) and sea turtle resuscitation guidelines. Although No Action is likely to provide some positive impacts to protected species, as the No Action area closure is shorter in duration and encompasses a smaller area than the areas proposed in Sub-Options A and B, No Action would likely have less of a positive impact on protected resources than either option. As a result, the No Action Alternative is likely to have low positive to negligible impacts on protected species.

7.3.2.1.1.2 Option 2: Additional GOM cod Spawning Protection Measures

Under this option, commercial and recreational vessels fishing would be prohibited from fishing in areas of the Western GOM, during several months of the year in order to protect aggregations of spawning cod.

7.3.2.1.1.2.1 Sub-Option A

Sub-Option A would create GOM cod spawning closure areas in May, June, November through January, and April. With the exception of the November-January closure, which restricts fishing from Massachusetts Bay east to Stellwagen Bank, in general, the designated closures encompass portions of Ipswich and Massachusetts Bays (see Figure 2). Based on this information, Sub-Option A coincides with the occurrence and distribution of large and small cetaceans, sea turtles, pinnipeds, Atlantic salmon, and Atlantic sturgeon in the GOM and therefore, will close particular areas of the Western GOM during

periods of time these species are known to be present in these waters. The closure areas will also encompass known North Atlantic right whale critical habitat (Cape Cod Bay Critical Habitat Area), foraging grounds, and wintering areas during times of known right whale occurrence. In addition, the closures will also coincide with HPTRP and ALWTRP management areas.

The spawning closures created by Sub-Option A would restrict commercial and recreational fishing in areas of the Western Gulf of Maine (WGOM). Specifically, all commercial and recreational fishing vessels using gear, such as gillnet or trawl gear, capable of catching groundfish are prohibited in these areas at the designated times. As a result, it is expected that effort shifts may occur as result of Sub-Option A's seasonal closures. The shifts; however, will be confined to areas that are already subject to fishing by bottom trawls and gillnets in the GOM and therefore, in areas which have been considered by NMFS in its assessment of fishery effects to protected species (ESA and non-ESA listed species) and that are thus, currently regulated to minimize interactions with protected species (i.e., Harbor Porpoise, HPTRP; large whales, ALWTRP) or have been determined to be areas where takes are not expected to so great that the continued existence of the species is jeopardized (NMFS 2013; Waring *et al*. 2014). In addition, the seasonal closures will eliminate protected species interactions in those areas that are closed in the GOM at particular times of year. Shifts in fishing effort from the GOM to other areas of the multispecies fishery (e.g., GOM to GB), as well as well as changes in fishing behavior in other components of the multispecies fishery are also not expected as a result of Option 2, Sub-Option A. Based on this information, overall, Sub-Option A is not expected to result in increased interactions with protected species. The rationale to further support this conclusion is provided below.

The commercial fisheries in the GOM are primarily prosecuted with various trawl gear types and gillnets. Of these, gillnets have a higher impact potential on specific protected species in the GOM area, as outlined in Section 6.1.6. Although it is possible that the shift of gillnet effort could increase potential interactions, this is not expected to be the case. The majority of the closures are inshore of the WGOM area. Based NEFOP and ASM observed marine mammal (non-listed) gillnet takes from 2007-2012, a substantial amount of gillnet interactions with marine mammal species west of the Western Gulf of Maine (WGOM) Closure Area have been observed, suggesting that the area along the WGOM Closure area is heavily concentrated with gillnet gear and therefore, poses an interaction risk to not only non-listed marine mammal species, but also listed species. Because Sub-Option A would close many inshore areas seasonally, it is expected that the number of takes in gillnets may be reduced, resulting in positive impacts for protected species. In addition, as Sub-Option A is expected to disperse gillnets from this area in many months of the year (See seasonal closure areas; Figure 19), as well as moderately reduce the amount of groundfish specific gillnet gear used in the GOM, the risk of protected species interacting with gillnet gear may decrease in the affected area as gillnet gear will not only be more diffuse, but also reduced in number. In addition, throughout the designated closure periods, HPTRP and ALWTRP management areas are in effect, further reducing the potential for an interaction with a protected species. As a result, Sub-Option A is expected to have positive to negligible impacts on protected species with respect to overall gillnet gear interactions.

Interaction with trawl gear is more variable as seen in the observed takes distribution of trawl gear. Interactions in trawl gear have not been observed in the GOM for any ESA listed species. Non-ESA listed marine mammal species have been observed incidentally taken in this area by trawl gear; however, there has been no indication that takes of non-ESA listed species of marine mammals in commercial trawl fisheries has gone above and beyond levels which would result in the inability of each species population to sustain itself (Waring et al. 2014)**.** As time and area closures will be in place in areas of the Western GOM where some trawl interactions with protected species have been observed, Sub-Option A may reduce the number of potential trawl interactions with protected species in these areas, and therefore, result in positive impacts to protected species. Because the overall effort will be constrained by the FW

53 catch limits and likely reduced by the combination of trip limits and area closures, Sub-Option A is not expected to result in elevated levels of take that are beyond those previously assessed by NMFS (Waring et al. 2014; NMFS 2013). As a result, Sub-Option A is expected to have positive to negligible impacts on protected species with respect to overall trawl gear interactions.

Overall when compared to No Action, Sub-Option A may positively affect protected species by limiting potential interaction with gear in the fishery (i.e., trawl and gillnet) via additional designated time/area closures. Specifically, use of gear capable of catching groundfish (e.g., trawl and gillnet) is prohibited in these areas during the closure. Gillnet and trawl gear are known to pose the greatest risk to serious injury or mortality to protected species and therefore, restricting the use of these gear types over a larger area of the Western GOM (compared to the No Action) during the designated closures may reduce harm and mortality to protected species.

Sub-Option A is likely to provide more protection from gear interactions than Sub-Option B because Sub-Option B closes a smaller overall area than Sub-Option A during the same months. Therefore, Sub-Option A would have a greater positive impact on protected resources when compared to Sub-Option B.

7.3.2.1.1.2.2 Sub-Option B

Sub-Option B would create GOM cod spawning closure areas in May, June, November through January, and April (see Figure 5). The spawning closures, although covering portions of Ipswich and/or Massachusetts Bay, encompass much smaller areas under the designated timeframes than Sub-Option A (e.g., May1-May 31: Sub-Option A closes blocks 140, 139, 133, 132, 125, 124; Sub Option B closes 133 and 125). Based on this information, Sub-Option B coincides with the occurrence and distribution of large and small cetaceans, sea turtles, pinnipeds, Atlantic salmon, and Atlantic sturgeon in the GOM and therefore, will close particular areas of the Western GOM during periods of time these species are known to present in these waters. The closure areas will also encompass known North Atlantic right whale critical habitat (Cape Cod Bay Critical Habitat Area), foraging grounds, and wintering areas during times of known right whale occurrence. In addition, the closures will also coincide with HPTRP and ALWTRP management areas.

As described in the analysis for Sub-Option A, protected species have been observed taken in gillnet and trawl gear in the areas west of the WGOM Closure area. Any time or area closures in these areas will potentially reduce protected species interactions with fishing gear (e.g., trawl and gillnet) and therefore, result in positive impacts to protected species. However, Sub-Option B does not close Block 132 and 139 during any season, where a large number of protected species (e.g., non-listed marine mammals) takes (primarily in gillnets) have been observed. In addition, as Sub-Option A closes all of Block 124 during the months of May, November-January, and April and Sub-option B only closes a part of 124 during the November-January closures, Sub-Option B is likely to provide less protection to protected species from gear interactions than Sub-Option A. Sub-Option B; however, will still provide time and area closures in 133, 125, and 124, where some protected species have been observed taken. In addition, HPTRP and ALWTRP management areas will be in effect in the Western GOM throughout any closure period. Based on this information, increased interactions with protected species are not expected under Sub-Option B and therefore, Sub-Option B is likely to have a low positive to negligible impact on protected species.

As noted above, compared to Sub-Option A, Sub-Option B is expected to have less of a positive impact on protected species than Sub-Option A due to the smaller overall area closed under Sub-Option B, and therefore, a smaller overall area where protection from gear interactions would be provided. As a result, compared to Sub-Option A, Sub-Option B may have a low negative to impact on protected species.

When compared to the No Action/Option 1, Sub-Option B may positively affect protected species by limiting potential interaction with gear in the fishery(i.e., trawl and gillnet) via additional designated time/area closures. Specifically, use of gear capable of catching groundfish (e.g., trawl and gillnet) is prohibited in these areas during the closure. Gillnet and trawl gear are known to pose the greatest risk to serious injury or mortality to protected species and therefore, restricting the use of these gear types over a larger area of the Western GOM (compared to the No Action) during the designated closures may reduce harm and mortality to protected species. Both sub-options could be expected to positively impact protected species compared to the No Action alternative.

7.3.2.1.2 Prohibition on the Possession of GOM cod

7.3.2.1.2.1 Option 1: No Action (*Preferred Alternative*)

No Action. There would be no revision to the retention regulations of GOM cod. This would require sector vessels to retain and land all legal sized cod, and common-pool and recreational fishermen to retain and land all legal sized cod up to a trip or bag limit, respectively. Each component of the fishery would continue to operate under strict catch limits and AMs. Option 1 is not expected to change behavior in the fishery, in and of itself, and therefore is expected to have a neutral impact on protected species.

7.3.2.1.2.2 Option 2: Prohibition on the possession of GOM cod

This option would prohibit possession of GOM cod by all commercial and recreational vessels (i.e. all vessels would be required to discard all GOM cod). Option 2 retains allocations of GOM cod for the groundfish fishery, and fishing effort is expected to be a function of the allocated ACL. In theory, this measure would not allow fishing effort to increase because commercial and recreational fisheries would continue to operate under strict catch limits and AMs. While landings and possession would be prohibited, all catch, in theory, would be accounted for. Any shift in effort would occur in areas that are already subject to fishing by bottom trawls and gillnets in the GOM and therefore, in areas which have been considered by NMFS in its assessment of fishery effects to protected species and that are thus, currently regulated to minimize interactions with protected species (i.e., Harbor Porpoise, HPTRP; large whales, ALWTRP) or have been determined to be areas where takes are not expected to so great that the continued existence of the species is jeopardized (NMFS 2013; Waring *et al*. 2014). For the reasons stated above, Option 2 is expected to have a neutral impact on protected species. When compared to the No Action, Option 2 is also expected to have a neutral impact on protected species.

7.3.2.1.3 GOM Cod Protection Measures

7.3.2.1.3.1 Option 1: No Action

No Action would maintain a suite of sector and common pool rolling closures in the commercial fishery (see Figure 4), and continue to allow for possession of GOM cod by recreational anglers through bag limits. As No Action would keep status quo conditions, it is reasonable to expect that the GOM cod spawning closure area (Whaleback) and rolling closure areas would continue to result in low positive to neutral impacts to protected species as they likely limit potential interaction with gear (i.e., trawl and gillnet) in the fishery during the designated closure timeframes (see 4.2.1.3). Specifically, use of gear capable of catching groundfish (e.g., trawl and gillnet) is prohibited in these areas during the designated closure timeframes. Gillnet and trawl gear are known to pose the greatest risk to serious injury or mortality to protected species and therefore, restricting the use of these gear types during the designated

closure may reduce harm and mortality to protected species that occur in the western portion of the GOM during these specified timeframes. To date, under status quo conditions, there has been no indication that takes of any ESA or non-ESA listed species has exceeded authorized levels (NMFS 2013) or reached levels that would result in the inability of each species population to sustain itself (Waring et al. 2014). In addition, No Action would still require compliance with protected species take reduction plans (e.g., Large Whale Take Reduction Plan, Harbor Porpoise Take Reduction Plan) and sea turtle resuscitation guidelines. For these reasons, No Action is likely to result in low positive to neutral impacts to protected species.

As noted above, the No Action rolling closure configurations consist of sector and common pool rolling closures. When compared with Option 2, in general, the sector and common pool rolling closures of the No Action close *more overall area* in time and space in the GOM than the proposed closure areas in Option 2. As a result, No Action affords slightly more protection (see above rational) to protected species than Option 2. For instance, under the no action alternative, blocks 133, 132, 124, and 125 are closed to sectors and common pool vessels during April. During this month, HPTRP regulations are also in place in these blocks and therefore, the closures plus the HPTRP regulations provide complimentary means of reducing harbor porpoise interactions with gillnet gear. However, under Option 2, blocks 133, 132, 124, and 125 would be open to all groundfish vessels during this month. Although HPTRP regulations will still be in place, the added benefits (e.g., no groundfish fishing permitted) provided by the previously existing closures will no longer be in place. Although Option 2 does not necessarily equate to additional takes of harbor porpoise under this scenario, when compared to No Action, it provides less protective qualities to this species than No Action. Based on this, No Action would likely have a more positive impact on protected resources than Option 2 for the commercial fishery.

Recreational fishing gear may interact with some turtle species and Atlantic sturgeon. However, the majority of interactions in the GOM are with sturgeon, and recreational groundfish fisheries occur further offshore, in water depths much greater than those preferred by Atlantic sturgeon (i.e., outside 50 meters) and; therefore, the likelihood of sturgeon interaction is believed to be lower. No Action for recreational fisheries would be expected to result in impacts that are similar or slightly more negative than Option 2 because the prohibition on possession of GOM cod in Option 2 may reduce overall recreational fishing effort. The overall recreational impact on protected species is expected to be negligible.

Overall, No Action would be expected to have a low positive impact on protected species when compared to Option 2.

7.3.2.1.3.2 Option 2: Gulf of Maine Cod Protection Measures

Option 2 would modify existing GOM rolling closures (sector and common pool) for the commercial groundfish fishery during the months of May, June, and November, implement new closures in December and January, and remove the April rolling closures for all vessels (Figure 5). As shown in Table 24, Option 2 opens up sector and common pool rolling closures areas that were once closed, and closes some areas that were currently open. It is important to note that sectors account for the majority of fishing effort within the groundfish fleet. Table 39 indicates that in FY2012, sector vessels took 12,943 groundfish trips, while common pool vessels took 1,553 groundfish trips in all stock areas (e.g. SNE, GB, and GOM). The majority of the rolling closures that would open under Option 2 applied to only the common pool, and did not exempt sector vessels from fishing in these areas. As sectors comprise the majority of the groundfish fishery, fishing behavior and effort in these areas will likely remain “as is” with or without the closed areas in effect. As noted previously, to date, there has been no indication that takes of any ESA or non-ESA listed species has exceeded authorized levels (NMFS 2013) or reached levels that would result in the inability of each species population to sustain itself (Waring et al. 2014; see section

7.1.3.1.2.2 for further details). As a result, we do not expect opening these areas will result in elevated levels of take above and beyond that which considered and/or authorized by NMFS to date. As noted above, however, April does represent the exception to this rationale. April results in the opening of areas once closed to sectors and common pool vessels. Specifically, blocks 133, 132, 124, and 125 (inshore GOM) would be opened for sectors, and blocks 121, 122, 123, 124, 125, 129, 130, 131, 132, and 133 (Figure 6). As noted above, this area has been observed to be an area where high numbers of non-listed marine mammals have been observed taken, primarily in gillnets. Although opening these areas has the potential to increase fishing effort and therefore, increase the potential for an interaction with a protected species, we do not think this will be the case because accountability measures for sectors prohibit fishing in a stock area once a sector has caught its harvest share. As April falls at the end of the fishing year, current ACLs would likely constrain fishing effort and therefore, reduce the potential for an interaction with a protected species.

In addition to the above, interactions with protected species are also not expected to increase as a result of Option 2 as any shift in effort resulting from this Option will be confined to areas that are already subject to fishing by bottom trawls and gillnets in the GOM in areas which have been considered by NMFS in its assessment of fishery effects to protected species and that are thus, currently regulated to minimize interactions with protected species (i.e., Harbor Porpoise, HPTRP; large whales, ALWTRP) or have been determined to be areas where takes are not expected to so great that the continued existence of the species is jeopardized (NMFS 2013; Waring *et al*. 2014). Also, as noted previously, seasonal closures are expected to eliminate protected species interactions in areas that are closed in the GOM at particular times of year. Shifts in fishing effort from the GOM to other areas of the multispecies fishery (e.g., GOM to GB), as well as well as changes in fishing behavior in other components of the multispecies fishery are also not expected as a result of Option 2. Based on this information, overall, Option 2 is not expected to result in increased interactions with protected species

Option 2 would also prohibit the possession of GOM cod by recreational anglers. The recreational impact on protected species is expected to be negligible. Recreational fisheries gear interaction has been documented with some turtle and Atlantic sturgeon. However, and as noted in the discussion of Option 1, the majority of the GOM cod and groundfish recreational fisheries occur further offshore, in water depths much greater than those preferred by Atlantic sturgeon (i.e., outside 50 meters), and the likelihood of sturgeon interaction is believed to be lower. The changes to zero possession requirements in Option 2 are expected to result in impacts that are similar or slightly more positive than Option 1. This is because the prohibition on possession may reduce overall recreational fishing effort in the GOM. For these reasons, and the reasons stated above, Option 2 is likely to have low positive to neutral impacts on protected species.

Overall, Option 2 would be expected to have a low negative impact on protected species when compared to No Action.

7.3.2.2 Default Groundfish Specifications

7.3.2.2.1 Option 1: No Action

In the absence of specifications for a stock due to a delay in rulemaking, fishing would not be allowed in the broad stock area for that stock. There are currently no provisions within the Northeast Multispecies FMP that allow for specifications to be rolled forward into the next fishing year to enable fishing to begin of time at the start of the fishing year (e.g. from FY 2014 to FY 2015). In the event of a delay in

rulemaking, No Action would decrease fishing effort in all broad stock reporting areas (GOM, GB, SNE) at the start of the fishing year, and would have a positive impact on protected resources.

7.3.2.2.2 Option 2: Percentage Rollover Provisions for Default Specifications (*Preferred Alternative*)

Option 2 would allow the FY to begin on time in the event of a delay in rulemaking by rolling forward specification values from one fishing year into the next (e.g. from FY 2014 to FY 2015). Sub-Options A, B, and C would roll forward a percentage of the prior year's stock specific ACL up to a value that may not exceed the stock's ABC for the upcoming fishing year. The default rollover ACL would be replaced by new, updated specifications upon rulemaking. This is an administrative measure that, in and of itself, is not expected to impact fishing effort or behavior over the course of an entire fishing year. However, varying percentages would allow varying levels of fishing effort in the event of a major delay in rulemaking.

7.3.2.2.2.1 Sub-Option A: Default Rollover 35% of all groundfish stocks to the following FY. (*Preferred Alternative*)

Sub-Option A is less conservative than Sub-Options B and C. These default rollover measures would have may have slightly negative impact on protected resources when compared to Sub-Options B and C because this option would allow the fishery to catch up to 35% of the prior year's ACL before new specifications are adopted. Sub-Option A would have a negligible impact on protected species when compared to No Action.

7.3.2.2.2.2 Sub-Option B: Default Rollover 20% of all groundfish stocks to the following FY.

Sub-Option B is the more conservative than Sub-Option A, but less conservative than Sub-Option C. These default rollover measures would have may have slightly positive impacts on protected resources when compared to Sub-Options A, and a slightly negative impact when compared to Sub-Option C because this would allow the fishery to catch up to 20% of the prior year's ACL before new specifications are adopted. Sub-Option B would have a negligible impact on protected species when compared to No Action.

7.3.2.2.2.3 Sub-Option C: Default Rollover 10% of all groundfish stocks to the following FY.

Sub-Option C is the most conservative of the default rollover measures under consideration, and would have may have slightly positive impacts on protected resources when compared to Sub-Options A or B because this would only allow the fishery to catch up to 10% of the prior year's ACL before new specifications are adopted. Sub-Option C would have a negligible impact on protected species when compared to No Action.

7.3.2.3 Sector ACE Carryover

7.3.2.3.1 Option 1: No Action

No Action would continue to allow groundfish sectors to carry over up to 10% of their unused sector ACE, as outline in Amendment 16. This is an administrative alternative and is not expected to have an impact on protected species.

7.3.2.3.2 Option 2: Modification to Sector ACE carryover

Option 2 would modify Sector carryover provisions in Amendment 16. Carryover effectively increases the total amount of allocation a sector can catch in the following fishing year.

Option 2 would allow groundfish sectors to carry forward up to 10% of unused ACE provided that the total unused sector ACE carried forward for all sectors from the previous FY does not exceed the ABC level minus the ACL for the fishing year in which the carryover would be landed. This provision keeps catches within the prescribed ABC, and in and of itself, is not expected to change fishing effort or behavior. This is an administrative alternative and is not expected to have an impact protected species.

7.4 Economic Impacts

Introduction
Consideration of the economic impacts of the changes made in this framework is required pursuant to the National Environmental Policy Act (NEPA) of 1969 and the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1976. NEPA requires that before any federal agency may take "actions significantly affecting the quality of the human environment," that agency must prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS) that includes the integrated use of the social sciences (NEPA Section 102(2)(C)). The MSA stipulates that the social and economic impacts to all fishery stakeholders should be analyzed for each proposed fishery management measure to provide advice to the Council when making regulatory decisions (Magnuson-Stevens Section 1010627, 109-47).

The National Marine Fisheries Service (NMFS) provides guidelines to use when performing economic reviews of regulatory actions. The key dimensions for this analysis are expected changes in net benefits to fishery stakeholders, the distribution of benefits and costs within the industry, and changes in income and employment (NMFS 2007). Where possible, cumulative effects of regulations are identified and discussed. Non-economic social concerns are discussed in Section 7.5. The economic impacts presented here consist of both qualitative and quantitative analyses dependent on available data, resources, and the measurability of predicted outcomes. It is assumed throughout this analysis that changes in revenues would have downstream impacts on income levels and employment; however, these are only mentioned if directly quantifiable.

Alternatives addressing ACLs, GOM cod spawning area closures, prohibition on the possession of GOM cod, and a combination of GOM cod commercial fishing area closures and prohibition on recreational possession of GOM cod and their sub-options are inter-related. Consequently, other than the No Action options, the impacts of each must be analyzed together. There are eight possible combinations:

1) No Action ACLs,
2) Modified (FW 53) ACLs with no new closures and existing GOM cod retention requirements,
3) FW 53 ACLs with spawning closures Option A and existing GOM cod retention requirements,
4) FW 53 ACLs with spawning closures Option B and existing GOM cod retention requirements,
5) FW 53 ACLs with no new closures and zero retention of GOM cod,
6) FW 53 ACLs with spawning closures Option A and zero retention of GOM cod,
7) FW 53 ACLs with spawning closures Option B and zero retention of GOM cod,
8) FW 53 ACLs with GOM cod protection measures, encompassing zero retention for the recreational fishery and changes to rolling closures in the commercial fishery.[26]

The impacts of these combinations are addressed using the following methods.

Impacts to the sector component of the groundfish fishery

Methods
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 most likely trips to take place under new regulatory conditions. To do this, a large pool of actual trips is created from a reference data set. The composition of this pool is conditioned on each trip's utilization of allocated ACE, under the assumption that the most likely trips to take place in the FY being analyzed are those fishing efficiently under the new regulatory requirements. 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

[26] The term "FW 53 ACLs" refers to the *Preferred Alternative* for the ACLs in this action, Option 2 in Section 4.1.2.2.

the 17 allocated stocks. Net revenues are calculated as gross revenues minus trip costs minus quota opportunity costs, where trip costs are based on observer data and quota opportunity costs are estimated from an inter-sector lease value model, based here on FY 2013 (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 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;
- 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.

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 and other operating costs may change due to larger economic shifts or shoreside industry consolidation. Demand for lease quota may drop as a result of time/area closures and/or zero retention policies, but the substantial decline in GOM cod quota supply will likely outweigh the impact of these forces, resulting in an increase in GOM cod lease values.

The net effect of the constraints placed by these assumptions is unclear. The selection algorithm draws only efficient trips—fishermen making relatively inefficient trips will bias the model results high. Fishermen, however, are generally good at their job, and through a combination of technological improvement (gear rigging, equipment upgrades, etc.) or behavioral modifications, are likely to improve on their ability to avoid constraining stocks. This will bias the model results low.

Additionally, the model will, in general, 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 still 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 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 model is intended to capture fishery-wide behavioral changes with respect to groundfish sub-ACL changes, and groundfish catch is maximized by the constrained optimization algorithm. Catch of non-groundfish stocks on groundfish trips are captured in the model, but not explicitly modeled, such that constraints on other fisheries are not incorporated.

To model the impacts of the proposed measures, several changes to standard QCM methods were made. Time/area closures were accommodated by removing from the sample pool of available trips all trips that occurred inside closure areas during closed months. However, the model was unable to be adjusted to account for trips in areas that are currently closed but are proposed to open (e.g., April under the GOM cod protection measures). Zero retention is modeled by converting all kept cod to discards, and the associated revenues are deducted from each trip's revenue. This changes the relative efficiency of trips, and the consequent probability that a trip will be drawn into a synthetic fishing year during model runs. In this respect, the behavioral changes associated with both time/area closures (i.e., the need to fish in other areas or other times) and zero retention (i.e. the reduced incentive to fish in areas of the GOM where cod are likely to be present in significant abundance) are directly incorporated in the model results.

That said, the true impacts of zero retention policies are difficult to model because it is uncertain how this measure would affect fishing behavior.

A last modification of the model was made to increase the likelihood, however slightly, that inefficient trips may happen. Between 1-2% of trips drawn into this version of the model would, under previous versions of the QCM, not have been drawn. This accommodation is made in deference to the possibility that an unknown number of trips may encounter unforeseen and unplanned levels of constraining stocks, primarily GOM cod. The inclusion of this modification decreases predicted aggregate fishery revenues, but this decrease is appropriate given the very low allocation of GOM cod.

Groundfish vessels on groundfish trips form the unit of measurement for this analysis and gross revenues from groundfish trips and from groundfish species alone are reported metrics. Many groundfish fishermen are involved in other fisheries and groundfish trip revenues may represent anywhere from 100% to a small fraction of the total revenues of individual fishing business impacted by these regulations.

The QCM is a prediction model and it is import to understand its ability to predict groundfish fishing in the past. The model was developed during FY 2011 to make predictions for FW 47 (FY 2012) and has been used in analyzing the impacts of all subsequent groundfish management actions that included ACL changes for the groundfish fishery. Table 71, summarizes its performance over the past few years.

Table 71 - QCM predictions, FY2011 – 2014 (2014 $ millions)

		FY 2010	FY2011[A] Model Calibration		FY2012 FW 47 (modified)		FY2013 FW 48		FY2014 FW 51		FY2014 GOM haddock/cod EA[B]	
		Realized	Predicted[1]	Realized	Predicted[2]	Realized	Predicted[3]	Realized	Predicted[4]	Realized	Predicted[4]	Realized
Revenues	Gross Revenue	110.2	137.8	121.4	92.3	93.1	75.5	79.2	71	n/a	81	n/a
	Gross Groundfish Revenue	89.1	114.4	93.7	73.5	70.4	57	58.6	55.6	n/a	64.3	n/a
Costs	Operations Cost	25.1	30.4	32.9	17.8	31.5	15	26.1	21.6	n/a	24.3	n/a
	Quota Opportunity Cost	21	29.4	28.4	21.4	17.6	12.4	11.3	12	n/a	12	n/a
	Sector Cost	2.5	3.3	2.7	1.9	2	1.8	1.8	1.6	n/a	1.7	n/a
Pct. Gross revenues net variable costs		*56%*	*54%*	*47%*	*55%*	*45%*	*61%*	*51%*	*50%*		*53%*	

[1]Reference pool = FY2010
[2]Reference pool = FY2010-11 (last six months FY10, first six months FY11)
[3]Reference pool = FY2012
[4]Reference pool = FY2013

[A]FY2011 revenues from GB haddock were predicted at $25.2 million. Realized revenues from GB haddock were $11.7 million.

[B]Based on updated GOM haddock ACL and GOM cod interim measures.

Lessons can be gleaned from Table 71. First, model results are highly sensitive to stock conditions. For example, the model over-predicted FY 2011 by about 20% almost exclusively due to GB haddock catch rates being higher in the reference year (FY 2010) than the prediction year (FY 2011). Back out GB haddock and gross revenues for groundfish are over-predicted by only about 5%.

The values used as the 'FY2014 Baseline' in Table 72 represent the best estimate of the economic impacts of the FW53 ACLs when compared to specifications adopted through the last framework action (FW51) and the interim measures for GOM cod and GOM haddock in FY 2014. The longer the lag between the reference year and the prediction year, the more likely stock conditions are to diverge, compromising prediction accuracy. In FY 2012 and 2013, the model handled quota reductions well, over-predicting slightly in 2012 and under-predicting slightly in 2013. Both the original FW 51 and subsequent models using FY 2013 input data appear to be biased low relative to a FY 2014 linear catch trajectory. Revenues for FY 2014 will likely be higher than FY 2013, and higher than those previously predicted. This is primarily driven by improved stock and fishery conditions for offshore stocks such as GB haddock and redfish. It should be noted that because the input data for the QCM is from FY2013, the northern windowpane flounder AMs were not incorporated in the analysis.

Cost predictions are less straightforward. The QCM demonstrates a persistent low bias when predicting operations costs—those associated with making a fishing trip, such as fuel, ice and food. This is because the model optimizes the trips taking place in the prediction year. In reality, the model predicts total catches and revenues somewhat accurately, but arrives at these totals from a substantially lower number of trips it takes to obtain those catches in reality—the model predicts on the order of 30% fewer trips than are realized. The low cost prediction bias will likely be consistent across time and year-on-year trends may prove meaningful, though it is certainly not guaranteed. Between FY 2012 and FY 2013, the model predicted a six percentage point increase in operational profit (gross revenues as a percent of variable costs). This six percentage point increase emerged from the realized data as well. One year does not make a trend, but the model predicts a decrease in operational profit between FY 2013 and 2014. Such a decrease would be consistent with longer steaming times for inshore vessels due to interim 2014 measures, but may be somewhat mitigated by increased fishing opportunities offshore for larger vessels. These trips will have lower quota opportunity costs (i.e., the cost of using a pound of ACE, whether leased in or not leased out) as stocks like GB haddock and redfish have low ACE lease values.

Data

Data Management and Imputation System (DMIS) data are used throughout. DMIS derives sub-trip/stock level landings and discards from Vessel, Dealer and Observer reports as well as the Sector and Permit databases maintained by NMFS GARFO and NEFSC.

General Overall Results

No Action in Section 4.1.2.2 does not specify ACLs for several stocks, including pollock, which is a unit stock. If the fishing year were to begin without specifications in place for this stock, vessels enrolled in sectors would not be permitted to fish for groundfish. Similarly, the common pool would not be able to operate and there would be no directed groundfish fishery. As this option is inconsistent with several MSA provisions, a more likely outcome would be additional interim measures proposed by NMFS GARFO. No Action is unlikely, and was not given additional consideration.

For the seven other proposed measures permutations, gross revenues from groundfish trips are predicted to decline by roughly 5-10% from a FY 2014 baseline of $81 million (Table 71). Gross revenues are predicted to be about $1.5 million higher under sub-option A in the GOM cod spawning area closures (Section 4.2.1.1.2) than the proposed FW53 ACL option alone (Table 72). GOM cod spawning area closure Sub-Option B is predicted to realize about $500k less in gross revenues than Sub-Option A. Zero retention options have non-linear impacts across the closure options, but produce uniformly higher aggregate gross revenues than non-zero retention options. Under the FW 53 ACLs with no additional closures, the predicted aggregate gross revenues under zero retention alone are on the order of $2.5 million higher than without zero retention. GOM cod spawning area

closure sub-option A with zero retention is predicted to see slightly higher revenues than zero retention without the spawning closures. GOM cod spawning area closure sub-option B, however, is predicted to realize nearly $1 million more in aggregate revenues relative to GOM cod spawning area closure sub-option A. The GOM cod protection measures alternative, in which would modify existing rolling closures in the commercial fishery, is predicted to have less negative impacts than the FW 53 ACLs alone in FY 2015, but more negative impacts than zero retention of GOM cod or zero retention combined with GOM cod spawning area closure sub-options A or B.

In FY 2014 under the interim measures, American plaice and witch flounder are predicted to be the most constraining stocks, with pollock contributing more revenues than any other stock (Table 73). Under all seven permutations of FW53 alternatives, constraining stocks are predicted to be GB winter flounder, SNE yellowtail flounder, and GOM cod (Table 74 to Table 80). Under the GOM cod spawning area closure options (both for zero and full GOM cod retention) catch of redfish, plaice, witch flounder and white hake are higher than under options with no additional closures. Discards of GOM cod under the seven alternatives and the baseline are shown in Table 81. Discards would be expected to be higher with zero retention.

At the port level, losses relative to the FY 2014 baseline are not evenly distributed across the groundfish fishery (Table 82). Ports north of Boston are predicted to incur significant loses under all alternatives, with Gloucester, MA predicted to have around 20-30% lower revenues in FY 2015 than FY 2014 (Table 83). New Hampshire ports are predicted to see a 40-50% decline in revenues and Maine ports are predicted to see a 13-19% drop. The port of Boston, MA is not expected to incur loses as large as those to the north, with revenues declining 0-7% from FY 2014 to FY 2015. Ports farther south are, in some cases, predicted to see a revenue increase. The port of New Bedford, MA is predicted to receive additional revenue of 6-10% under all alternatives, and Point Judith, RI is predicted to see revenues increase by 19-31%. Rhode Island, as a whole, is also predicted to see revenue increases of 19-29%. New York ports see revenues increase and New Jersey ports see revenues decline under all alternatives, but both states continue to have much lower groundfish volume than Maine, Massachusetts, and Rhode Island.

Similar to the port-level impacts, these measures are predicted to disproportionately affect smaller vessels (Table 84). Vessels in the 30'-50' size class are predicted to see declines on the order of 30-60% in gross revenues fleet-wide (Table 85). These smaller vessels would be most heavily impacted under additional closure areas, though revenues are expect to decline around 30% from the implementation of FW53 ACLs alone. Vessels in the 50'-75' size class are predicted to see a more modest reduction, around 10-15% under all alternatives. Unlike the 30-50' vessels, the 50-75' vessels are predicted to incur smaller loses when further closure areas are implemented. Vessels 75' and larger class are predicted to see slight loses under the FW53 ACLs alone or under the GOM cod protection measure closures. However, the largest vessels have minor revenue gains under the GOM cod spawning area closure sub-option A and under the GOM cod spawning area closure sub-option B with zero retention on GOM cod. As previously noted, the QCM does not account for the reopening of inshore areas of the GOM during the month of April under the GOM cod protection measures. As such, any potential benefit or loss in revenue from this additional access is not accounted for in the revenue values presented in Table 72 and Table 80.

Discussion

The groundfish fishery has experienced gross revenues declines from $120M FY 2011 to $79M in FY 2013, but the additional declines forecasted here will present serious, and perhaps unprecedented, difficulties for these vessels, owners and crew. Ports may see 50-80% declines in revenues from groundfish, and many vessels will either be forced to relocate or stop fishing altogether. The impacts on shoreside businesses in ports throughout the inshore GOM are difficult to predict, but infrastructure and facilities supporting fishing operations may be forced to consolidate, and may disappear altogether. When feasible, relocation of vessels to southern New England ports will likely occur, is not easy to quantify these impacts. As Table 84 and Table 85 show, the adoption of either GOM cod spawning area closures in conjunction with the FW 53 ACLs is expected to cause more revenue loss for 30-50' vessels than larger vessels.

The opportunity cost of quota may not be reflected in the ACE leasing markets currently. The analysis shows a consistent trend where closure areas lead to an *increase* in revenues relative to the FW53 sub-ACLs with no additional closures. The reason for this may be that quota, and GOM cod quota in particular, may not be flowing to those who may most profitably use it. Table 86 and Figure 37 demonstrate that larger vessels are able to generate much more revenue per pound of GOM cod ACE than smaller vessels—sometimes many multiples more. When GOM cod is a constraining stock, as it was in FY 2013, this should imply that vessels could still profitably afford to spend much more on leased GOM cod ACE, though this has not been evident in the ACE leasing market (Murphy et al. 2014). The question is not that GOM cod ACE leases have, historically, been so high, but rather, for FY 2013, how lease values remained so low in the face of constraints. The interim measures adopted mid-way through FY 2014 will likely mean that GOM cod is not constraining for vessels fishing in this stock area as modeling predicts plaice and witch flounder will constrain the fishery first (EA for GOM Cod Interim Action, 2014). Therefore, the GOM cod ACE lease values will likely remain at the low end of their historical range. FY 2015, however, may be the year that GOM cod ACE lease prices rise substantially above the ex-vessel price for cod.

This could partly explain why analysis shows that the fishery may generate more revenues under the closure scenarios than under the sub-ACL options with no closures. Further, Figure 38 shows that vessels fishing farther east are able and may be willing to pay much more for GOM cod ACE than vessels fishing west of 70°W longitude. Essentially, when GOM cod ACE is highly constraining, the model assumes only vessels able to use it efficiently will be fishing it. The fact that the sub-ACL options with no closures are predicted to have lower gross revenues (in aggregate) than the closure options points to a situation where inshore GOM vessels are not being offered sufficiently high ACE lease prices or, alternatively, have been (and modeling indicates will continue to be) unwilling to accept such lease arrangements. There are many possible reasons for this, the most relevant being that fisherman may simply want to fish, and prioritize their profession over higher profits.

Given the fact that GOM cod could very well be a constraining stock in FY 2015, the revenues generated per GOM cod ACE could go a long way in determining total groundfish revenue generated in FY 2015. The model assumes that quota will flow to those (larger) vessels that can use it. Whether this proves to be the case, or not, will remain to be seen.

Zero retention options are predicted to see higher gross revenues than No Action, because the assumed discard mortality rates for trawl and gillnet vessels are (75% and 80%, respectively) allowing captains to land 20-25% more groundfish per unit of GOM cod ACE when catch of GOM cod is discarded and other concurrently captured stocks are not fully utilized. Table 86 indicates that vessels may make $40 or more per pound of GOM cod ACE in FY 2015, even when backing out the lost revenue from cod ($3/lb). The ability to leverage 25% more groundfish landings per GOM cod ACE could translate to an extra $10 or more per pound of ACE from discards than landed catch.

The analysis of zero retention options underestimates realized revenues for all size classes and GOM ports, because these models assume that cod caught and discarded will be accounted for. With GOM cod as the primary constraint on fishing in the GOM, vessels may fish under two very different sets of incentives depending on whether or not a trip is observed. If a trip is observed, the primary incentive for captains could be to minimize cod as a percent of total catch. This incentive is likely to be strong, as there is an inverse and nearly linear relationship between a sector's discard rate for GOM cod and the number of trips that sector's vessels will be able to make before being closed out of the broad stock area. The variance of cod caught on a trip is high, and it is possible that captains would be able to achieve quite low discard rates on observed trips.Rather, vessel operators will seek to maximize revenue on all species on unobserved trips, irrespective of GOM cod catch. Irrespective of the incentives driving behavior, Table 86 indicates that vessels in FY15 can make $10-20 or more per pound of cod caught than in FY14.

The net effect will be twofold:

- True discards are likely to be many multiples of imputed discards, rendering the catch data an

incomplete picture of true fishing mortality; and

- Gross revenues will be substantially higher than predicted for all aspects of the GOM fishery, as the nominal cod constraint is essentially relaxed through a combination of observer effects and mandated regulatory discards on unobserved trips.

Fishermen are expected to fish in a manner that will generate the highest profitability in a FY given the regulatory constraints. Again, there is no regulatory or compliance aspect to this situation—captains are not required to "act the same on observed and unobserved trips". Captains, however, are required by VTR regulations to record all catch and report whether kept or discarded, whether on an observed or unobserved trip.

For the GOM cod protection measures, which alter the rolling closures in the commercial fishery and implement a zero possession limit in the recreational fishery, the higher predicted losses relative to zero possession limit and GOM cod spawning area closure can be explained by lease market for GOM cod ACE. The existing GOM rolling closures shut out inshore vessels from some fishing opportunities, but not to such a degree that they lease all or most of their GOM cod ACE to larger vessels. The more efficient vessels, in terms of using GOM cod ACE, would be unable to do so relative to other management alternatives, and smaller vessels would continue to fish, because it is what they wish to do, though it may not be in their best interest. The analysis of benefit to revenues that may be obtained by opening previously closed areas (such as in April under the GOM cod protection measures) was unable to be determined using the QCM.

The FY 2013 input data for the QCM did not include AMs for windowpane flounder. As outlined in FW 52, the selective gear requirements within the AM areas may reduce profitability by impacting flatfish catch. In the northern windowpane AM areas, catch of GB winter flounder, a stock that is fully utilized under all FY 2015 iterations of the QCM, may be particularly affected. Haddock is the highest-grossing groundfish stock in the northern areas, and haddock catchability is not likely to be heavily impacted by the selective gear requirements. In the southern windowpane AM areas, flatfish represents the vast majority of groundfish catch. Consequently, the QCM may particularly overestimate the profitability of these fishing areas in FY 2014 and FY 2015.

A final point on the QCM, the analyses include a higher probability of "ACE inefficient" trips occurring in the prediction scenarios than in previous year's models. The extremely low GOM cod sub-ACL carries a very real risk that a small number of trips, particularly observed trips, that encounter unexpected quantities of GOM cod would endanger fishing operations for entire sectors. Table 86 may provide evidence of a second problem—higher than expected GOM cod catch rates. The decrease in revenues per GOM cod ACE from 2012 to 2013 is especially worrying in light of the fact that GOM cod was a constraining stock in FY 2013. If cod become difficult for fisherman to avoid, these models will surely over-state aggregate revenues and under-state predicted losses for affected vessels, ports and communities.

Table 72 - Summary of median predicted gross revenues for seven models ($M, median values with 5th and 95th percentile confidence intervals from 500 simulations)

Model	All groundfish trips, gross			All groundfish, gross			% Change from FY14 Groundfish trips	% Change from FY14 Groundfish
	Revenue	p5 Revenue	p95 Revenue	Revenue	p5 Revenue	p95 Revenue		
FY 2014 Baseline[1]	81.0	77.8	84.0	64.6	61.8	67.1		
FW 53 ACLs	75.3	71.1	79.4	58.1	54.5	61.5	-7%	-10%
FW 53 ACLs + Closure A	76.9	72.6	80.4	59.6	56.0	62.5	-5%	-8%
FW 53 ACLs + Closure B	76.1	71.8	80.0	58.8	55.3	62.0	-6%	-9%
FW 53 ACLs + Zero retention GOM cod	78.0	73.9	81.5	60.4	56.9	63.1	-4%	-7%
FW 53 ACLs + Zero retention GOM cod + Closure A	77.8	73.8	81.6	60.3	56.8	63.3	-4%	-7%
FW 53 ACLs + Zero retention GOM cod + Closure B	78.1	74.3	81.0	60.5	57.6	63.2	-4%	-6%
FW 53 ACLs + GOM cod Protection Measures	76.9	72.5	81.6	59.0	55.5	62.2	-5%	-9%

[1]The FY2014 Baseline is based on updated GOM haddock ACL and GOM cod interim management measures.

Note: "FW53 ACLs" refers to the *Preferred Alternative*, Option 2 in Section 4.1.2.

Table 73 - FY 2014 baseline, predicted catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,138	4,793	36%	10.9	10.2	11.5
GB Winter Flounder	3,364	1,587	47%	6.0	5.4	6.9
GB Haddock West	18,666	4,208	23%	10.7	9.8	11.8
GB Cod West	1,584	1,482	94%	5.6	5.3	6.0
White Hake	4,308	1,964	46%	5.8	5.5	6.1
Plaice	1,359	1,329	98%	4.6	4.3	4.7
Redfish	10,522	4,504	43%	5.0	4.5	5.5
SNE Winter Flounder	968	758	78%	2.5	2.2	2.8
Witch Flounder	601	590	98%	3.1	3.0	3.2
GB Haddock East	9,971	1,034	10%	2.5	2.0	3.0
SNE/MA Yellowtail Flounder	450	365	81%	1.1	1.0	1.2
GOM Cod	814	700	86%	3.6	3.4	3.8
CC/GOM Yellowtail Flounder	467	372	80%	1.1	1.0	1.2
GOM Haddock	432	187	43%	0.7	0.6	0.8
GOM Winter Flounder	690	163	24%	0.6	0.6	0.7
Halibut	0	51	.	0.2	0.2	0.2
GB Yellowtail Flounder	252	40	16%	0.2	0.1	0.2
GB Cod East	145	25	17%	0.1	0.1	0.1
Northern Windowpane	0	218	.	0.0	0.0	0.0
Ocean Pout	0	32	.	.	.	.
Southern Windowpane	0	112	.	.	.	.
Wolffish	0	16	.	.	.	.
Non groundfish	0	9,331	.	16.3	15.6	17.1

Table 74 - FW 53 sub-ACLs (no closures), predicted stock level catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,632	3,803	28%	8.6	8	9.2
GB Winter Flounder	1,875	1,869	100%	7	6.5	7.3
GB Haddock West	16,206	4,454	27%	11.3	9.6	13.2
GB Cod West	1,629	1,531	94%	5.8	5.2	6.1
White Hake	4,313	1,643	38%	4.9	4.5	5.2
Plaice	1,382	1,156	84%	3.9	3.6	4.2
Redfish	10,988	3,924	36%	4.3	3.8	4.9
SNE Winter Flounder	1,147	838	73%	2.7	2.3	3.1
Witch Flounder	598	512	86%	2.6	2.5	2.8
GB Haddock East	5,402	1,067	20%	2.6	2.1	3.2
SNE/MA Yellowtail Flounder	457	457	100%	1.4	1.3	1.5
GOM Cod	202	201	100%	1	1	1
CC/GOM Yellowtail Flounder	443	215	48%	0.6	0.5	0.7
GOM Haddock	948	122	13%	0.4	0.4	0.5
GOM Winter Flounder	375	97	26%	0.4	0.3	0.4
Halibut	0	46	.	0.2	0.2	0.2
GB Yellowtail Flounder	192	53	28%	0.2	0.1	0.4
GB Cod East	124	30	24%	0.1	0.1	0.1
Northern Windowpane	0	250	.			
Ocean Pout	0	35	.			
Southern Windowpane	0	148	.			
Wolffish	0	14	.			
Non groundfish	0	9,932	.	16.9	15.8	18.1

Table 75 - FW 53 sub-ACLs with Closure A, predicted stock level catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,632	3,880	28%	8.7	8	9.3
GB Winter Flounder	1,875	1,867	100%	6.9	6.4	7.3
GB Haddock West	16,206	4,597	28%	11.6	10	13.2
GB Cod West	1,629	1,550	95%	5.8	5.2	6.1
White Hake	4,313	1,757	41%	5.2	4.8	5.6
Plaice	1,382	1,235	89%	4.2	3.9	4.5
Redfish	10,988	4,306	39%	4.8	4.2	5.3
SNE Winter Flounder	1,147	839	73%	2.7	2.3	3.1
Witch Flounder	598	533	89%	2.7	2.5	2.9
GB Haddock East	5,402	1,122	21%	2.7	2.2	3.3
SNE/MA Yellowtail Flounder	457	457	100%	1.4	1.3	1.5
GOM Cod	202	201	100%	1	1	1
CC/GOM Yellowtail Flounder	443	147	33%	0.4	0.4	0.5
GOM Haddock	948	128	13%	0.4	0.4	0.5
GOM Winter Flounder	375	82	22%	0.3	0.2	0.3
Halibut	0	47	.	0.2	0.2	0.2
GB Yellowtail Flounder	192	52	27%	0.2	0.1	0.4
GB Cod East	124	30	24%	0.1	0.1	0.1
Northern Windowpane	0	245	.	0	0	0
Ocean Pout	0	35	.			
Southern Windowpane	0	138	.			
Wolffish	0	14	.			
Non groundfish	0	9,369	.	17.1	16.1	18.3

Table 76 - FW 53 sub-ACLs with Closure B, predicted stock level catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,632	3,749	28%	8.4	7.8	9
GB Winter Flounder	1,875	1,869	100%	7	6.4	7.3
GB Haddock West	16,206	4,535	28%	11.5	10	13.2
GB Cod West	1,629	1,526	94%	5.7	5.2	6
White Hake	4,313	1,700	39%	5	4.6	5.4
Plaice	1,382	1,233	89%	4.2	3.9	4.5
Redfish	10,988	4,181	38%	4.6	4	5.2
SNE Winter Flounder	1,147	820	72%	2.6	2.3	3.1
Witch Flounder	598	531	89%	2.7	2.5	2.9
GB Haddock East	5,402	1,095	20%	2.7	2.2	3.3
SNE/MA Yellowtail Flounder	457	457	100%	1.4	1.3	1.5
GOM Cod	202	201	100%	1	1	1
CC/GOM Yellowtail Flounder	443	195	44%	0.5	0.5	0.6
GOM Haddock	948	129	14%	0.5	0.4	0.5
GOM Winter Flounder	375	91	24%	0.3	0.3	0.4
Halibut	0	46	.	0.2	0.2	0.2
GB Yellowtail Flounder	192	54	28%	0.2	0.1	0.4
GB Cod East	124	29	24%	0.1	0.1	0.1
Northern Windowpane	0	243	.	0	0	0
Ocean Pout	0	34	.			
Southern Windowpane	0	137	.			
Wolffish	0	14	.			
Non groundfish	0	9,330	.	17.1	16.1	18.1

Table 77 - FW 53 sub-ACLs with zero GOM cod retention, predicted catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,632	4,078	30%	9.2	8.7	9.8
GB Winter Flounder	1,875	1,868	100%	7	6.3	7.3
GB Haddock West	16,206	4,477	28%	11.4	10.2	13
GB Cod West	1,629	1,554	95%	5.8	5.4	6.2
White Hake	4,313	1,736	40%	5.1	4.8	5.6
Plaice	1,382	1,221	88%	4.1	3.8	4.5
Redfish	10,988	4,117	37%	4.6	4	5.1
SNE Winter Flounder	1,147	855	75%	2.7	2.4	3.1
Witch Flounder	598	544	91%	2.8	2.6	3
GB Haddock East	5,402	1,082	20%	2.6	2.1	3.3
SNE/MA Yellowtail Flounder	457	456	100%	1.4	1.3	1.5
GOM Cod	202	197	98%	0	0	0
CC/GOM Yellowtail Flounder	443	245	55%	0.7	0.6	0.7
GOM Haddock	948	137	14%	0.5	0.4	0.5
GOM Winter Flounder	375	112	30%	0.4	0.4	0.5
Halibut	0	48	.	0.2	0.2	0.2
GB Yellowtail Flounder	192	52	27%	0.2	0.1	0.4
GB Cod East	124	29	24%	0.1	0	0.1
Northern Windowpane	0	251	.	0	0	0
Ocean Pout	0	36	.			
Southern Windowpane	0	148	.			
Wolffish	0	15	.			
Non groundfish	0	10,196	.	17.4	16.2	18.5

Table 78 - FW 53 sub-ACLs with zero GOM cod retention and Closure A, predicted catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,632	4,030	30%	9	8.2	9.7
GB Winter Flounder	1,875	1,866	100%	7	6.1	7.2
GB Haddock West	16,206	4,477	28%	11.4	10	13.3
GB Cod West	1,629	1,553	95%	5.8	5.4	6.1
White Hake	4,313	1,821	42%	5.3	4.8	5.7
Plaice	1,382	1,268	92%	4.3	4	4.6
Redfish	10,988	4,384	40%	4.9	4.2	5.5
SNE Winter Flounder	1,147	866	75%	2.7	2.3	3.1
Witch Flounder	598	544	91%	2.7	2.5	2.9
GB Haddock East	5,402	1,109	21%	2.7	2.2	3.3
SNE/MA Yellowtail Flounder	457	457	100%	1.4	1.2	1.5
GOM Cod	202	196	97%	0	0	0
CC/GOM Yellowtail Flounder	443	164	37%	0.5	0.4	0.5
GOM Haddock	948	135	14%	0.5	0.4	0.5
GOM Winter Flounder	375	89	24%	0.3	0.3	0.4
Halibut	0	48	.	0.2	0.2	0.2
GB Yellowtail Flounder	192	56	29%	0.2	0.1	0.4
GB Cod East	124	26	21%	0.1	0.1	0.1
Northern Windowpane	0	244	.	0	0	0
Ocean Pout	0	34	.	0	0	0
Southern Windowpane	0	137	.			
Wolffish	0	15	.			
Non groundfish	0	9,407	.	17.3	16	18.5

Table 79 - FW 53 sub-ACLs with zero GOM cod retention and Closure B, predicted catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,632	3,987	29%	8.9	8.2	9.6
GB Winter Flounder	1,875	1,867	100%	7	6	7.3
GB Haddock West	16,206	4,550	28%	11.5	10.2	13.1
GB Cod West	1,629	1,543	95%	5.7	5.3	6.1
White Hake	4,313	1,791	42%	5.3	4.9	5.7
Plaice	1,382	1,285	93%	4.4	4.1	4.7
Redfish	10,988	4,297	39%	4.8	4.3	5.5
SNE Winter Flounder	1,147	842	73%	2.7	2.3	3
Witch Flounder	598	554	93%	2.8	2.6	3
GB Haddock East	5,402	1,115	21%	2.7	2.2	3.3
SNE/MA Yellowtail Flounder	457	457	100%	1.4	1.2	1.5
GOM Cod	202	197	97%	0	0	0
CC/GOM Yellowtail Flounder	443	219	49%	0.6	0.5	0.7
GOM Haddock	948	142	15%	0.5	0.5	0.6
GOM Winter Flounder	375	106	28%	0.4	0.3	0.4
Halibut	0	48	.	0.2	0.2	0.2
GB Yellowtail Flounder	192	52	27%	0.2	0.1	0.4
GB Cod East	124	29	23%	0.1	0.1	0.1
Northern Windowpane	0	247	.	0	0	0
Ocean Pout	0	34	.			
Southern Windowpane	0	136	.			
Wolffish	0	15	.			
Non groundfish	0	9,492	.	17.4	16	18.3

Table 80 - FW 53 sub-ACLs with GOM cod protection measures, predicted catch, utilization and revenues ($M)

	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Pollock	13,632	3,707	27%	8.3	7.6	8.9
GB Winter Flounder	1,875	1,870	100%	7	6.5	7.3
GB Haddock West	16,206	4,495	28%	11.4	10.1	13.1
GB Cod West	1,629	1,526	94%	5.7	5.2	6.1
White Hake	4,313	1,689	39%	5	4.6	5.4
Plaice	1,382	1,218	88%	4.1	3.8	4.5
Redfish	10,988	4,145	38%	4.6	4	5.1
SNE Winter Flounder	1,147	833	73%	2.7	2.2	4.2
Witch Flounder	598	526	88%	2.7	2.5	2.9
GB Haddock East	5,402	1,107	20%	2.7	2.1	3.4
SNE/MA Yellowtail Flounder	457	457	100%	1.4	1.3	1.5
GOM Cod	202	201	100%	1	1	1
CC/GOM Yellowtail Flounder	443	204	46%	0.6	0.5	0.6
GOM Haddock	948	124	13%	0.4	0.4	0.5
GOM Winter Flounder	375	96	26%	0.4	0.3	0.4
Halibut	0	47	.	0.2	0.2	0.2
GB Yellowtail Flounder	192	55	28%	0.2	0.1	0.4
GB Cod East	124	30	24%	0.1	0.1	0.1
Northern Windowpane	0	252	.	0	0	0
Ocean Pout	0	35	.			
Southern Windowpane	0	136	.			
Wolffish	0	14	.			
Non groundfish	0	9,405	.	17.4	16.2	20.5

Table 81 - Discards of GOM cod in FY 2014 and under the FW 53 alternatives for FY 2015

	Discards (mt)
FY 2014	19
FW 53 ACLs	11
FW 53 ACLs + Closure A	11
FW 53 ACLs + Closure B	11
FW 53 ACLs + ZR GOM cod	197
FW 53 ACLs + ZR GOM cod + Closure A	196
FW 53 ACLs + ZR GOM cod + Closure B	197
FW 53 ACLs + GOM cod protection measures	11

Table 82 - Homeport state and port predicted gross groundfish revenues ($M, median values with 5th and 95th percentile confidence intervals, 500 simulations)

State / Port	FY14 Baseline			FW 53 ACLs			FW 53 ACLs + Closure A			FW 53 ACLs + Closure B			FW 53 ACLs + Zero Retention GOM cod			FW 53 ACLs + ZR GOM cod + Closure A			FW 53 ACLs + ZR GOM cod + Closure B			FW 53 ACLs + GOM cod Protection Measures		
	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
MA	43.7	39.6	48.1	40	35	45.2	41.1	36.5	46	40.9	36	45.9	40.6	36	45.3	40.9	36.8	45.6	41.3	36.9	46.4	39.5	34.7	44.4
Boston	*12.9*	*11.8*	*14.1*	*12.1*	*10.4*	*13.8*	*12.9*	*11.3*	*14.7*	*12.8*	*11*	*14.7*	*12.3*	*10.6*	*13.8*	*12.8*	*11.5*	*14.6*	*12.9*	*11.3*	*14.6*	12.4	10.7	14.2
Gloucester	*10.3*	*9.4*	*11.4*	*7.4*	*6.4*	*8.4*	*8.2*	*7.2*	*9.3*	*8.1*	*7.1*	*9.1*	*7.7*	*6.9*	*8.8*	*8.1*	*7*	*9.1*	*8.3*	*7.3*	*9.2*	7.6	6.6	8.6
New Bedford	*15.4*	*14*	*16.8*	*16.4*	*14.9*	*18.1*	*16.9*	*15.5*	*18.2*	*16.8*	*15.4*	*18.1*	*16.5*	*15.2*	*17.9*	*16.9*	*15.6*	*18.1*	*16.9*	*15.6*	*18.4*	16.4	15.0	17.8
ME	14.7	13.2	16.4	12.4	10.6	14.1	12.9	11	14.6	12.4	10.9	14.1	12.7	11.1	14.4	12.8	11.2	14.6	12.6	10.9	14.4	11.9	10.3	13.6
Portland	*12.3*	*11*	*13.6*	*10.6*	*9.1*	*12*	*11.4*	*9.8*	*13*	*11.1*	*9.7*	*12.6*	*10.9*	*9.5*	*12.3*	*11.5*	*10.1*	*12.9*	*11.3*	*9.8*	*12.9*	10.6	9.1	12.0
NH	2.4	2.1	2.7	1.4	1.2	1.6	1.3	1.1	1.5	1.3	1.1	1.5	1.4	1.2	1.6	1.3	1	1.4	1.3	1.1	1.4	1.2	1.0	1.4
NJ	0.3	0.2	0.3	0.2	0.1	0.3	0.2	0.1	0.3	0.2	0.2	0.3	0.2	0.1	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.1	0.3
NY	0.9	0.7	1.2	1.2	0.9	1.6	1	0.7	1.3	1	0.7	1.3	1.2	0.9	1.6	1	0.7	1.3	1	0.7	1.4	1.0	0.7	1.4
RI	2.1	1.8	2.4	2.7	2.3	3.2	2.6	2.1	3	2.6	2.1	3.1	2.7	2.3	3.2	2.5	2	3	2.5	2	3	2.6	2.1	3.2
Pt. Judith	*1.6*	*1.4*	*1.8*	*2.1*	*1.8*	*2.4*	*1.9*	*1.7*	*2.2*	*1.9*	*1.7*	*2.2*	*2.1*	*1.9*	*2.4*	*1.9*	*1.6*	*2.1*	*1.9*	*1.6*	*2.1*	2.0	1.6	2.4
Other Northeast	0.1	0	0.1	0	0	0	.	.	.	0	0	0	0	0	0	.	.	.	0	0	0.1	0.0	0.0	0.0

Table 83 - Homeport state and port level predicted percent change in gross revenues from groundfish, relative to FY 2014 baseline

	FW 53 ACLs	FW 53 ACLs + Closure A	FW 53 ACLs + Closure B	FW 53 ACLs + Zero Retention GOM cod	FW 53 ACLs + ZR GOM cod + Closure A	FW 53 ACLs + ZR GOM cod + Closure B	FW 53 ACLs + GOM cod Protection Measures
Connecticut	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Massachusetts	-8%	-6%	-6%	-7%	-6%	-5%	-10%
Boston	-6%	0%	-1%	-5%	-1%	0%	-4%
Gloucester	-28%	-20%	-21%	-25%	-21%	-19%	-26%
New Bedford	6%	10%	9%	7%	10%	10%	6%
Maine	-16%	-12%	-16%	-14%	-13%	-14%	-19%
Portland	-14%	-7%	-10%	-11%	-7%	-8%	-14%
New Hampshire	-42%	-46%	-46%	-42%	-46%	-46%	-48%
New Jersey	-33%	-33%	-33%	-33%	-33%	-33%	-31%
New York	33%	11%	11%	33%	11%	11%	14%
Rhode Island	29%	24%	24%	29%	19%	19%	23%
Point Judith	31%	19%	19%	31%	19%	19%	24%
Other Northeast	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 84 - Vessel size class predicted gross groundfish revenues ($M, median values with 5th and 95th percentile confidence intervals from 500 simulations)

	FY14 Baseline			FW 53 ACLs			FW 53 ACLs + Closure A			FW 53 ACLs + Closure B			FW 53 ACLs + Zero Retention GOM cod			FW 53 ACLs + ZR GOM cod + Closure A			FW 53 ACLs + ZR GOM cod + Closure B			FW 53 ACLs + GOM cod Protection Measures		
Length class	**Rev**	**p5 rev**	**p95 rev**	**Rev**	**p5 rev**	**p95 rev**	**Rev**	**p5 rev**	**p95 rev**	**Rev**	**p5 rev**	**p95 rev**	**Rev**	**p5 rev**	**p95 rev**	**Rev**	**p5 rev**	**p95 rev**	**Rev**	**p5 rev**	**p95 rev**	**Rev**	**p5 rev**	**p95 rev**
<30'	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-<50'	9.0	9.0	10.0	6.0	6.0	7.0	5.0	4.0	5.0	5.0	4.0	5.0	6.0	6.0	7.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0
50-<75'	19.0	18.0	20.0	16.0	15.0	18.0	17.0	16.0	19.0	17.0	16.0	18.0	17.0	16.0	18.0	17.0	16.0	18.0	17.0	16.0	18.0	17.0	16.0	19.0
75'+	36.0	34.0	38.0	35.0	32.0	38.0	37.0	34.0	40.0	36.0	34.0	39.0	36.0	33.0	38.0	37.0	34.0	40.0	37.0	34.0	39.0	37.0	34.0	40.0

Table 85 - Vessel size class predicted percent change in gross revenues from groundfish, relative to FY 2014 baseline

Length class	FW 53 ACLs	FW 53 ACLs + Closure A	FW 53 ACLs + Closure B	FW 53 ACLs + Zero Retention GOM cod	FW 53 ACLs + ZR GOM cod + Closure A	FW 53 ACLs + ZR GOM cod + Closure B	FW 53 ACLs + GOM cod Protection Measures
<30'	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30'to<50'	-33%	-44%	-44%	-33%	-56%	-44%	-44%
50'to<75'	-16%	-11%	-11%	-11%	-11%	-11%	-11%
75'+	-3%	3%	0%	0%	3%	3%	3%

Table 86 - Median nominal gross revenues per pound of GOM cod ACE for all trips by vessels in four size classes

Vessel length	2010	2011	2012	2013
≤30'	$4.38	$5.56	$85.43	$33.58
30'to<50'	$5.87	$6.67	$24.23	$10.10
50'to<75'	$9.03	$8.69	$34.45	$21.18
75'+	$68.42	$88.88	$300.20	$140.72

Figure 37 - Average nominal gross revenues generated per pound of GOM cod ACE for fishing trips by vessels in four size classes, FY 2010-2013

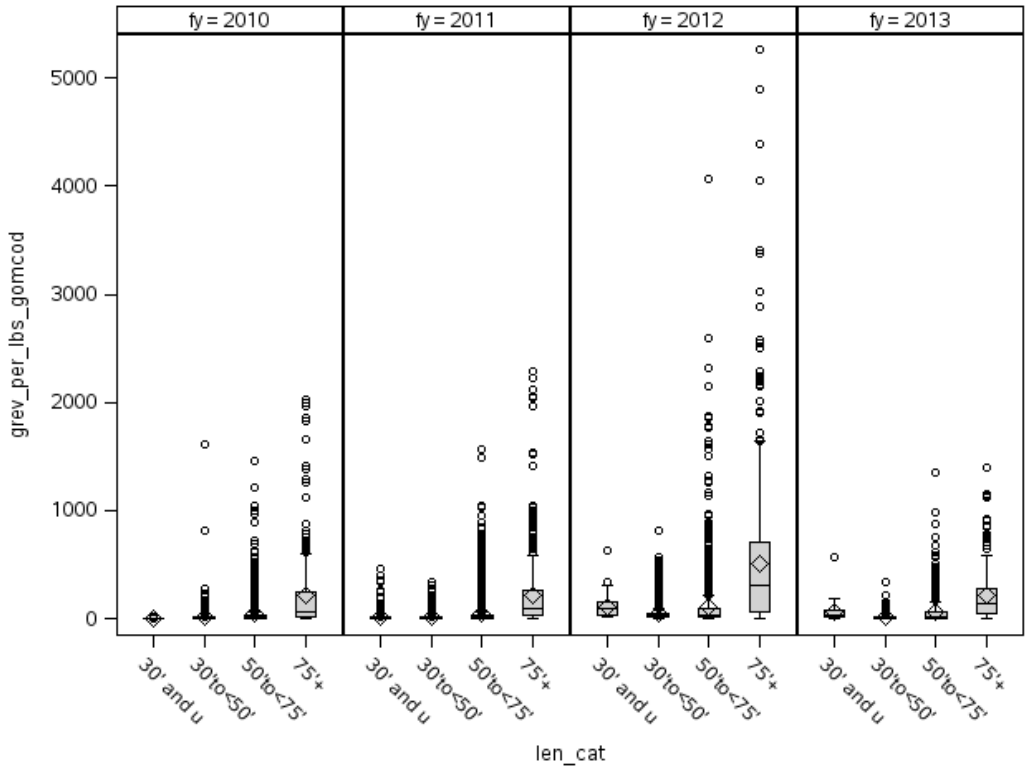


Figure 38 - Average nominal gross revenues generated per pound of GOM cod ACE for fishing trips by longitude, FY 2010-2013

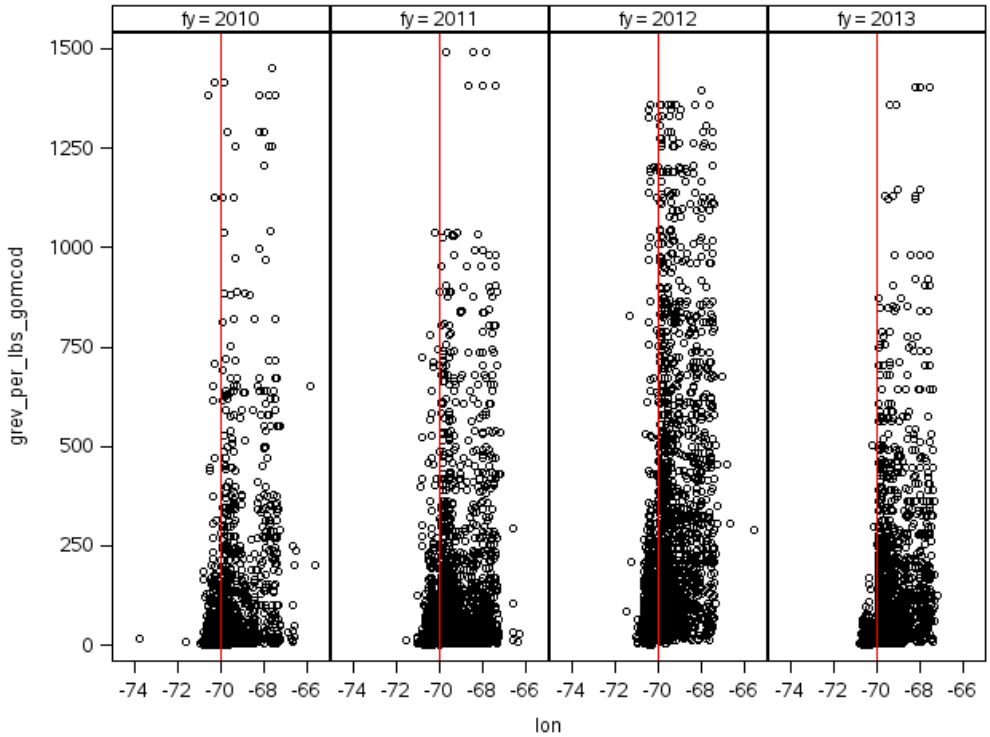


Table 87 - Sector-level allocations of GOM cod at an ABC of 386mt

	FY 2013 Allocation (ABC=1,500mt)	ABC=386mt
Common pool	40,297	10,370
Fixed Gear Sector	44,396	11,425
Maine Coast Community Sector	84,065	21,633
Maine Permit Bank	21,018	5,409
Northeast Coastal Communities Sector	13,679	3,520
NEFS 2	96,165	24,746
NEFS 3	205,153	52,793
NEFS 4	44,349	11,412
NEFS 5	17,340	4,462
NEFS 6	336,353	86,555
NEFS 7	263,112	67,707
NEFS 8	175,681	45,209
NEFS 9	233	60
NEFS 10	53,313	13,719
NEFS 11	7,169	1,845
NEFS 12	8,986	2,312
NEFS 13	31,729	8,165
New Hampshire Permit Bank	20,797	5,352
Sustainable Harvest Sector 1	356,549	91,752
Sustainable Harvest Sector 3	9,452	2,432

7.4.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits

7.4.1.1 Revised Status Determination Criteria

7.4.1.1.1 Option 1: No Action

Under Option 1, there would be no revisions to the SDC and numerical estimates of groundfish stocks (including GOM cod, GOM haddock, GOM winter flounder, GB yellowtail flounder, GB winter flounder, and pollock) would not change (Table 2 and Table 3).

If Option 1 is selected, there would not be any immediate economic impacts, since it does not alter the current methodology used for setting the ABC for each species. Long term impacts of Option 1 would be that biomass targets would be based on outdated information. This would not constitute the use of best scientific information as stipulated by the MSA (Magnuson-Stevens 101-627, 104-297), and not incorporating the new SDCs determined by the latest stock assessments could result in overfishing. Over time, using the existing SDCs would likely have a negative economic impact to fishermen through reduced catchability and lower Annual Catch Limits (ACLs). Overall, the economic impacts of Option 1 would be low negative.

7.4.1.1.2 Option 2: Revised Status Determination Criteria *(Preferred Alternative)*

Under Option 2, the SDC for GB yellowtail flounder would be based on the 2014 TRAC assessment (Table 4). Option 2 would also update the numerical assessments for GOM cod, GOM winter flounder, GB winter flounder, and pollock, as well as a benchmark assessment for GOM haddock (Table 5). This would result in a lower MSY for each stock, and consequently, lower ACLs.

The Council selected Option 2 as its *Preferred Alternative*. In the short term, the lower ACLs for these species may result in fishermen experiencing lower net revenues as a result of anticipated catch reductions. Option 2 is expected to have positive long-term stock benefits through the prevention of overfishing, yielding higher and more sustainable future landings than expected under No Action. Overall, the economic impacts of Option 2 would be low negative.

7.4.1.2 Annual Catch Limits

7.4.1.2.1 Option 1: No Action

Under Option 1, groundfish fishery ACLs for FY 2015 and 2016 would be unchanged from those adopted through FW 51, but there are missing values for many stocks (Table 6 and Table 8). Specifically, GOM winter flounder, GB winter flounder, GB yellowtail flounder, and pollock would have no ACLs set and fishing would not be permitted for these species, nor would fishing be allowed in these species' BSAs. Additionally, there would be no quotas for FY 2015 for the transboundary Georges Bank stocks (GB cod, GB haddock, GB yellowtail flounder).

Economic impacts on the commercial groundfish fishery
Under Option 1, ACLs for several stocks, including pollock, would not be specified. As pollock is a unit stock, vessels enrolled in sectors would not be permitted to fish for groundfish. The common pool would also not be permitted to fish and there would be no directed groundfish fishery (i.e., no revenue from the directed fishery).

If Option 1 is selected, the economic impacts to the commercial groundfish fishery would be negative.

Economic impacts on the recreational groundfish fishery
GOM cod and GOM haddock are the only groundfish stocks that have recreational sub-ACLs. Under Option 1, there would be recreational sub-ACLs for GOM cod and GOM haddock in FY 2015, so the recreational fishery would be able to begin on May 1st. However, specifications would not be in place for these stocks during FY 2016 and FY 2017.

If Option 1 is selected, the short term impacts for anglers targeting GOM cod would be neutral, as the sub-ACL would remain unchanged from FY14. For GOM haddock, No Action would not change the sub-ACL, resulting in negligible impacts relative to FY 2014. However, relative to the new sub-ACL under Option 2, No Action would have negative impacts for anglers catching haddock, due to a lower sub-ACL. Other groundfish stocks, such as GOM winter flounder, GOM yellowtail flounder, and pollock are also fished by recreational anglers. These stocks, and all other groundfish stocks outside of GOM cod and GOM haddock, have recreational catch estimated in the state waters and other subcomponents. No Action is expected to have little impact on anglers targeting these estimated catch stocks. For FY 2016 and 2017, the impacts to the recreational fishery would be negative due to the lack of a sub-ACL for GOM cod and GOM haddock.

Economic impacts on other fisheries
Under No Action, not only would the directed commercial groundfish fishery be unable to operate in the absence of ACLs for pollock and other groundfish stocks, but other fisheries would be affected. The Northeast Multispecies FMP allows for sub-allocations of regulated groundfish stocks for the purposes of bycatch in other fisheries. The ability to limit the impacts of other fisheries on some of the groundfish stocks is done so through the implementation of sub-ACLs. The following fisheries have sub-ACLs for at least one groundfish stock and the expected impacts of No Action ACLs are described.

Sea scallop fishery
Under No Action, there would be no scallop fishery sub-ACL for GB yellowtail flounder. While this would not prevent the scallop fishery from fishing in FY 2015, it is not clear if the absence of a sub-ACL would be treated as if the sub-ACL was zero. If this would be the case, then any catches of these stocks would lead to scallop fishery AMs being triggered in FY 2016 and/or later years.

Under No Action/Option 1, there would be large reductions in scallop fishery revenues relative to Option 2. However, if the scallop fishery catches of these stocks do not trigger AMs, Option 1 might allow for greater scallop fishery revenues than would be the case if AMs are triggered using the ACLs of Option 2. The precise impacts of the No Action option on the scallop fishery are thus unknown.

Atlantic herring fishery
No Action would not revise the sub-ACLs for GOM and GB haddock in the mid-water trawl (MWT) Atlantic herring fishery for FY 2015, both of which would increase under Option 2 relative to No Action. As a result, AMs would potentially be more likely to be triggered in FY 2015 for the MWT Atlantic herring fishery than under the revised haddock sub-ACLs in Option 2. This would result in negative economic impacts in FY 2016 for the MWT fishery and possibly beyond.

Small mesh fishery
No Action would result in no sub-ACL for GB yellowtail flounder in the small mesh fishery. If this scenario would be treated as a zero sub-ACL for GB yellowtail flounder, AMs would be triggered for the small mesh fishery. This would result in negative economic impacts in FY 2016 and possibly beyond. If the GB yellowtail flounder sub-ACL is considered non-existent in the absence of an overall ACL, the small mesh fishery could have potential positive impacts by avoiding any possibility of AMs attributed to catch of GB yellowtail flounder.

Summary
Overall, the economic impacts of Option 1 would be negative.

7.4.1.2.2 Option 2: Revised Annual Catch Limit Specifications (*Preferred Alternative*)

Under Option 2, there would be annual specifications set for FY 2015 for all stocks, and several stocks would have specifications for FY 2016 and FY 2017 as well (Figure 9).

Economic impacts relative to No Action
The Council selected Option 2 as its *Preferred Alternative*. The economic impacts of Option 2 would be positive compared to Option 1, because under Option 1, there would be no directed groundfish fishery for either the sectors or common pool. The magnitude of difference depends upon the combination of sub-options selected regarding GOM Cod Spawning Area Closures (4.2.1.1), GOM Cod Protection Measures (4.2.1.3), and Prohibition on the Possession of GOM cod (4.2.1.2).

Economic impacts on the Sector-based commercial fishery relative to FY 2014
Under Option 2, gross groundfish revenues for FY 2015 are predicted to be just over $58 million and all gross revenues on groundfish trips are predicted to be just over $75 million (Table 72). This represents approximately a 10% reduction in gross groundfish revenues and a 7% reduction in gross revenues on groundfish trips relative to those predicted in FY 2014 (Table 72). Final predicted revenues in this FW depend upon the combination of options selected in other alternatives. On a home-port state level, New Hampshire would have the largest percentage decline (42%) in gross revenues from groundfish relative to FY 2014.

The impacts to gross revenues would be distributed non-uniformly across different vessel length categories as well (Table 84). The 30-50' category is predicted to see the largest drop in gross revenue compared to FY 2014, with a predicted 33% reduction resulting from the ACL changes alone. This increases up to a possible 56% reduction depending upon the other alternatives selected (Table 85). Larger vessel classes are not expected to be impacted as heavily by the FW 53 ACLs, with the largest vessel size class (75'+) predicted to see a 3% decline in gross revenues. However, under some scenarios, the largest vessels may see a slight increase in revenue (Table 85). Among the reasons for the difference in predicted revenues by vessel size are the variation in scalability and an inability for smaller vessels to cover the same geographic range as larger vessels, particularly given the status of inshore GOM cod stocks.

For the remainder of FY 2014, under the interim measures, American plaice and witch flounder are predicted to be the most constraining stocks, with pollock contributing more revenue than any other stock (Table 73). FY 2015 is not predicted to repeat this situation, with constraining stocks predicted to be GB winter flounder, SNE yellowtail flounder and GOM cod under all six FW 53 permutations. Western GB haddock is predicted be the highest-grossing stock in the groundfish complex under the FW 53 ACLs in FY 2015 (Table 74). Pollock, the predicted highest-grossing stock in FY 2014, falls to second behind Western GB haddock in FY 2015 under all seven management measures, and GB winter flounder is predicted to generate the third most revenue of all groundfish stocks. The lower U.S. quotas for the

transboundary GB yellowtail flounder and Eastern GB cod stocks are not expected to have huge economic impacts, as neither stock is predicted to be fully used under the FW 53 ACLs, regardless of other measures chosen (Table 8). The U.S. quota for Eastern GB haddock would increase from 10,530 mt in FY 2014 to 17,760 mt in FY 2015 under the FW 53 ACLs, but the increased opportunity to catch haddock is not predicted to be realized due to the constraining stocks (Table 74 to Table 82).

Economic impacts on the Common Pool fishery relative to FY 2014

The QCM incorporated only sector vessels in the analysis, as they make up the vast majority of groundfish landings and revenue. As the sector-based fishery incorporates all the same fishing vessel types and port locations as in the common pool, it is expected that most vessels in the common pool groundfish fishery would incur economic loses relative to FY 2014. However, because there would be no directed groundfish fishery under Option 1, the economic impacts of Option 2 would be positive compared to Option 1.

Economic impacts on the Recreational fishery relative to FY 2014

Option 2 lowers the recreational sub-ACL for GOM cod and raises the sub-ACL for GOM haddock relative to Option 1. These revisions would likely have positive economic impacts through rebuilding of the cod stock and a higher sustainable catch for haddock.

Economic impacts on other fisheries

For the Atlantic sea scallop, Atlantic herring fishery, and small-mesh fisheries, the catch limits under Option 2 would include allocations for bycatch of groundfish species in these fisheries. For each of these fisheries, there are AMs that would be triggered if their respective allocations are exceeded. Thus, the likelihood of triggering an AM is a function of changes to the ACLs each year.

Sea scallop fishery

Under Option 2, the sea scallop fishery sub-ACL for GB yellowtail flounder is expected to decrease by 12.4 mt (-24.4%) relative to FY 2014. GB yellowtail flounder AMs were developed for the sea scallop fishery in Amendment 15 to the Atlantic Sea Scallop FMP, and later modified in FW23. The scallop fishery is subject to an AM in the following fishing year if scallop vessels participating in either open-area or access-area trips exceed their sub-allocation of GB yellowtail flounder, and either the total GB yellowtail flounder ACL is exceeded or the scallop fishery exceeds its ACL by 50 percent or more. The length of the AM area closures is determined by the overage percent. If the total ACL is exceeded, the fishery that caused the overage would also be subject to a pound for pound payback under the US/Canada resource sharing agreement.

If the sea scallop fishery triggers the GB yellowtail flounder AMs, Option 2 would likely reduce scallop fishery revenues. However how this reduction in revenue compares to the Option 1/No Action is unclear. The No Action does not identify a scallop fishery sub-ACL for GB yellowtail flounder. While this would not prevent the scallop fishery from fishing in FY 2015, it is not clear if the absence of a sub-ACL would be treated as if the sub-ACL was zero. If this were the case, then catches would lead to scallop fishery AMs being triggered in FY 2016 and/or later years. As a result, No Action/Option 1 would result in large reductions in scallop fishery revenues relative to Option 2. But if this is not the case, and the scallop fishery catches do not trigger AMs, then Option 1/No Action might allow for greater scallop fishery revenues than would be the case if AMs are triggered using the sub-ACL specified in Option 2.

Option 2 specifies a sea scallop fishery GB yellowtail sub-ACL equal to 38 mt which is between the low and high projected estimate of GB yellowtail bycatch (27.9 to 49.6 mt) in the scallop fishery under

preferred Alternative 3 with "2 closed areas only" submitted in the Atlantic Sea Scallop FMP FW26. Based on recent catch performance, AMs for GB yellowtail flounder have never been implemented for the sea scallop fishery as a result of an overage. Additionally, based on sea scallop management measures that are proposed in 2015, it is not expected that scallop effort will increase on GB relative to recent years. In addition, LAGC vessel effort is minimal in the GB yellowtail flounder stock area and as such the Option 2 is expected to have negligible if any impact on LAGC vessels. Although Option 2 could have negative economic impacts, the sea scallop fishery is not expected to exceed it GB yellowtail allocation in 2015. As such, it is unlikely that a significant overage will occur and thus scallop dependent small entities are not expected to be significantly impacted in terms of profitability.

Atlantic herring fishery

FW 46 to the Northeast Multispecies FMP created separate MWT sub-ACLs for GB haddock and GOM haddock equal to 1% of the respective ABCs. In the event that the herring fishery exceeds their sub-allocation of haddock for either stock, harvesting restrictions in GB and GOM AM areas for herring will go into effect and the total amount of the overage will be deducted from the following fishing year's sub-ACL as well.

Table 88 summarizes GOM and GB haddock catch by Atlantic herring MWT vessels from FY 2011- FY 2014 year to date. During the 2012 groundfish fishing year, the haddock catch cap was fully utilized in the GB area. The GB haddock catch cap for the 2013 groundfish FY (May 1, 2013 – April 30, 2014) was 273 mt, and the GOM haddock catch cap was 3 mt. The FY 2013 GB catch cap was exceeded by approximately 17 mt, and as a result the GB haddock catch cap for 2014 was adjusted downward from 179 mt to 162 mt to account for the overage. There remains very little if any catch of GOM haddock by MWT vessels in the Atlantic herring fishery.

Table 88- GOM and GB Haddock Catch by Midwater Trawl Vessels Subject to Haddock Catch Caps (FY2011-2014 YTD)

FY	2011		2012		2013		2014	
Areas	**GB**	**GOM**	**GB**	**GOM**	**GB**	**GOM**	**GB**	**GOM**
Haddock Catch Cap (mt)	318 mt	11 mt	286 mt	9 mt	273 mt	3 mt	162 mt	3 mt
Haddock Catch (mt)	101 mt	3 mt	285 mt	0 mt	290 mt	0 mt	111 mt	0 mt
% of Catch Cap	**32%**	**23%**	**100%**	**0%**	**106%**	**0%**	**69%**	**0%**

Catch Caps are based on groundfish fishing year (May 1 – April 30). Effective 10/23/2014: The GB haddock incidental catch cap was exceeded in FY 2013. As a result, the GB haddock incidental catch cap for 2014 was adjusted downward from 179 mt to 162 mt to account for the overage.
Source: NOAA/NMFS (http://www.nero.noaa.gov/ro/fso/reports/reports_frame.htm); data reported through February 11, 2015.

The mid-water trawl (MWT) sub-ACL for GB haddock is expected to increase by 65 mt (+40%) under Option 2. The MWT sub-ACL for GOM haddock is also expected to increase by 11 mt (+467%). If haddock bycatch rates for the MWT herring fishery change disproportionately to haddock biomass levels for FY 2015, there could be risk of an overage to the haddock catch cap. Under those circumstances MWT herring vessels might face increased costs from avoidance strategies to prevent AMs or lost herring revenue from triggering the AMs. Because the ABCs are based off of latest stock assessment information

and the MWT haddock sub-ACLs will be calculated at a fixed rate of 1%, it is less likely that the MWT haddock AMs will be triggered under Option 2.

Compared to Option 2, the No Action alternative would not revise the sub-ACLs for GOM and GB haddock in the Atlantic herring fishery for FY 2015, both of which would increase under Option 2 relative to No Action. As a result, AMs would potentially be more likely to be triggered in FY 2015 for the Atlantic herring fishery than under the revised haddock sub-ACLs in Option 2. This would result in negative economic impacts in FY 2015 and possibly beyond. Under Option 2, allocations for GOM (227 mt) and GB haddock (14 mt) are both expected to increase in 2015 relative to 2014 which could result in positive economic impacts to the MWT Atlantic herring fishery.

The GOM haddock catch cap has never been triggered and it is unlikely that the fleet will reach the catch cap given status quo conditions. However, in FY 2013, the AM for GB haddock was triggered. As a result, it is possible that this could occur again in 2015 depending on catch rates of herring and haddock by the MWT fleet. The Atlantic herring sock is undergoing an operational assessment (update) in 2015, with specifications for CY2016-CY2018 are expected in a future Atlantic herring action. Therefore, Atlantic herring specifications are uncertain for the second half of the groundfish fishing year in 2015. If the AM is triggered for GB haddock, there could be negative economic impacts that result from foregone Atlantic herring yield. The magnitude of these potential negative impacts would depend on how much herring quota remained at the time the AM was implemented and whether other Atlantic herring management areas were open for directed herring fishing. Overall, the economic impact to the MWT herring fishery of Option 2 when is expected to be neutral when compared to the status quo and positive relative to No Action.

Small mesh fishery

Compared to Option 2, the No Action alternative would result in no sub-ACL for GB yellowtail flounder in the small mesh fishery. If this scenario is treated as a zero sub-ACL for GB yellowtail flounder, AMs would be triggered for the small mesh fishery. This would result in negative economic impacts in FY 2016 and possibly beyond. If the GB yellowtail flounder sub-ACL is considered non-existent in the absence of an overall ACL, the small mesh fishery could have potential positive impacts by avoiding any possibility of AMs attributed to catch of GB yellowtail flounder.

FW 48 created the small-mesh sub-ACL for GB yellowtail flounder and FW 51 adopted a gear-based AM. Additionally if the total ACL is exceeded, the fishery that caused the overage would also be subject to a pound for pound payback under the US/Canada resource sharing agreement. The GB yellowtail flounder allocation for small-mesh fisheries would be a decrease in 2015 (4.6 mt) compared to 2014 (6.1 mt), which could increase the likelihood of triggering accountability measures. However, based on recent catch performance an AM for GB yellowtail flounder has never been implemented for this fishery as a result of an overage (e.g., GB yellowtail flounder catch in FY 2014 was 2.5 mt, roughly 64% of the sub-ACL; estimated catches of GB yellowtail flounder in some previous years have exceeded 4 mt). Although the catch limit under Option 2 could have negative economic impacts, small-mesh fisheries are not expected to exceed their GB yellowtail flounder allocation in 2015. If the AM is triggered due to increases in GB yellowtail flounder catch by the small-mesh multispecies fishery or by the lower proposed sub-ACL, vessels that participate in the small-mesh multispecies fishery in the following year would be required to use a modified small mesh nets that has been shown to substantially reduce GB yellowtail flounder catch. With enough forewarning of implementation at the start of the next fishing year, this expense would not be much greater than that associated with normal gear maintenance and replacement. Overall, the economic impact to small mesh fisheries is expected to be neutral under Option 2.

7.4.2 Commercial and Recreational Fishery Measures

7.4.2.1 GOM Cod Management Measures

7.4.2.1.1 GOM Cod Spawning Area Closures

7.4.2.1.1.1 Option 1: No Action (*Preferred Alternative*)

Under Option 1, the current GOM cod spawning area closure for commercial and recreational vessels (known as the Whaleback Closure) implemented through FW 45 is maintained. The Council selected Option 1 as its *Preferred Alternative*.

Economic impacts on the commercial groundfish fishery
The economic impacts associated with Option 1 would be neutral relative to status quo. Generally, maintaining the current GOM cod spawning area closures is predicted to have lower gross revenues (in aggregate) than the predicted revenue associated with additional closures in Option 2. This points to a situation where inshore GOM vessels are not being offered sufficiently high ACE lease prices or, alternatively, have been (and modeling indicates will continue to be) unwilling to accept such lease arrangements. There are many reasons this may be so, the most relevant being that fisherman may simply want to fish, and prioritize their profession over higher profits.

Economic impacts on the recreational fishery
Option 1 would not create any additional GOM cod spawning area closures for the recreational fishery. Short term economic impacts would be minimal, as recreational anglers would not face further restrictions on where they can fish. There may be some negative economic impacts in the long term if the GOM cod biomass remains low.

Overall, the economic impacts of Option 1 would be neutral relative to status quo and positive relative to Option 2.

7.4.2.1.1.2 Option 2: Additional GOM Cod Spawning Protection Measures

Under Option 2, there are two sub-Options that would create additional GOM cod spawning area closures in the Gulf of Maine that apply to the commercial and recreational groundfish fisheries.

General economic impacts of Option 2

Economic impacts on the groundfish fishery
The shift toward fishing eastward and by larger vessels under all scenarios considered in FW 53 is shown in Table 84 to Table 86. With cod being constraining in the GOM, the closure options effectively force vessels that would otherwise chose to fish, to no longer fish. The QCM assumes that their quota will flow to those (larger) vessels that can use it. Whether this proves to be the case, or not, will remain to be seen. Relocation of vessels to SNE ports in search of fishing opportunities may occur. As Table 82 and Table 83 show, the adoption of either sub-Option A or B may make fishing from GOM ports unsustainable for vessels that do not have the range to fish in profitable areas during times of inshore spawning closures.

Economic impacts on the recreational fishery
The proposed GOM cod spawning closure areas encompass the principal recreational bottom fishing locations in the GOM and the majority of the recreational fishing access points in the GOM.

Approximately 85-90% of GOM cod and haddock mortality generally occurs in Federal waters though, so if anglers only catch GOM cod and haddock in state waters during FY 2015, a mortality reduction would likely occur from the proposed closures. The larger unknown, however, is the level of noncompliance that would occur in federal waters under the closures. Even marginal differences in state and federal regulations may increase noncompliance, so an unprecedented change of prohibiting bottom fishing in federal waters, combined with allowing anglers to continue to bottom fish in state waters, would almost certainly increase noncompliance in federal waters during FY 2015 – thereby reducing the conservation benefit of the closures.

The proposed prohibition on recreational bottom fishing in the closed areas would also generally be unenforceable. Currently, virtually all enforcement of recreational fishing regulations is conducted in state waters by State Law Enforcement Agencies. The United States Coast Guard (USCG) has legal authority to enforce recreational fishing regulations, but safety checks generally take priority over monitoring fishing activity occurring in state and federal waters. NOAA's Office of Law Enforcement also has legal authority to enforce federal recreational fishing regulations, but their focus is almost exclusively on compliance with commercial fishing regulations. Thus, since enforcement mainly occurs only in state waters, where anglers would most certainly be allowed to bottom fish in FY 2015 during the proposed rolling closures, the potential for noncompliance in the closed areas would be high. The level of noncompliance associated with the closed areas is impossible to predict, but if it is high, the conservation benefit of the closures would be further eroded.

The economic consequences of the spawning closures on the for-hire industry and businesses that support the recreational fishing industry in the GOM would be extensive. Landings during the proposed closure areas accounted for approximately 75% of annual for-hire landings of Atlantic cod, haddock, pollock, white hake, and redfish. Although possession of GOM cod could be prohibited in FY 2015 with or without implementation of the closure areas, catch of the remaining species over the past five years is clearly concentrated in the areas and time periods under consideration for closures. This high degree of concentration implies that it would be difficult for for-hire businesses to move to alternative areas that hold bottom fish for their customers.

The sheer size of the proposed closed areas would also make it difficult for for-hire vessels, particularly the larger head boat vessels, to steam up to 60 miles through the closed areas to open water fishing sites. The travel time required to traverse through the closed areas will exceed the total time allotted for the most common type of for-hire trip offered by for-hire businesses in the GOM: 4 or 6 hour fishing trips. Thus, implementation of the proposed closures would likely have a devastating effect on for-hire businesses operating in the GOM.

The impact of the closures on private vessels fishing in the GOM is less certain. Spatial data on fishing locations are not available for private boat anglers, so the extent to which private anglers fish in the proposed closed areas to bottom fish is unknown. However, since approximately 80-85% of private vessels catch of GOM cod and haddock takes place in federal waters, it is likely that the vast majority occurs in the proposed closed areas. Although the closures would legally exclude private boat anglers from bottom fishing within the closed areas, some level of bottom fishing would likely continue by private boat anglers within the closed areas in FY 2015. Private boat anglers would also still be allowed to use pelagic gear to target bluefish, striped bass, etc. within the proposed closures, thereby exacerbating the enforcement problem. Ultimately, overall private boat fishing effort would likely decline, at least somewhat, if recreational bottom fishing is prohibited in the proposed closed areas. The magnitude of the decline though is unknown.

Businesses that support the recreational fishing industry would also be impacted if recreational fishing effort declines because of the prohibition of bottom fishing in the closed areas. Bait and tackle shops,

marinas, boat repair shops, convenience stores, restaurants, hotels, and many other indirectly affected businesses would face revenue declines due to lower angler spending.

Specific economic impacts of the sub-Options

7.4.2.1.1.2.1 Sub-Option A:

Under Sub-Option A, new seasonal GOM cod spawning closure areas would be created in 30-minute blocks (Figure 2).

If Sub-Option A is selected, gross groundfish revenues for FY 2015 are predicted to be over $59 million and all gross revenues on groundfish trips are predicted to be almost $77M (Table 72). This represents approximately a 8% reduction in gross groundfish revenues and a 5% reduction in gross revenues on groundfish trips relative to those predicted in FY 2014 (Table 72). While these are not insignificant reductions, gross revenues are predicted to be about $1.5M higher under sub-Option A than the No Action alternative.

On a home-port state level, New Hampshire is expected to have the largest percentage decline (46%) in gross revenues from groundfish relative to FY 2014 although this decline increases up to 50% if zero retention options are selected as well (Table 83). New York and Rhode Island are expected to be positively impacted by the closures, with an 11% and 24% predicted increase in gross groundfish revenues relative to FY 2014, however these increases are reduced relative to the ACL Option 2 with no additional closures (Table 83). For major home-ports, Gloucester, MA is expected to have the largest percentage decline (20%) in gross revenue and New Bedford, MA is expected to be the least affected with a 10% increase in gross groundfish revenues predicted. Both Gloucester and New Bedford are predicted to have higher gross revenues with this closure option than No Action assuming FW53 ACLs are implemented.

The impacts to gross revenues are expected to be distributed non-uniformly across different vessel length categories as well, with the 30-50 foot category experiencing the largest drop in gross revenue compared to FY 2014, with a predicted 44% reduction resulting from the closures in sub-Option A. This is a greater reduction than the 33% reduction associated with just the changes in ACL, and would increases up to a possible 56% reduction depending upon the zero retention alternative selected (Table 84). Larger vessel classes are predicted to experience smaller declines in gross revenues, with the largest vessel size class (75+ ft) predicted to see a 3% increase in gross revenues resulting from closure sub-Option A (Table 84). This result is not surprising, as small vessels have a smaller geographic range.

Overall, the economic impacts of sub-Option A would be negative, and represent a sizable decline in revenues when compared to FY 2014 and No Action. Additionally, the economic impacts of Sub-Option A would be more negative than those associated with Sub-Option B.

7.4.2.1.1.2.2 Sub-Option B:

Sub-Option B would create seasonal GOM cod spawning closure areas in 30-minute blocks (Figure 3).

If sub-Option B is selected, gross groundfish revenues for FY 2015 are predicted to be just under $59 million and all gross revenues on groundfish trips are predicted to be just over $76M Table 73). This represents approximately a 9% reduction in gross groundfish revenues and a 6% reduction in gross revenues on groundfish trips relative to those predicted in FY 2014 (Table 73). If the zero retention option is selected in conjunction with sub-Option B, overall revenues decline slightly further. While these

are not insignificant reductions, gross revenues are predicted to be almost $1M higher under closure sub-Option B than No Action (assuming FW 53 ACLs).

On a homeport state level, New Hampshire is expected to have the largest percentage decline (46%) in gross revenues from groundfish relative to FY 2014, although this decline increases up to 50% if zero retention is selected as well (Table 82). New York and Rhode Island are expected to be positively impacted by the closures, with an 11% and 24% predicted increase in gross groundfish revenues relative to FY 2014, however these increases are reduced relative to the FW53 ACL option with no additional closures (Table 82). For major homeports, Gloucester, MA is expected to have the largest percentage decline (21%) in gross revenue and New Bedford, MA is expected to be the least affected with a 9% increase in gross groundfish revenues predicted. Both Gloucester and New Bedford are predicted to have higher gross revenues with this closure option than No Action assuming the *Preferred Alternative* ACLs are implemented.

The impacts to gross revenues are expected to be distributed non-uniformly across different vessel length categories as well, with the 30-50 foot category experiencing the largest drop in gross revenue compared to FY 2014, with a predicted 44% reduction resulting from the closures in sub-Option B. This is a greater reduction than the 33% reduction associated with just the changes in ACL, and would increases up to a possible 56% reduction depending upon the zero retention alternative selected (Table 84). Larger vessel classes are predicted to experience smaller declines in gross revenues, with the largest vessel size class (75+ ft) predicted to see no change in gross revenues resulting from closure sub-Option B. This result is not surprising, as small vessels have a smaller geographic range.

Overall, the economic impacts of sub-Option B would be negative, and represent a sizable decline in revenues when compared to FY 2014. However, when compared to the predicted economic impacts of the *Preferred Alternative* ACLs (Section 7.4.1.2.2), the economic impacts of sub-Option B would be less negative. Additionally, the economic impacts of sub-Option B would be more negative than those associated with sub-Option A as sub-Option B is predicted to realize about $500k less in gross revenues than sub-Option A. The magnitude of difference also depends upon the option selected regarding the prohibition on the possession of GOM cod.

Summary

Overall, the economic impacts of Option 2 would be negative relative to FY 2014 and No Action. The impacts of sub-Option A would be more negative relative to sub-Option B.

7.4.2.1.2 Prohibition on the Possession of GOM Cod

7.4.2.1.2.1 Option 1: No Action (*Preferred Alternative*)

Under Option 1, prohibition on the possession of GOM cod in commercial and recreational fisheries would not be implemented. The continued allowance of possession of GOM cod in the recreational fishery is conditional upon Section 4.2.1.3. The Council selected Option 1 as its *Preferred Alternative*.

Economic impacts on the commercial groundfish fishery
If Option 1 is selected, in the long term, the concern of overfishing is likely slightly higher with the commercial fishery allowed to land GOM cod, however, the revised ACLs (Section 4.1.2) are designed to address this concern. The economic impacts associated with No Action are similar to those analyzed under Section 7.4.1.2.2.

Economic impacts on the recreational fishery
Continuing to allow possession of GOM cod in the recreational fishery would result in minimal economic impact in the short term. Long term impacts could be negative if the ability of the GOM cod stock to recover is compromised by recreational landings. However, the issues of discard mortality and noncompliance in the recreational fishery if a prohibition on landings is adopted mean the long term benefits of GOM cod to the recreational fishery are hard to project, no matter the regulations selected.

Summary
Overall, the economic impacts of Option 1 would be neutral relative to status quo and positive relative to Option 2.

7.4.2.1.2.2 Option 2: Prohibition on the possession of GOM cod

Under Option 2, commercial and recreational vessels would be required to discard all catch of GOM cod (i.e., zero possession). There would be no change in how GOM cod is allocated, and there would be no changes made to catch accounting or accountability measures.

Economic impacts on the commercial groundfish fishery
The true impacts of zero retention policies are difficult to model. Such policies in a fishery with less than 100% catch monitoring may incentivize fishing significantly differently when an observer is present. The incentive is even stronger when, as in this case, the stock is allocated and discards are the likely constraint on fishing in the broad stock area.

If Option 2 is selected, the zero retention option would have non-linear impacts across the spawning closure options. Under the FW 53 ACLs with no additional closures, the predicted impact of zero retention alone is on the order of $2.5M higher aggregate gross revenues relative to GOM cod spawning area closures without zero retention (Table 72). GOM cod spawning area closures sub-option A with zero retention is predicted to have only slightly higher revenues than zero retention without the closures. GOM cod spawning area closure sub-Option B, however, is predicted to have nearly $1M in aggregate benefit relative to the sub-Option A.

The impacts to gross revenues are expected to be distributed non-uniformly across different vessel length categories as well, with the 30-50 foot category experiencing the largest drop in gross revenue compared to FY 2014, with a predicted 33% reduction resulting from zero retention. This is the same reduction associated with just the changes in ACL, and would increases up to a possible 56% reduction if additional spawning closures are selected (Table 85). Larger vessel classes are predicted to experience smaller

declines in gross revenues, with the largest vessel size class (75'+) predicted to see an increase in gross revenues resulting from the zero retention option, an increase that gets larger with the implementation of additional closures. This result is not surprising, as small vessels have a smaller geographic range.

Zero retention options are predicted to see higher gross revenues than their full retention analogs because the assumed discard rate for trawl and gillnet vessels (75 and 80% respectively) allows captains to land 20-25% more groundfish per unit of GOM cod ACE when that ACE is discarded than they can when the ACE is landed catch. Table 86 indicates that vessels may make $40 or more per pound of GOM cod ACE in FY15—even when backing out the lost revenue from cod (say, $3/lbs) the ability to leverage 25% more revenue may mean an extra $10 or more per pound of ACE from discards than landed catch.

The analysis of zero retention options presented here underestimates realized revenues for all size classes and GOM ports, because these models assume that cod caught and discarded will be accounted for. This is not a realistic assumption. Because GOM cod is the primary constraint on fishing in the GOM, vessels will fish under two very different sets of incentives depending on whether or not a trip is observed. If a trip is observed, the primary incentive for captains will be to minimize cod as a percent of total catch. This incentive will be strong, as there is an inverse and nearly linear relationship between a sector's discard rate for GOM cod and the number of trips that sector's vessels will be able to make before being closed out of the broad stock area. The variance of cod caught on a trip is high, and it is possible (even likely) that captains will be able to achieve quite low discard rates on observed trips.

Unobserved trips have no such incentive. Rather, these trips will maximize revenue on all species irrespective of GOM cod catch. Table 86 indicates the value of GOM cod being over $40 in revenue per pound, showing the critical importance of avoiding GOM cod catch that will count against the ACE.

The net effect will be twofold:

- True discards are likely to be many multiples of imputed discards, rendering the catch data an incomplete picture of true fishing mortality; and
- Gross revenues will be substantially higher than predicted for all aspects of the GOM fishery, as the nominal cod constraint is essentially relaxed through a combination of observer effects and mandated regulatory discards on unobserved trips.

All told, the economic impacts of Option 2 on GOM cod would be negative relative to FY 2014 and No Action. In the long term, unaccounted for discarding of GOM cod could compromise stock rebuilding efforts, resulting in negative impacts.

Economic impacts on the recreational fishery

If Option 2 is selected, the recreational fishery would be prohibited from landing GOM cod, but as anglers would not be constrained by where they can fish under this alternative alone, the cod encounter rate would likely remain relatively unchanged. Both private boats and party boats will incur some negative impacts because of an inability to catch cod. The exact impacts are difficult to quantify, but would be significantly related to choice of fish by anglers. The preference to target certain species is a product of, among other things, upbringing and history/tradition (Hickley 1998).

As GOM cod has deep-rooted history in the recreational fishery, it is likely that some anglers will be turned away from fishing to a certain extent if cod fishing is not an option. Bait and tackle shops, marinas, and other shore-side businesses would also incur losses if fewer anglers choose to participate. The long term impacts of Option 2 are uncertain as recreational anglers that follow regulations will not be able to land GOM cod in federal waters where they previously could do so, but the foregone cod landings may, or may not, rebuild the stock. The stock rebuilding potential of this alternative will likely also be

mitigated by noncompliance, though those illegally landing cod would be receiving the same benefits as under No Action.

Summary
Overall, the economic impacts of Option 2 would be negative relative to FY 2014 and No Action.

7.4.2.1.3 GOM Cod Protection Measures

7.4.2.1.3.1 Option 1: No Action

The No Action alternative would continue to allow recreational catch of GOM cod and maintain the rolling closures in the sector and common pool groundfish fisheries (Figure 4).

If Option 1 is selected, the economic impacts under would essentially be the same as Section 7.4.1.2.2, with the FW 53 ACLs implemented but no prohibition on possession of GOM cod and no change in closure areas to either the commercial or recreational fisheries. These impacts would be negative relative to FY 2014.

Economic impacts on other fisheries
No Action/Option 1 and Option 2 do not restrict exempted gear or exempted fisheries. Fishing effort from fisheries with exempted gear and exempted fisheries is not expected to change as a result of Option 2, since the No Action/Option 1 and Option 2 are only applicable to the commercial groundfish fishery. In general, the economic impacts on these other fisheries would be neutral.

7.4.2.1.3.2 Option 2: Gulf of Maine Cod Protection Measures *(Preferred Alternative)*

Option 2 would prohibit the possession of GOM cod in the recreational fishery and modify the rolling closure areas in the sector and common pool vessels (Figure 5). The Council selected Option 2 as its *Preferred Alternative*.

Economic impacts on the commercial groundfish fishery
In Table 72, simulations of the combination of FW53 ACLs + GOM cod protection closures predicted slightly higher fleetwide groundfish revenue in FY2015 when compared to FW53 ACLs alone. It is important to note that the FY2014 baseline *includes* the impact of existing GOM rolling closures that would be maintained under the No Action because the model uses reference trips from FY2013 that were subject to those time/area closures. Relative to No Action, the adoption of the GOM cod protection measures are predicted to result in less severe economic loses to the commercial fishery than the FW 53 ACLs (and rolling closures) for FY 2015 (Table 72).

Beyond FY 2015, it is difficult to quantify the economic impacts of the cod protection measures relative to No Action. Option 2 is designed to allow the GOM cod stock to rebuild by protecting key areas from the commercial fishery and minimizing mortality from the recreational fishery. The added GOM cod protection closures from November through January should allow for increased spawning potential for the GOM cod stock. This component of the protection measures is critical in whether or not long term benefits can be accrued from this alternative. The other changes to the rolling closures may improve the viability of some of the inshore vessels in FY 2015, but as demonstrated by the QCM, this does not translate to positive overall impacts. The results of the QCM do not include any benefit to revenues that may be obtained by opening previously closed areas during April.

Economic impacts on the recreational fishery
As with Section 7.4.2.1.2.2, the impacts to the recreational fishery under Option 2 would be negative in the short term due to a lost opportunity to land GOM cod. In the long term, cod that are discarded by the recreational fishery and survive would contribute to rebuilding the stock. However, as with Section 7.4.2.1.2.2, noncompliance in the recreational fishery and discard mortality for GOM cod would factor into the long term benefits of Option 2. The changes to rolling closures in the commercial fishery would not have a major impact on the recreational fishery in the short term, but could potentially help the recreational fishery in the long term through GOM cod stock rebuilding.

Economic impacts on other fisheries
No Action/Option 1 and Option 2 do not restrict exempted gear or exempted fisheries. Fishing effort from fisheries with exempted gear and exempted fisheries is not expected to change as a result of Option 2, since the No Action/Option 1 and Option 2 are only applicable to the commercial groundfish fishery. In general, the economic impacts on these other fisheries would be neutral.

Summary
Overall, the economic impacts of Option 2 would be low positive for the commercial fishery and low negative for the recreational fishery relative to No Action. In general, the economic impacts on other fisheries would be neutral.

7.4.2.2 Default Groundfish Specifications

7.4.2.2.1 Option 1: No Action

Under Option 1, in the event of a rulemaking delay, there would be no fishing for stocks without specifications in place on May 1, nor any fishing for other groundfish stocks that share the same BSA as stocks with no specifications.

If Option 1 is selected, no additional economic impacts are expected (neutral), though as fishing cannot occur until the specifications are finalized, there would be potential negative economic impacts to No Action.

7.4.2.2.2 Option 2: Percentage Rollover Provisions for Default Specifications

The Council may select either sub-option A, B, or C. Although less than 100% of the anticipated FY's ACL would be available, Sectors would be expected to plan operation as if final specifications would be in place. Other fisheries would receive less than 100% of the anticipated FY's sub-ACL under default specifications. This is not expected to negatively impact fisheries with AMs in a subsequent year (e.g., sea scallops and small-mesh multispecies fisheries with sub-ACLs for yellowtail flounder stocks). Fisheries with in-season AMs (i.e., MWT Atlantic herring fishery with sub-ACLs for haddock stocks) may be negatively impacted if the reduced sub-ACL leads to trigging an AM in-season. However, final specifications would be expected to be in place in time before such as event, and therefore impacts are expected to be neutral.

7.4.2.2.2.1 Sub-Option A: Default Rollover 35% of all groundfish stocks to the following FY. *(Preferred Alternative)*

The Council selected sub-Option A as its *Preferred Alternative*. Under sub-Option A, a situation where there is no ACE available to fish due to a delay in the specifications being implemented would likely be

avoided. Fishermen may make adjustments to the time of year they fish. The economic impacts of sub-Option A are likely to be positive, as it is more likely than Option 1 to allow fishermen to operate at the beginning of the following FY.

7.4.2.2.2.2 Sub-Option B: Default Rollover 20% of all groundfish stocks to the following FY.

Under sub-Option B, a situation where there is no ACE available to fish due to a delay in the specifications being implemented would be less likely to occur relative to Option 1. Fishermen may make adjustments to the time of year they fish. The economic impacts of sub-Option B are likely to be positive, as it is more likely than Option 1 to allow fishermen to operate at the beginning of the following FY. However, the positive impacts may not be as far-reaching as Sub-Option A, as the default would not be as large.

7.4.2.2.2.3 Sub-Option C: Default Rollover 10% of all groundfish stocks to the following FY.

Under sub-Option C, a situation where there is no ACE available to fish due to a delay in the specifications being implemented would be less likely to occur than Option 1. Fishermen may make adjustments to the time of year they fish. The economic impacts of sub-Option C are likely to be positive, as it is more likely than Option 1 to allow fishermen to operate at the beginning of the following FY. However, the positive impacts may not be as far-reaching as sub-Options A and B, as the rollover would not be as large.

Overall, the economic impacts of Option 2 would be positive when compared with No Action, with Sub-Option A being most positive compared with Sub-Option B or C. Sub-Option B would be more positive than Sub-Option C.

7.4.2.3 Sector ACE Carryover

7.4.2.3.1 Option 1: No Action

Under No Action, groundfish sectors would continue to be allowed to carry forward up to 10% of their unused sector ACE, as outline in Amendment 16 to the Northeast multispecies FMP.

If Option 1 is selected, there would be no new economic impacts (neutral).

7.4.2.3.2 Option 2: Modification to Sector ACE Carryover *(Preferred Alternative)*

Option 2 would allow groundfish sectors to carry forward up to 10% of unused ACE, provided that the total unused sector ACE carried forward for all sectors from the previous FY plus the total ACL does not exceed the ABC for the fishing year in which the carryover would be harvested. The AM criteria previously adopted by NMFS' May 2014 carryover action would not be affected.

The Council selected Option 2 as its *Preferred Alternative*. The economic impacts of Option 2 are likely minor. If the unused ACE in a FY is followed by a FY with a decreased ABC (and ACE), then negative economic impacts are possible. Overall, the economic impacts of Option 2 are low negative when compared to the No Action alternative.

7.5 Social Impacts

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 will 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, and tourism). Certainly, management regulations influence the direction and magnitude of economic and social change, but attribution is difficult with the tools and data available. While the focus here is on the economic and social impacts of the proposed fishing regulations, 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.

The social impact factors outlined below can be used to describe the Northeast multispecies 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 2007) and other texts (e.g., Burdge 1998). Longitudinal data describing these social factors region-wide and in comparable terms is limited. While this analysis does not quantify the impacts of the management alternatives relative to the social impact factors, 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 effects of the proposed action on *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 proposed action; 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 2007).

7.5.1 Updates to Status Determination Criteria, Formal Rebuilding Programs and Annual Catch Limits

7.5.1.1 Revised Status Determination Criteria

7.5.1.1.1 Option 1: No Action

Under Option 1, there would be no revisions to the Status Determination Criteria (SDC) and numerical estimates of groundfish stocks (including GOM cod, GOM haddock, GOM winter flounder, GB yellowtail flounder, GB winter flounder, and pollock) would not change (Table 2 and Table 3).

If Option 1is selected, the primary effect would be to maintain the biomass targets established based on outdated assessments for the stocks in question. This is not expected to have substantial social impacts, since it does not alter the current method of setting Acceptable Biological Catch for each stock. However, since new assessments have been completed for these stocks, the use of the old values would not constitute the best available science. There could be negative impacts on the *Attitudes, Beliefs and Values* of stakeholders if management is based upon outdated science. Not incorporating revised SDC could result in overfishing, which would lead to negative social impacts in the future. Overall, the social impacts of Option 1 are low negative.

7.5.1.1.2 Option 2: Revised Status Determination Criteria *(Preferred Alternative)*

Under Option 2, the SDC for GB yellowtail flounder would be based on the 2014 TRAC assessment (Table 4). Option 2 would also update the numerical assessments for GOM cod, GOM winter flounder, GB winter flounder, and pollock, as well as a benchmark assessment for GOM haddock (Table 5). This would result in a lower MSY for each stock, and consequently, lower ACLs.

The Council selected Option 2 as its *Preferred Alternative*. Compared to the No Action alternative, the most substantial effect of this alternative would be to change the status determination for GB yellowtail flounder to unknown. This could have small negative social impacts on the *Attitudes, Beliefs and Values* of stakeholders, because the assessment process was unable to approve an assessment model for this stock. However, given concerns regarding the VPA assessment model previously used for GB yellowtail, the decision to no longer use this model could have positive impacts on the *Attitudes, Beliefs and Values* of stakeholders regarding the flexibility of management. Using the most recent stock assessment information could have positive impacts on the *Attitudes, Beliefs and Values* of stakeholders.

Lowering the ACLs for GOM cod, GOM haddock, GOM winter flounder, GB winter flounder, and pollock, and consequently, lowering the ACLs would have a negative short-term social impact on the *Size and Demographics* of the groundfish fishery, because of a probable reduction in fishing opportunity, revenue and employment. Although lowering MSY does not necessarily leads to lower ACLs, this also depends on stock status.However, if the ACL reductions lead to stock rebuilding, the social impacts would be positive in the long term, as stocks increase. Overall, the social impacts of Option 2 are neutral relative to No Action.

7.5.1.2 Annual Catch Limits

7.5.1.2.1 Option 1: No Action

Under Option 1, groundfish fishery ACLs for FY 2015 and 2016 would be unchanged from those adopted through Framework Adjustment 51, but there are missing values for many stocks (Table 6 and Table 8). The following stocks would not have ACLs specified: GB yellowtail flounder, GB winter flounder, GOM winter flounder, and pollock. There would also be no quotas for the stocks managed under the U.S./Canada Resource Sharing Understanding: EGB cod, EGB haddock and EGB yellowtail flounder. With the exception of white hake in FY 2016, all other groundfish stocks would not have ACLs for FY 2016 and FY 2017. Commercial groundfish vessels may not fish in the broad stock area of any stock that does not have an ACL specified. Through existing authority, NMFS would likely prohibit recreational catch of GOM cod and GOM haddock if no ABC/ACL were specified for those stocks (in FY 2016 and FY 2017). Non-groundfish fisheries could continue to be able to fish however (e.g., scallop, herring, small-mesh multispecies, etc.).

Impacts on the commercial multispecies fishery
If Option 1 is selected, it would have substantial negative social impacts, particularly in terms of the *Size and Demographic Characteristics* of the fishery-related workforce and the *Historical Dependence on and Participation in* the fishery. Since several critical stocks will have no ACL specified, directed commercial groundfish fishing would not be permitted for sector or common pool vessels for the species with undefined ACLs, nor would fishing be allowed in these species' broad stock areas. Because pollock is a unit stock, no directed groundfish trips would occur. This would have a negative impact on the individuals and communities involved with the commercial groundfish fishery. Under such circumstances, extreme industry consolidation would be expected, leading to the loss of many groundfish fishing jobs and a reduction in household income for fishing families. Shore-side infrastructure, including service and gear providers, as well as wholesalers, could become unprofitable due to the reduced business and may be forced to shut down, further impacting the social fabric of fishing communities. For those fishermen that remain in the fishery, there may be an incentive to adopt risky behavior such as deferring boat maintenance and replacement in an attempt to make ends meet (Lord 2011). Other impacts to the *Non-Economic Social Aspects* of the fishery could include reduced job satisfaction caused by the restrictions on catches and uncertainty about the future. Option 1, however, could have some positive long-term social impacts if stock rebuilding targets were reached more quickly due to decreased effort.

Selecting Option 1 could also cause distrust in management, because having no ACLs and no quota for U.S./Canada Resource Sharing stocks could be seen as a failure on the part of management to use best available science and a timely specifications process. This could have a negative impact on the formation of *Attitudes, Beliefs, and Values* of fishermen and other stakeholders.

With such a severe limitation on fishing opportunity, many fishermen may leave the fishery entirely or at least seek temporary opportunities in another fishery, and the number of vessels and fishermen involved would be reduced. There is already a perception among many fishermen that there is a diminishing return on investment in the groundfish fishery that makes it hard to earn a living from fishing. In a 2010 telephone survey of multispecies permit holders, 62% indicated that, based on their fishing income at the time, they could only remain in business for 1-2 years (Holland et al. 2010). Option 1, would further limit the income potential of many groundfish fishermen, forcing some to leave the fishery, having a negative impact on the *Historical Dependence on and Participation in* the fishery.

Selecting Option 1 could lead to perceived inequities between the commercial versus recreational and other fishery components (e.g., scallops), if the commercial fishery cannot continue fishing while others

can. This could cause resentment or conflict between fishing groups, a negative social impact in the form of changes to *Social Structure and Organization*.

Impacts on the recreational fishery
For the recreational fishery, there would be ACLs for GOM cod and GOM haddock in FY 2015, so the recreational fishery would be able to continue next year, but the recreational fishery would not be permitted in FY 2016 and FY 2017.

If Option 1 is selected, the social impacts on the recreational fishery would be neutral in the near-term, but negative in the long-term. If commercial fishing is prohibited while the recreational fishery can proceed, there could be negative impacts on the *Attitudes, Beliefs, and Values* of commercial fishermen towards management and increased conflicts between stakeholder groups, a negative impact on the *Non-Economic Social Aspects* of the fishery.

Impacts on the scallop fishery
Under No Action, the scallop fishery would not have a sub-ACL for GB yellowtail flounder, and while this would not prevent the scallop fishery from fishing in FY 2015, it is unclear whether catches of GB yellowtail flounder in FY 2015 would trigger AMs for FY 2016 and beyond.

If Option 1 is selected, in the short-term, the social impacts would be neutral for the scallop fishery. If AMs are triggered in later years, that may be seen as a failure by fisheries management to implement specifications, a negative impact on the *Attitudes, Beliefs, and Values* of stakeholders. To the degree the AMs constrain the scallop fishery, there may be negative impacts on the *Size and Demographic Characteristics* of that fishery. Allowing the scallop fishery to proceed while the groundfish fishery cannot may be a source of conflict within and between communities about the fairness of management, a negative impact on the *Non-Economic Social Aspects* of the fishery.

Impacts on the herring fishery
Under No Action, the herring fishery would have a sub-ACL for GOM and GB haddock, so the herring fishery would proceed without disruption in FY 2015, unless the fishery exceeds its sub-ACLs and AMs are triggered. The social impacts of No Action are expected to be neutral for the herring fishery. Allowing the herring fishery to operate while the groundfish fishery cannot may be a source of conflict within and between communities about the fairness of management, a negative impact on the *Non-Economic Social Aspects* of the fishery.

Impacts on the small-mesh multispecies fishery
Under No Action, the small-mesh multispecies fishery would not have a sub-ACL for GB yellowtail flounder, and while this would not prevent the small-mesh fishery from fishing in FY 2015, it is unclear whether catches of GB yellowtail flounder in FY 2015 would trigger AMs for FY 2016 and beyond.

If Option 1 is selected, in the short-term, the social impacts would be neutral for the small mesh fishery. If AMs are triggered in later years, that may be seen as a failure by fisheries management to implement specifications, a negative impact on the *Attitudes, Beliefs, and Values* of stakeholders. To the degree the AMs constrain the small mesh fishery in the future, there may be negative impacts on the *Size and Demographic Characteristics* of that fishery. Allowing the directed small mesh fishery to proceed while the groundfish fishery cannot may be a source of conflict within and between harvesters and communities about the fairness of management, a negative impact on the *Non-Economic Social Aspects* of the fishery.

Overall, the social impacts of Option 1 would be negative.

7.5.1.2.2 Option 2: Revised Annual Catch Limits (*Preferred Alternative*)

Under Option 2, there would be annual specifications set for FY 2015 for all stocks, and several stocks would have specifications for FY 2016 and FY 2017 as well (Table 9 and Table 59). The total ACLs in FY 2015 are the same as Option 1, except for GOM cod (lower), GB haddock (lower), and GOM haddock (higher), as well as the stocks that do not have specifications under Option 1: GB yellowtail flounder, GB winter flounder, GOM winter flounder, and pollock. Option 2 would also adopt specifications for the stocks with U.S./Canada Resource Sharing Understanding quotas. For several stocks, the percent distribution of the total ACL would be adjusted between the groundfish fishery and the state waters and other sub-components (Appendix III).

Social impacts relative to No Action
The Council selected Option 2 as its *Preferred Alternative*. There would generally be positive social impacts relative to No Action, as all stocks would have specified catch limits, so some amount of fishing could occur in all the Broad Stock Areas. The impacts to the *Size and Demographic Characteristics* and the *Historical Dependence on and Participation in* the fishery would be positive relative to No Action. The GOM haddock ACL would more than triple under Option 2, however, as this stock is frequently caught in conjunction with GOM cod, the potential social benefits of this increase would be limited by the very low GOM cod ACL, which would be about 75% lower than under No Action, as well as the fishermen's ability to avoid cod while targeting haddock.

Option 2 would likely result in more positive impacts on the *Attitudes, Beliefs, and Values* of stakeholders towards management than Option 1, because the groundfish fishery would be able to operate in FY 2015, in addition to the scallop and herring fisheries. Many public comments have been received by the Council expressing frustration with the amount of time it takes to incorporate new science and stock assessments into management measures. The failure to adopt ACLs based on the most recent assessments and analyses would only exacerbate that perception. Acheson (2010) points out that groundfish fishermen in New England have an inherently different view of the ocean and its fisheries than the views held by federal ocean/fisheries scientists, based largely on personal experience and their own proximal environment. This view can be at odds with the characterization of the larger environment described by fisheries scientists. It is, in part, because these differing views cannot always be reconciled that industry opinion of federal fisheries science is so low in New England (Acheson 2010; Acheson & Gardner 2011; Holland, et al. 2010). Furthermore, fishermen tend to identify fishing effort as only one factor affecting the size of stocks, and often believe it may not be the most important factor. Management control of fishing pressure, as in the revised ACL specifications set by Option 2, may not be perceived to be the most effective control of fish stocks size (Acheson & Gardner 2011).

Social impacts relative to FY 2014specifications
When compared to the ACLs in FY 2014 (Table 6), FY 2015 ACLs would be unchanged or increased for all stocks with the exception of GOM cod, GB yellowtail flounder, and GB and GOM winter flounder. Due to the large decrease in the GOM cod ACL, and the relative importance of GOM cod to the groundfish fishery, the social impacts of Option 2 are likely to be highly negative relative to the FY 2014 fishery and years immediately prior (Table 59). Under Option 2, reduced fishing opportunities in FY2015 and FY2016 relative to prior years are expected, likely resulting in increased negative social impacts for the fishery. If Option 2 leads to successful rebuilding of GOM cod and other depleted stocks, there could be long-term positive impacts, unless markets, processing capability, and other infrastructure that are lost during the period of low catch are unable to recover when the stocks rebuild.

In an attempt to avoid quota limited stocks with low annual catch limits, vessel operators in the groundfish fishery would be forced to modify where and how they fish, having a negative impact on the *Historic and Present Participation* in the fishery. The reduced catch limits set by Option 2, would also

have a negative social impact on the *Size and Demographics* of the groundfish fishery because of a probable reduction in fishing opportunity, revenue (10% reduction predicted; Table 73), and employment. The reductions in catch limits included in Option 2, which are based on science that many Northeast fishermen consider flawed, could further erode the faith fishermen have in the quality of federal science. This continued lack of faith in the science used to support management decisions could undermine the perceived legitimacy of future management actions and have a negative social impact on the formation of *Attitudes, Beliefs, and Values* about management.

The negative social impacts expected under Option 2 are likely to be disproportionate across the fishery. GOM cod is important to primary and secondary ports throughout the Northeast U.S., but ports in Maine, New Hampshire and Massachusetts that rely on fishing in the Gulf of Maine would be particularly impacted by this measure. This could shift the *Historical Dependence on and Participation in* the fishery. In particular, New Hampshire is expected to have the largest percent decline in gross revenue (42%) relative to FY 2014, while the fisheries in New York and Rhode Island are expected to experience increases in revenue. Smaller vessels in the 30-50' range are expected to experience the largest reduction in revenue. This could negatively impact the *Non-Economic Social Aspects* of the fishery if the fishermen that are disproportionately impacted feel unfairly treated or if the action leads to conflicts within the fishery.

The declines in the *Size and Demographic Characteristics* of the fishery-related workforce in areas such as New Hampshire, Gloucester and New Jersey are expected to be substantial (projected 42%, 28%, and 33% revenue decline, respectively; Table 82), and would depend, in part, on the degree to which fishermen can switch fisheries as well as the constraints of existing management measures and those implemented through this framework. Declines in groundfish revenue to ports may cause shore-side support services to become unsustainable. As shore-side support disappears from a fishing community, those fishermen who are left may opt to shift their operations to other ports, or leave fishing entirely, negatively impacting the *Historical Dependence on and Participation* in the fishery by communities.

U.S./Canada TACs

Comparing the proposed FY 2015 U.S. TACs to the FY 2014 U.S. TACs, the EGB haddock quota would increase by 68.7%, but EGB cod and GB yellowtail flounder would decrease by 19.5% and 34.5%, respectively (Table 7 and Table 8). This could result in negative social impacts, if the ability to harvest the haddock is constrained by cod and yellowtail flounder. Vessel operators, families and communities that fish offshore, particularly those who are reliant on the groundfish fishing opportunities in EGB would experience the greatest impact from these changes. Specifying stocks on Georges Bank provide an incentive for offshore vessels to fish offshore. This could improve the *Non-Economic Social Aspects* of fishing. There could be reduced gear conflicts with smaller vessels on inshore grounds, improving safety and reducing fishing-related stress. The limitations imposed by the lowered TACs in the EGB could force fishermen to move to alternative fishing grounds or in some cases relocate their vessels to a different port as they adjust their fishing practices (Tuler et al. 2008).

Adjustments to ACL Distribution

Option 2 would adjust the percent distribution of the total ACL between the different fishery components (e.g., groundfish, state waters, other sub-components) to better reflect recent and expected catches and enable the full ACL to be harvested (Appendix III). These adjustments would likely result in positive social impacts to the *Attitudes, Beliefs, and Values* of stakeholders towards management if Optimum Yield for groundfish can be better achieved and improve fishing opportunities. Since FY 2010, expected Canadian catch has only been considered for Eastern GB cod and haddock and GB yellowtail, though Canadian catch of GB winter flounder and halibut occurs. Option 2 would account for Canadian catch in distributing the ABC/ACLs to ensure that biological objectives are met and total catch does not exceed the overall ABC. While this option may have negative social impacts in the short-term on the U.S.

fishermen that rely on these stocks, preventing overages in catch limits would have long-term social benefits, preventing the imposition of AMs and better ensuring that catch levels are sustainable.

Impacts on the scallop fishery
If Option 2 is selected, there would be low positive social impacts on the scallop fishery relative to No Action and to FY2014. The scallop fishery would have a sub-ACL for GB yellowtail flounder for FY2015, and would know what level of catch could result in triggering the AM for the fishery. This would be a positive impact on the *Attitudes, Beliefs, and Values* of fishery participants towards management. However, the GB yellowtail flounder scallop sub-ACL under Option 2 is lower than the FY2014 sub-ACL. If the ability to harvest scallops is constrained by the yellowtail flounder sub-ACL, or the AM is triggered for future FYs, there could be reduced scallop harvest. This would lead to negative impacts for the scallop fishery, in terms of reduced *Size and Demographic Characteristics* of the fishery-related workforce. Vessel operators, families and communities that prosecute the scallop fishery in the GB yellowtail flounder stock area could experience the greatest impact from these changes.

Impacts on the herring fishery
If Option 2 is selected, there would be positive social impacts on the herring fishery relative to No Action and to FY2014. The herring fishery would have a sub-ACLs for GOM and GB haddock and proceed without disruption in FY 2015, unless the fishery exceeds its sub-ACLs and AMs are triggered. This would be a positive impact on the *Attitudes, Beliefs, and Values* of fishery participants towards management. The mid-water trawl sub-ACL for GB haddock is expected to increase by 65 mt (+40%), and the GOM haddock sub-ACL is also expected to increase by 11 mt (+467%), which would have positive impacts in terms of reducing the likelihood that the sub-ACLs would be exceeded and allow the fishery to harvest more of its target catch (herring). This would be a positive impact on the *Size and Demographic Characteristics* of the herring fishery, as well as sustaining the *Historical Dependence on and Participation* in the fishery.

Impacts on the small-mesh multispecies fishery
If Option 2 is selected, there would be low positive social impacts relative to No Action and to FY2014. The small-mesh multispecies fishery would have a sub-ACL for GB yellowtail flounder for FY2015, and would know what level of catch could result in the triggering of the AM for the fishery. This would be a positive impact on the *Attitudes, Beliefs, and Values* of fishery participants towards management. However, the GB yellowtail flounder small-mesh sub-ACL under Option 2 is lower than the FY2014 sub-ACL. If the ability to harvest small-mesh species is constrained by the new sub-ACL, or the AM is triggered for future FYs, there could be reduced small-mesh multispecies harvest. This would lead to negative impacts for the small-mesh multispecies fishery, in terms of reduced *Size and Demographic Characteristics* of the fishery-related workforce. Vessel operators, families and communities that prosecute the small-mesh multispecies fishery in the GB yellowtail flounder stock area could experience the greatest impact from these changes.

Summary
Overall, the social impacts of Option 2 would be positive relative to No Action, but high negative relative to the fishery in FY 2014.

7.5.2 Commercial and Recreational Fishery Measures

7.5.2.1 GOM Cod Management Measures

General social impacts of area closures
This action considers changes to closed areas for the commercial and recreational fishery. The following is a description of the social impacts that can generally occur as a result of area closures.

Area closure alternatives can have numerous social impacts across various fisheries and communities. The most direct impacts would be on vessels currently fishing in these areas that would no longer have access due to the expanded closures. The addition of new closures would force fishing operations with gear capable of catching groundfish to modify where and how they fish, having a negative impact on the *Historical Dependence on and Participation* in the affected fisheries. This would also have a negative social impact on the *Size and Demographic Characteristics* of the affected fisheries, because of a probable reduction in fishing opportunity, revenue, and employment. Negative social impacts would be expected in the *Non-economic Social Aspects* of the fishery, as fishermen would have less flexibility in choosing where to fish.

The ability to adapt to a new closure is highly variable. Less mobile fishermen may bear a larger impact as they are less able to easily switch harvest areas. Smaller vessels would be less adaptable to near shore closures, as their range is limited and they cannot easily prosecute the fishery in offshore areas. Any change in fishing behavior by less mobile fishing businesses that attempt to employ more mobile fishing strategies would likely have additional social costs, such as disruptions to family and community life, as well as increase the likelihood of safety risks. Increased risk can result when fishermen spend longer periods at sea to access offshore areas that would not be affected by the closures. Fishermen severely impacted by the new closed areas may leave fishing entirely or at least seek temporary opportunities in another fishery or gear type that is less affected by the management alternatives. Both possibilities would cause a change in the *Size and Demographic Characteristics* of the different fisheries.

Those communities that are more dependent on groundfish and are located in proximity to the proposed closures (e.g., in southern Maine, New Hampshire and northern Massachusetts for this action) would have larger social impacts than those that participate in a range of fisheries including areas further offshore. Negative impacts on *Attitudes, Beliefs, and Values* may be based on perceptions of differing levels of impact to particular gear types or fisheries. For example, the spawning protection areas alternatives in this action are designed to improve cod spawning protection. However, the restrictions impact a wide range of vessels capable of catching groundfish, including those where cod may not be the primary target. This may cause resentment among fishermen using gear types that are capable of catching groundfish and would be affected by the restrictions, but do not target cod and are thus unlikely to benefit from future cod spawning improvement. This could negatively affect the *Social Structure and Organization* of a community. Additionally, the impacts of recreational fishing on spawning cod are not as well documented. Therefore, these restrictions may be seen as overly restrictive.

There are many instances in which fishermen have differing views than those held by ocean and fisheries scientists. A fisherman's view is based largely on personal experience and their own proximal environment, which can be at odds with the larger environment described by fisheries scientists. This continued lack of faith in the science used to inform management decisions could undermine the perceived legitimacy of future management actions and have a negative social impact on the formation of *Attitudes, Beliefs, and Values* about management. The impact of revising GOM cod spawning closures on the *Attitudes, Beliefs, and Values* of fishermen is uncertain and is largely related to the level of acceptance and belief in the efficacy of the new closures to adequately protect spawning cod without placing undue

restrictions during areas and times when cod are not spawning. In informational interviews conducted by the Council related to spawning closure alternatives in the Habitat Omnibus Amendment, some members of the fishery mentioned that due to the output controls associated with sector management, there is no need for additional spawning protection.

There is the potential for positive social impacts derived from new closures. These are generally associated with the potential future and long-term benefits that the closures would have on the improvement of fish stocks. These benefits are difficult to analyze, because of the uncertainty associated with the magnitude of the benefit, how these benefits would be distributed among fishing communities, and the timing of these impacts. For example, vessels that are unable to adapt to new restrictions in the short-term may not be able to benefit from the potential stock increases in the long-term. Additionally, the short-term impacts on markets, processing capability, and other infrastructure during the period of adjustment to the new closures may be such that these shoreside resources are lost and unable to recover in the future when potential stock increases occur. However, given the current status of GOM cod, future improvements to the stock could have large positive social impacts.

7.5.2.1.1 GOM Cod Spawning Area Closures

7.5.2.1.1.1 Option 1: No Action (*Preferred Alternative*)

Under Option 1, the current GOM cod spawning protection area for commercial and recreational vessels (known as the Whaleback Closure) implemented through FW 45 is maintained.

The Council selected Option 1 as its *Preferred Alternative*. The social impacts associated with Option 1/No Action are expected to be neutral in the short-term, as it would maintain the status quo. There may be some negative impacts on the *Attitudes, Beliefs, and Values* of members of the groundfish fishery and other stakeholders related to the lack of flexibility of management as this would maintain current spawning closures and not incorporate current research concerning timing and location of cod spawning. Given the current status of the GOM cod stock, Option 1 may be seen as a missed opportunity to implement new management that could help improve the GOM cod population. In the long-term, if spawning cod is not adequately protected by No Action, there could be negative social impacts if there are fishery declines as a result.

Thus, the social impacts of Option 1 would be neutral.

7.5.2.1.1.2 Option 2: Additional GOM Cod Spawning Protection Measures

Under Option 2, there are two sub-Options that would create additional GOM cod spawning closures in the Gulf of Maine that apply to the commercial and recreational groundfish fisheries.

7.5.2.1.1.2.1 Sub-Option A:

Under Sub-option A, new seasonal GOM cod spawning closure areas would be created in 30-minute blocks (Figure 2).

If sub-Option A is selected, the short-term social impacts would be negative for the commercial and recreational fisheries relative to No Action, as the new closures would restrict access to inshore fishing areas where the bulk of GOM cod landings have traditionally come from (Figure 24). In particular, block 124, which contains a 10-minute block where over 25% of the commercial GOM cod landings have come

from since at least 2010, would be closed for five months. The negative impacts would particularly affect smaller vessels (30-50 ft) from the communities in Maine, New Hampshire and Massachusetts for whom it may be difficult to adjust fishing areas. It is difficult to determine if fishermen would be precluded from fishing or would be able to shift effort to other months of the year or to other areas. However, economic analysis suggests overall groundfish revenues for these segments of the fishery would decline, despite overall revenue gains.

The Quota Change Model predicts that this alternative would result in 100% utilization of GOM cod (Table 75). Thus, overall GOM cod mortality would be limited by the ACL rather than by the adjustments in area closures. However, there are likely to be substantial negative social impacts within the fishery, based on which segments of the fleet can adjust their operations to remain active. Smaller vessels that fish inshore may be unable to be active during the new times and areas that would be open. Thus, the ACE that these vessels may have used may be leased to other (larger) vessels that are more flexible. This may change the *Social Structure and Organization* of communities as well as *Historical Dependence on and Participation* in the fishery by individuals and communities.

Recreational vessels are not currently constrained by area closures other than Whaleback, so this sub-option could have large negative impacts on the recreational fishery as it adjusts to a new management tool. As detailed in the economic impacts, the enforceability of and compliance with area closures in the recreational fishery is uncertain and may lead to negative impacts on *Attitudes, Beliefs, and Values* of stakeholders towards management.

The negative short-term social impacts of sub-Option A would be greater than the impacts associated with sub-Option B, due to the larger spatial coverage of restrictions associated with sub-Option B, therefore allowing less flexibility in where people fish. The long-term social impacts of sub-Option A are expected to be positive if the protection of spawning cod leads to increased cod populations.

7.5.2.1.1.2.2 Sub-Option B:

Sub-Option B would create seasonal GOM cod spawning closure areas in 30-minute blocks (Figure 3).

The short-term social impacts of Sub-Option B are expected to be negative for the commercial and recreational fisheries relative to No Action, as the new closures would restrict access to inshore fishing areas where the bulk of GOM cod landings have traditionally come from (Figure 24). These impacts will particularly affect smaller vessels from the communities in Maine, New Hampshire and Massachusetts for whom it may be difficult to adjust fishing areas. It is difficult to determine if fishermen would be precluded from fishing or be able to shift effort to other months of the year or to other areas. However, economic analysis suggests overall groundfish revenues for these segments of the fishery would decline.

The Quota Change Model predicts that this alternative would result in 100% utilization of GOM cod (Table 76). Overall GOM cod mortality would be limited by the ACL rather than the adjustments in area closures. However, there are likely to be substantial negative social impacts within the fishery, based on which segments of the fleet can adjust their operations to remain active. Smaller vessels that fish inshore may be unable to be active during the new times and areas that would be open. Thus, the ACE that these vessels may have used may be leased to other (larger) vessels that are more flexible. This may change the *Social Structure and Organization* of communities as well as *Historical Dependence on and Participation* in the fishery by individuals and communities.

Recreational vessels are not currently constrained by area closures other than Whaleback, so this sub-Option could have large negative impacts for the recreational fishery as it adjusts to this new management tool. As detailed in the economic impacts, the enforceability of and compliance with area closures in the

recreational fishery is uncertain and may lead to negative impacts on *Attitudes, Beliefs, and Values* of stakeholders towards management.

The short-term social impacts of sub-Option B would be less negative than the impacts associated with sub-Option A, because the spatial restrictions associated with sub-Option B cover less area (e.g., just part of block 124 would be closed for three months versus the entire block for four months), thus allowing more flexibility in when and where people fish. The long term social impacts of sub-Option B are expected to be positive if the protection of spawning cod leads to increased cod populations.

Summary
Overall, the social impacts of Option 2 are negative relative to FY 2014 and the No Action option that assumes the *Preferred Alternative* for the ACLs is implemented. The impacts of sub-Option A are negative relative to sub-Option B.

7.5.2.1.2 Prohibition on the Possession of GOM Cod

7.5.2.1.2.1 Option 1: No Action (Preferred Alternative)

Under Option 1, there would be no revision to the retention regulations of GOM cod.

The Council selected Option 1 as its *Preferred Alternative*. The social impacts are expected to be mixed. If a very low GOM cod ACL is selected in conjunction with Option 1, there could be negative social impacts to the *Attitudes, Beliefs, and Values* of fishermen and other stakeholders towards management, in allowing a stock with a very low ACL to be targeted. However, allowing GOM cod landings maintains the continuous collection of data on GOM cod catch, which could have a positive impact on *Attitudes, Values and Beliefs* of fishermen and other stakeholders towards fisheries science. Overall, the social impacts of Option 1 are expected to be neutral.

7.5.2.1.2.2 Option 2: Prohibition on the Possession of GOM Cod

Under Option 2, for commercial and recreational vessels, there would be zero possession of GOM cod, i.e., they would be required to discard all catch of GOM cod. There would be no change in how GOM cod is allocated, and there would be no changes made to catch accounting or accountability measures.

Impacts on the commercial fishery
If Option 2 is selected, though the sub-ACL of GOM cod is expected to be low, regulatory discarding of marketable fish causes a loss of potential revenue, which can have a negative effect on the *Size and Demographic Characteristics* of the fishery. In this case, the economic analysis (Section 7.4) suggests that the assumed GOM cod discard rate would allow vessels to increase their catch of other stocks, and that in balance, the decrease in revenue from GOM cod would be more than offset by the increase in revenue from other stocks. Thus, in the short-term, there would be positive social impacts to the *Size and Demographic Characteristics* of the fishery-related workforce, stemming from increased revenue in the fishery. However, an increase in GOM cod discards, particularly if unaccounted for, could jeopardize the rebuilding plan for this stock, resulting in long-term negative social impacts as the fishery would need to be further constrained in the future.

Discarding fish can have a negative impact on the *Attitudes, Beliefs, and Values* of fishermen and other stakeholders relative to the perceptions of fisheries management and the moral dilemmas fishermen face at sea. It could also cause a demoralizing sense of waste among those forced to discard marketable fish,

impacting the *Non-Economic Social Aspects* of the fishery. Moreover, larger vessels from Gulf of Maine ports may be able to fish on Georges Bank and land more cod, increasing perceptions of inequity in some communities. This often exacerbates conflicts between sectors of the industry, a negative impact on the *Non-Economic Social Aspects* of fishing. There could be intracommunity conflict and loss of community cohesion as a result, a negative impact on *Social Structure and Organization*. Additionally, this leads to a loss of data about a fishery at a critical point, so the long term negative impacts could be large.

Impacts on the recreational fishery
Under Option 2, the recreational fishery would be prohibited from landing GOM cod. This will cause negative social impacts, as the projected discards would exceed the sub-ACL, likely leading to future constraints on recreational fishing effort. For the party/charter vessels, cod is a popular target species for customers, so these vessels may experience declines in their businesses if customers are unwilling to fish for other stocks instead. The *Size and Demographic Characteristics* of the party/charter fleet may be negatively impacted as a result.

Summary
Overall, the social impacts of Option 2 relative to No Action would be negative.

7.5.2.1.3 GOM Cod Protection Measures

General social impacts of opening previously closed areas
There are a number of social impacts associated with opening a previously closed area. Opening additional areas for access to fishing can create opportunities for increased catch and revenue, leading to increased occupational opportunities and positive impacts on the *Historical Dependence on and Participation in* the fishery as well as the *Size and Demographic Characteristics of* the fishery- related workforce. Fishermen often comment that once areas are closed, they are never opened again, so the opening of previously closed areas may have a positive impact on the *Values, Attitudes and Beliefs* of fishermen regarding the flexibility of management.

While there are many positive social impacts associated with opening closed areas, there are some negative social impacts as well. First, if the current closed areas are improving fish stocks, creating a spillover benefit into fishable areas, this benefit is lost. Second, there is the potential for gear conflicts resulting from opening closed areas. Some gear types have been exempted from current closure areas and the addition of new, competing gears may cause conflicts between user groups which can exacerbate intra- and intercommunity conflicts, create additional perceptions of inequity, and weaken overall cohesion within communities. These conflicts can occur within a gear type as well, if the perception of larger available catches in a newly opened area creates a derby fishery, resulting in intense fishing effort concentrated in the area, with landings that are too high in too short a time period, causing lower prices and a waste of quota. This would result in negative impacts on the *Non-Economic Social Aspects* of the fishery.

There are distributional and equity issues to consider when changing area closures. Some vessel size classes and fishing ports would be negatively impacted. If ports are highly dependent on the resource and have historical participation in the fishery are home to vessel classes that are less mobile and less adaptable to closed area boundary shifts, fishing areas that are open may be inaccessible. Impacts to these particular components of the fleet may not be offset by any overall gain in economic revenues.

7.5.2.1.3.1 Option 1: No Action

Option 1 maintains the current regulations for the commercial and recreational vessels, including the Whaleback closure and the rolling closures for the commercial fishery.

The social impacts associated with Option 1/No Action are expected to be neutral in the short-term, as it would maintain the status quo. There may be some negative impacts on the *Attitudes, Beliefs, and Values* of members of the groundfish fishery and other stakeholders related to the lack of flexibility of management as this would maintain current closures and not incorporate current research concerning cod. Given the current status of the GOM cod stock, Option 1 may be seen as a missed opportunity to implement new management that could help improve the GOM cod population. In the long-term, if cod is not adequately protected by No Action, there could be negative social impacts if there are resulting fishery declines. Thus, the social impacts of Option 1 are neutral.

7.5.2.1.3.2 Option 2: GOM Cod Protection Measures *(Preferred Alternative)*

Option 2 would prohibit the possession of GOM cod by the recreational groundfish fishery and modify the timing and extent of GOM rolling closures for the commercial groundfish fishery (sectors and common pool). These measures would be subject to review when the GOM cod stock biomass reaches 50% of SSB_{MSY}. Closures would be removed and/or added for the sectors and/or common pool during various times of year as follows (Figure 5):

- May 1 – May 31: the five 30-minute blocks closed to sectors under No Action would remain closed, and part of one open area (block 125) would close. For the common pool, of the 12 blocks closed, six would fully open and one (block 125) would partially open.

- June 1 – June 30: of the six blocks closed to sectors under No Action, three would open (blocks 152, 145 and 133), but block 132 and a portion of block 125 that are currently open, would close. For the common pool, of the 12 blocks closed, seven would fully open, and part of one open block (125) would close.

- October 1 – October 30: blocks 124 and 125 would continue to be closed for the common pool.

- November 1 – January 31: there are no area closures for sectors under No Action. A new closure consisting of one block fully closed (125) and one block partially closed (124) would be added. For the common pool, of the two areas closed, one area would partially open (124).

- April 1-April 30: Both sector and common poll rolling closures would be removed. This would afford sectors access to blocks 124, 125, 132, and 133, and the common pool access to blocks 121, 122, 123, 124, 125, 129, 130, 131, 132, and 133.

In summing up the total number of blocks and months that would be opened or closed under Option 2, there would be no net change for the sector fishery over the course of a year. For the common pool, closures would be removed in twenty four full blocks and part of one block.

The Council selected Option 2 as its *Preferred Alternative*.

Impacts on the commercial fishery
The social impacts of Option 2 relative to No Action are difficult to predict, because they would depend on how important particular areas have been or would be to the fishery.

The short-term social impacts of Option 2 are expected to be slightly positive for the commercial fishery relative to No Action, as the measures would create additional access for the commercial fishery by removing or modifying inshore time and area (rolling) closures for sector and common pool vessels in April. As noted above, the GOM cod protection measures would significantly reduce the footprint of existing rolling closures for the common pool in May and June. These modified closure areas would afford the commercial fishing industry additional opportunities, a positive impact on the *Size and Demographic Characteristics* of the fishery, as well as the *Attitudes, Beliefs, and Values* of the industry. However, there may be negative social impacts within the fishery if segments of the fleet cannot adjust their operations to remain active during the inshore winter closure from November through January (Figure 5). This may change the *Social Structure and Organization* of communities as well as *Historical Dependence on and Participation* in the fishery by individuals and communities. For smaller vessels that fish inshore, this may be mitigated if they can be active in April, when inshore areas of the GOM that were previously closed would now be open.

When compared to recent fishing years, the Quota Change Model predicts that this alternative would result in 100% utilization of GOM cod (Table 73). Overall GOM cod mortality would be limited by the ACL rather than the adjustments in area closures. Analysis of the proportion of commercial GOM cod landings by month per 10 minute square for 2010-partial calendar year 2014 (Figure 24) show that the blocks with the highest proportion of commercial landings would remain open under Option 2. In particular, over 25% of cod landings have come from a 10-minute square within block 124 would not be closed by this option. Thus, Option 2 is not expected to constrain the fishery substantially.

Option 2 would more closely align the rolling closures applicable to the common pool and sectors and remove many that are currently applicable to just the common pool. This may increase the sense of equity between these two fishery segments, a positive impact on the *Non-Economic Social Aspects* of the fishery. The degree Option 2 may make the common pool more attractive to permit holders is unknown, possibly increasing the number of permits enrolled in the common pool. In the long-term, there may be negative impacts should this option not promote GOM cod rebuilding due to fishing on spawning cod.

Impacts on the recreational fishery

Under Option 2, the recreational fishery would be prohibited from landing GOM cod. This could result in negative social impacts, as the projected discards would exceed the sub-ACL, likely leading to future constraints on recreational fishing effort. For the party/charter vessels, cod is a popular fish for customers, so these vessels may experience declines in their businesses if customers are unwilling to fish for other stocks instead. The *Size and Demographic Characteristics* of the party/charter fleet may be negatively impacted as a result.

Summary

Overall, the social impacts of Option 2 are low positive for the commercial fishery and negative for the recreational fishery relative to No Action.

7.5.2.2 Default Groundfish Specifications

7.5.2.2.1 Option 1: No Action

Under Option 1, in the event of a rulemaking delay, there would be no fishing for stocks without specifications in place on May 1, nor any fishing for other groundfish stocks that share the same Broad Stock Area as stocks with no specifications.

If Option 1 is selected, there would be no additional social impacts relative to the status quo. However, not having specifications in place at the start of the fishing year would result in negative impacts for the fishermen and fishing communities that rely on fishing in those Broad Stock Areas, because no directed

multispecies trips would be allowed. The lack of specifications would not address the MSFCMA requirements to achieve Optimum Yield and consider the needs of fishing communities. This would have a negative impact on the *Size and Demographic Characteristics* of the fishery, depending on the length of delay, as well as a negative impact on the *Attitudes, Beliefs, and Values* of the fishermen and other stakeholders towards management and the regulatory process. Most of the other federal fisheries in the Northeast have default provisions in place, so not having one for the multispecies fishery could be causing conflict and perceptions of inequity between fishermen, a negative impact on the *Non-Economic Social Aspects* of fishing. While non-groundfish fisheries with sub-ACLs for groundfish stocks are not required to cease fishing in the absence of specifications for a groundfish stock (e.g., scallop and whiting fisheries), these fisheries may be subject to Accountability Measures for overages in the following fishing year. To date, there has not been a rulemaking delay on specifications in the multispecies fishery, in part, because the lack of a default provision has incentivized a timely assessment, management and regulatory process.

Overall, Option 1 would have no additional social impacts (neutral), though a lack of specifications would be negative.

7.5.2.2.2 Option 2: Percentage Rollover Provisions for Default Specifications *(Preferred Alternative)*

Under Option 2, a default percentage of the prior year's ACL would be in place in the absence of specifications due to a delay in rule-making. However, the default specifications would expire on August 1st and may not exceed the anticipated ABC for the upcoming FY. Default specifications would be replaced by approved OFL and ABC values upon rulemaking. Catches occurring while default specifications are in place (after May 1st through final rulemaking) would be counted against the updated ACL for the FY. Northeast groundfish sectors would not be subject to the 20% holdback of the prior year's Sector ACE while default specifications are in place.

If Option 2 is selected, the fishing year would be able to start on time, which would result in more positive social impacts relative to No Action. The fishery would be allowed to continue operations with less disruption, a positive impact in terms of the *Size and Demographic Characteristics* of the fishery, as well as the *Historical Dependence on and Participation* in the fishery. Option 2 would also improve the *Attitudes, Beliefs, and Values* of fishermen and other stakeholders about management, unless the annual specifications process became chronically delayed. Then, stakeholders may perceive that a default provision may be an excuse for delay in the assessment, management, and regulatory processes. Because most of the other federal fisheries in the Northeast have a default provision in place, having a default provision may decrease conflict and improve perceptions of equity between fishery participants, a positive impact on the *Non-Economic Social Aspects* of fishing.

The Council considered three options for default specifications, 35%, 20%, and 10% of the prior year's ACLs. The social impacts of Option 2 depend on the specific percentage selected and how quickly the fishery caught the ACLs of the allocated stocks. Preliminary commercial catch data from prior fishing years can be used to estimate the timing of sub-ACL use. By mid-August, about 30% through the fishing year, the percentage caught of each allocated stock varied from 0.5% to 35.4% for FY 2012 - FY 2014 (Table 65).

Sub-Option A (35% default, *Preferred Alternative*) would have the least potential to constrain the fishery (and the most positive social impacts) relative to No Action and sub-Options B and C, and thus provide the most flexibility for the industry in the near-term. In FY 2012-2014, less than 35% of the commercial

sub-ACLs for the allocated stocks were caught by mid-August in 98% of the cases (of 17 stocks over three years).

Sub-Option B (20% default) would have more potential to constrain the fishery relative to sub-Option A, but less relative to No Action and sub-Option C, thus providing some flexibility for the industry in the near-term. In FY 2012-2014, less than 20% of the commercial sub-ACLs for the allocated stocks were caught by mid-August in 63% of the cases (of 17 stocks over three years).

Sub-Option C (10% default) would have more potential to constrain the fishery relative to sub-Options A and B, but less relative to No Action, thus providing little flexibility for the industry in the near-term. In FY 2012-2014, less than 10% of the commercial sub-ACLs for the allocated stocks were caught by mid-August in 25% of the cases (of 17 stocks over three years).

Overall, the social impacts of Option 2 are expected to be positive relative to No Action, with sub-Option A being most positive.

7.5.2.3 Sector ACE Carryover

7.5.2.3.1 Option 1: No Action

Under Option 1, groundfish sectors would continue to be allowed to carryover 10% of their unused ACE.

If Option 1 is selected, there would be no additional social impacts relative to the status quo. In the event of bad weather or unforeseen circumstances near the end of the fishing year that prevents the groundfish fleet from using the entire sub-ACL, a carryover provision would improve safety at sea and allow vessels to fully utilize their allocation in the following year, which would otherwise go unharvested. Thus, Option 1 would have a positive impact on *Non-Economic Social Aspects* of the groundfish fishery (e.g., safety) and the *Size and Demographic Characteristics* of the fishery-related workforce (e.g., employment). This alternative would promote certainty in business planning, which would have a positive impact on the *Non-Economic Social Aspects* of the fishery.

7.5.2.3.2 Option 2: Modification to Sector ACE carryover

Under Option 2, the Amendment 16 carryover provisions would be modified. Groundfish sectors would be able to carry forward up to 10% of unused ACE provided that the total unused sector ACE carried forward for all sectors from the previous FY does not exceed the ABC level minus the ACL for the fishing year in which the carryover would be landed (e.g., FY 2015).

If Option 2 is selected, there would likely be positive social impacts in terms of the *Attitudes, Beliefs, and Values* of fishermen and other stakeholders towards management, because the U.S. District Court for the District of Columbia's April 4, 2014 ruling would be addressed regarding NMFS' carryover-related Framework Adjustment 50 measures. By selecting Option 2, the Council may be perceived in a more positive light, because it would be taking action to modify the carryover-related measures. Without Council action, NMFS would likely be required to take unilateral action. Limiting the carryover to the ABC level minus the ACL (i.e., management uncertainty) for the fishing year in which the carryover will be landed would reduce the risks associated with increased management uncertainty compared to a full carryover option. The social impacts of Option 2 relative to Option 1 would depend on the magnitude of the management uncertainty for the coming fishing year relative to what 10% of unused sector ACE would be, thus are uncertain. Overall, the social impacts of Option 2 are low positive.

7.6 Cumulative Effects Analysis

7.6.1 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 216-6. 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 Framework 53 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 framework (May, 2015) and 2020.

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 endangered and protected species, the geographic range is the total range of each species (Section 6.4).

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 6.5) 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 90 . 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 framework is included. The culmination of all these factors is considered when making the cumulative effects assessment.

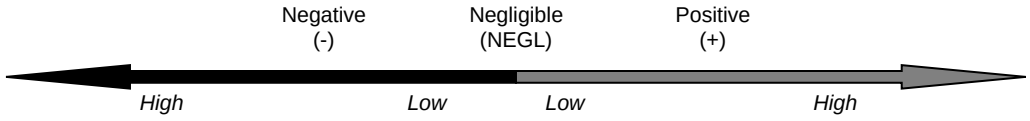
Impact definitions for the tables in this section are as summarized in Table 89.

Table 89 - Impact definitions for cumulative effects analyses.

VEC	Direction		
	Positive (+)	**Negative (-)**	**Negligible/Neutral**
Allocated target species, other landed species, and protected resources	Actions that increase stock/population size	Actions that decrease stock/population size	Actions that have little or no positive or negative impacts to stocks/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



7.6.2 Past, Present and Reasonably Foreseeable Future 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 – the last EIS developed for the NE Multispecies FMP.

Table 90- 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**	**+**

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
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**

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
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-**
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 -**

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
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**

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
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 +**
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+**

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
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 FY2014-2014 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 sets specifications for scallop FY 2014 and 2015. It is also considering accountability measures for windowpane flounder stocks.	Likely Negl	Likely Negl to L+	Likely Negl to L+	Likely Negl	Likely - to +

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
Reasonably Foreseeable Future Fishing Actions					
Omnibus Essential Fish Habitat Amendment **Phase 2 of the Omnibus EFH Amendment would consider 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 would reconsider closures put in place to protect EFH and groundfish mortality in the Northeast Region.**	**Likely +**	**Likely +**	**Likely +**	**ND**	**ND**
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 -**
FW52 to the Multispecies FMP **This FW would modify exisiting AMs for northern and southern windowpane flounder**	**Likely L+**	**Likely +**	**Likely +**	**Negl**	**Likley +**
Framework 26 to the Atlantic Sea Scallop FMP **This framework would set specifications for scallop FY 2016 and 2017. It is also considering proactive accountability measures for windowpane flounder.**	**Likely Negl**	**Likely Negl to L+**	**Likely Negl to L+**	**Likely Negl**	**Likely - to +**
A18 to the Multispecies FMP **This amendment would create accumulation limits, a fishery for Handgear A, and inshore/offshore measuress.**	**Mixed**	**Likely +**	**Likely +**	**Negl**	**Mixed**

Actions	Habitat	Regulated Groundfish Stocks	Non-Groundfish Species	Endangered and other Protected Resources	Human Communities
FW 54 to the Multispecies FMP/ Joint Monkfish Framework 9 This framework would modify regulations for vessels in the DAS program.	**ND**	**ND**	**ND**	**ND**	**ND**

Noted: ND= Not determined

Table 90 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 91 come from fishery-related activities (e.g., federal fishery management actions – many of which are identified above in Table 90). 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 socio-economic impacts for fishery participants. However, these impacts are usually necessary to bring about long-term sustainability of a given resource and as such should, in the long-term, promote 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 are those that 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. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and, as such, may indirectly constrain 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.

Framework Adjustment 26 (FW 26) to the Scallop FMP is considering establishing a proactive AM for the scallop fishery for windowpane flounder. The AM may reduce flatfish bycatch in the scallop fishery overall, which may have potentially positive cumulative impacts on the groundfish resource and groundfish fishery.

Omnibus Essential Fish Habitat Amendment 2 is considering six types of management alternatives: (1) EFH designations, (2) HAPC designations, (3) Habitat Management Areas, (4) Spawning Management Areas, (5) Dedicated Habitat Research Areas, and (6) changes to approaches to framework adjustments and monitoring.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. EFH designations consist of two complementary elements, the text descriptions, and the map representations. The EFH maps are generally based on trawl survey data, with higher relative abundance areas identified as EFH. Most of the maps are refined using depth and temperature data. A major improvement in the new text descriptions is their inclusion of specific depth and temperature ranges that more explicitly connect with the map representations of EFH.

This amendment also includes a number of alternatives to designate habitat areas of particular concern, or HAPCs. Designation of HAPCs is intended to indicate which areas within EFH should receive more of the Council's and NMFS' attention when providing comments on Federal and state actions, and in establishing higher standards to protect and/or restore such habitat.

The habitat management and spawning protection alternatives consist of combinations of current areas, modified versions of current areas, or newly identified areas. The alternatives were developed to address either adverse effects minimization, including more focused objectives related to juvenile groundfish habitat protection, or spawning protection objectives, respectively. Fishing restriction measures vary by area and alternative type. Generally mobile-bottom tending gear restrictions are proposed in habitat management areas and restrictions on gears capable of catching groundfish are proposed in spawning areas.

One approach to address habitat-related information needs is to designate Dedicated Habitat Research Areas (DHRAs) in concert with habitat management areas. These DHRAs would be the focus of research activities to provide information to managers, improve understanding of the ecological effects of fishing across a range of habitats, and ultimately improve model forecasts and inform future habitat management.

Table 91- Summary effects of past, present and reasonably foreseeable future actions on the VECs identified for Framework 53.

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	**Positive** Combined effects of past fishery actions have reduced effort and thus interactions with protected resources	**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	**Positive** Continued effort controls along with past regulations will likely help stabilize protected species interactions
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

7.6.3 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 table (Table 92) summarizes the added effects of the condition of the VECs (i.e., status/trends from Section 6.2.1) and the sum effect of the past, present and reasonably foreseeable future actions (from Table 91 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 6.1 and 6.5 , respectively. As mentioned above, this cumulative effects baseline is then used to assess cumulative effects of the proposed management actions in Table 93.

Table 92- Cumulative effects assessment baseline conditions of the VECs.

VEC		Status/Trends, Overfishing	Status/Trends, Overfished	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 91)	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		
	GOM Haddock	No	No		
	GB Yellowtail Flounder	Unknown	Unknown		
	SNE/MA Yellowtail Flounder	No	No		
	CC/GOM Yellowtail Flounder	***Yes***	***Yes***		
	American Plaice	No	No		
	Witch Flounder	***Yes***	***Yes***		
	GB Winter Flounder	No	No		
	GOM Winter Flounder	No	Unknown		
	SNE/MA Winter Flounder	No	***Yes***		
	Acadian Redfish	No	No		
	White Hake	No	No		
	Pollock	No	No		
	Northern (GOM-GB) Windowpane Flounder	***Yes***	***Yes***		
	Southern (SNE-MA) Windowpane Flounder	No	No		
	Ocean Pout	No	***Yes***		
	Atlantic Halibut	No	***Yes***		
	Atlantic Wolffish	n/a	***Yes***		

Table 92 cont'd.

VEC		Status/Trends	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 91)	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 occurring. Winter skate is not overfished but overfishing is 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 6.1); 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, Kemp's ridley and green sea turtles are classified as endangered under the ESA and loggerhead sea turtles are classified as threatened.	**Positive** – reduced gear encounters through effort reductions and management actions taken under the ESA and MMPA have had a positive impact	**Positive** – reduced gear encounters through effort reductions and additional management actions taken under the ESA and MMPA.
	Fish	Atlantic salmon, Shortnose sturgeon, and Atlantic sturgeon are classified as endangered under the ESA; Atlantic sturgeon Gulf of Maine DPS is listed as threatened; cusk and dusky shark are candidate species		
	Large Cetaceans	Of the baleen whales (right, humpback, fin, blue, sei and minke whales) and sperm whales, all are protected under the MSA and with the exception of minke whales, all are listed as endangered under the ESA.		
	Small Cetaceans	Pilot whales, dolphins and harbor porpoise are all protected under the MSA, the HPTRP and the Large Whale Take Reduction Plan Amendment		
	Pinnipeds	ESA classification: Endangered, number of nesting females below sustainable level; taken by longfin trawl		

Table 92 cont'd.

VEC	Status/Trends	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 91)	Combined CEA Baseline Conditions
Human Communities	Complex and variable (see Section 6.5). 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

7.6.4 Summary Effects of Framework 53 Actions

The alternatives contained in Framework 53 are focused on changes to status determination criteria, specifications and management measures. The action modifies commercial and recreational groundfish fishing measures to establish management measures for GOM cod that reduce fishing mortality while providing opportunity for the groundfish fishery to prosecute healthy stocks in other times and areas and allow for flexibility in groundfish specifications under certain circumstances.

Amendment 16 defined the fishing mortality targets needed to rebuild groundfish stocks and end overfishing, and adopted a complex suite of measures designed to achieve these mortality objectives. This action further builds upon the specifications adopted in Frameworks 44, 45, 46, 47, 48, 50, and 51 that used the best available science to translate those mortality targets into specific amounts of fish. These quantities must be defined in order to implement the ACLs and AMs called for in the amendment. The management measures in FW 53 are thus consistent with the amendment. These measures affect the prosecution of the commercial and recreational fishery. The proposed changes would modifiy rolling closures GOM cod, prohibit possession of GOM cod by the recreational fishey, address instances when the fishing year may begin without specifications in place for some stocks, and revise regulations governing Sector ACE carryover.
The proposed GOM cod protection closures would modify existing GOM rolling closures (for sector and common pool) for the commercial groundfish fishery during the months of May, June, and November, implement new closures in December and January, and remove the April rolling closures for all vessels (see Figure 5 in Section 4.2.1.3). As shown in Figure 6, the GOM cod protection closures would open blocks 124, 125, 132, and 133 in April for all vessels, and closes block 125 and portions of block 124 from November through January.

In general, the adoption of these measures will benefit groundfish stocks because it will be more likely that mortality targets will not be exceeded. These measures are not likely to impact non-groundfish stocks, protected species, or habitat to any great extent when compared to the No Action alternatives.

Table 93- Summary of Impacts expected on the VECs.

Management Measure		VECs				
		Managed Resources	**Non-target Species**	**Protected Resources**	**Habitat Including EFH**	**Human Communities**
UPDATES TO STATUS DETERMINATION CRITERIA, FORMAL REBUILDING PROGRAMS, AND ANNUAL CATCH LIMITS	**REVISED STATUS DETERMNA-TION CRITERIA (GB YELLOWTAIL FLOUNDER)**	**Positive** – Revised specifications will guide management actions (AMs) and rebuilding using the best available science. This, combined with past management efforts, should contribute to stock rebuilding and provide positive cumulative impacts	**No Impact/ Neutral** – Provided rebuilding continues, additional impacts to non-target species are not anticipated	**No Impact/ Neutral** – Provided rebuilding continues, additional impacts to protected species are not anticipated	**No Impact/ Neutral** – Provided rebuilding continues, additional impacts to habitat are not anticipated	**Positive** – Overall revenues will increase as stock rebuilds
	REVISED OFL/ABCS/ ACLS	**Positive** – These ABCs, ACLs, and sub-ACLs, and the AMs will impose tighter controls on fishing mortality for these stocks using the best available science. This, combined with past management efforts, should contribute to stock rebuilding and provide positive cumulative impacts	**No Impact/ Neutral** – Provided rebuilding continues, additional impacts to non-target species are not anticipated	**No Impact/ Neutral** – Provided rebuilding continues, additional impacts to protected species are not anticipated	**No Impact/ Neutral** – Provided rebuilding continues, additional impacts to habitat are not anticipated	**Mixed** – While the Preferred Alternative produces more revenues than No Action, reduced ACLs (as compared to recent years) will result in continued reductions in fishing revenues in the short term. Overall revenues will increase as stocks increase.

Table 93 cont'd.

Management Measure		VECs				
		Managed Resources	**Non-target Species**	**Protected Resources**	**Habitat Including EFH**	**Human Communities**
COMMERCIAL AND RECREATIONAL FISHERY MEASURES	**GOM COD PROTECTION MEASURES**	**Mixed** – Positive, neutral, and negative impacts are expected for groundfish species depending on the time and location of closures and fishing behavior	**Mixed** – Positive, neutral, and negative impacts are expected for non-target species depending on the time and location of closures and fishing behavior	**Low negative** – When compared to No Action. However, measures are not expected result in an increased number of interactions with protected resources	**Low negative –** However, fishing effort is expected to be reduced in some times and areas and when compared with fishing effort in recent years	**Mixed** – Overall revenues will increase as stocks rebuild, however restrictions may constrain commercial and recreational fishing
	DEFAULT GROUNDFISH SPECIFICATIONS	**Low negative/ Neutral** – measures are expected to create low negative impacts to target species if fishing activity increases during the default period	**Low negative/ Neutral** – measures are expected to create low negative impacts to non-target species if fishing activity increases during the default period	**No impact** – measures are not expected to create additional impacts to protected resources	**No impact**– When compared to No Action but measures are not expected to create additional negative impacts to habitat when compared with recent fishing activity	**Positive** – Increasing access to landings will provide additional commercial fishing revenues and recreational opportunities
	MODIFICATIONS TO SECTOR ACE CARRYOVER	**Low negative/ Neutral** – When compared to No Action, measures are expected to create additional negative impacts to target species	**Low negative/ Neutral** – When compared to no action, measures are expected to create additional negative impacts to non-target species	**No impact** – measures are not expected to create additional impacts to protected resources	**Low Negative/ Neutral** – When compared to No Action, slight decreases in effort would lead to low negative impacts on habitat	**Positive** – Increasing access to landings will provide additional commercial fishing revenues

7.6.5 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 M-S Act 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 regulatory environment, 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 93 provides a summary of likely cumulative effects found in the various groups of management alternatives contained in FW53. The CEA baseline that, as described above in Table 93, 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 effect on the VEC would 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 92, 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 action proposed by FW 53 is expected to continue this trend. The adoption of specifications and management measures for the groundfish fishery are designed to meet fishing mortality targets and to promote stock rebuilding. 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. The Council's preferred alternative for GOM cod protection measures would prohibit the possession of GOM cod for recreational anglers, and modify the suite of existing rolling closures in the GOM that apply to commercial groundfish vessels. The intent of this measure is to increase protection for winter cod by adding the winter closures, and to create more economic opportunities for the commercial in the spring (i.e., by opening up the April closure). Fishery closures may prove more or less effective depending on fish ecology (e.g., thermal habitat preference, distributional shifts in response to environmental conditions, spawning site fidelity, and prey availability) and climate change response on a species by species basis. The GOM cod protection measures would add new protection for winter spawning cod and continue to provide some positive benefits through protection of spring spawning cod through modified rolling closures, while the low ACL for GOM cod would control catches. The measures would encapsulate a greater diversity of cod spawning variants (i.e., spring and winter), and in particular for winter spawning cod potentially increase its resiliency to climate change impacts. In addition, the cumulative impacts of FW 26 to the Scallop FMP on groundfish species are likely negligible and potentially positive for windowpane flounder.

The GOM cod protection closure in Framework 53 aligns with several of the preferred spawning alternatives identified in the Omnibus Habitat Amendment 2 in the GOM, including the existing GOM cod spawning protection area ('Whaleback') and the closure of an area in Massachusetts Bay that from November 1st – January 31st. Significant overlap exists across the GOM cod protection measures, which modify the existing GOM rolling closures, and the GOM spawning alternatives identified in the Omnibus Habitat Amendment 2.

Non-Target Species

As noted in Table 92, 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 action proposed by FW 53 is expected to continue this trend. The primary mechanism is through the reduced ABCs/ACLs (reduced from recent years). The modifications in management measures are expected to affect non-target species depending on fishing behavior. 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.

Protected Resources

As noted in Table 92, the combined impacts of past federal fishery management actions have reduced fishing effort, and therefore reduced interactions with protected resources. Current management measures, including those implemented through Amendment 16 to the FMP, are expected to continue to control effort and catch, and therefore continue to lessen interactions with protected resources. The action proposed by FW 53 is expected to continue this trend; however, as stocks rebuild to sustainable levels, future actions may lead to increased effort, which may increase potential interactions with protected species. The reductions in ABCs/ACLs may provide short-term benefits to protected resources as groundfish fishing effort will decline, but as stocks rebuild effort may increase. Changes to management measures are not expected to affect protected species. Overall, the combination of past, present, and future actions is expected to stabilize protected species interactions and lead to positive, non-significant cumulative impacts to protected species.

Habitat, Including EFH

As noted in Table 92, 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 management measures are not expected to have substantial impacts on habitat or EFH. The reduced ABCs/ACLs may result in reduced groundfish fishing activity and provide some minor short-term benefits to habitat. 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.

Human Communities

As noted in Table 92, 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. Modifying the rolling closures, establishing default specifications, and revising sector ACE carryover will provide some benefits to groundfish fishing communities. The magnitude of economic benefits of reopening previously closed areas is difficult to predict, and may be greater than anticipated. However, this action alone is not expected to have significant socioeconomic impacts beyond what was anticipated in Amendment 16. In addition, the cumulative impacts of FW 26 to the Scallop FMP on the groundfish fishery are likely to be negligible and potentially positive for the windowpane flounder fishery. 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.

8.0 Applicable Law

8.1 Magnuson-Stevens Fishery Conservation and Management Act

8.1.1 Consistency with National Standards

Section 301 of the Magnuson-Stevens Act requires that regulations implementing any Fishery Management Plan or Amendment be consistent with the ten national standards listed below.

Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

Amendment 16 to the Northeast Multispecies FMP adopted measures designed to end overfishing on the groundfish stocks that were subject to excessive fishing pressure at the time of its development. This action adjusts those measures in a way that is designed to maximize optimum yield while preventing overfishing and continuing rebuilding plans. For overfished fisheries, the Magnuson-Stevens Act defines optimum yield as the amount of fish which provides for rebuilding to a level consistent with producing the maximum sustainable yield from the fishery. The measures are designed to achieve the fishing mortality rates, and yields, necessary to rebuild the overfished stocks as well as to keep fishing mortality below overfishing levels for stocks that are not in a rebuilding program. The measures in Section 4.1 that adopt status determination criteria and adjust ACLs set controls on catch to ensure that the appropriate fishing mortality rates are implemented. Changes to commercial and recreational fishery measures in Section 4.2 implement and adjust programs to achieve the desired mortality levels

Conservation and management measures shall be based on the best scientific information available.

The Preferred Alternatives are based on the most recent estimates of stock status available for GOM cod, GOM haddock, GB yellowtail flounder, GOM winter flounder, GB winter founder, and pollock. These estimates are mostly in the form of information provided by the Northeast Fisheries Science Center in the TRAC and Integrated Peer Review, SAW/SARC 59, and 2014 Groundfish Updates and Peer Review. Additionally, the mortality limits were determined based on the scientific advice of the SSC, which recommends ABCs to the Council.

With respect to bycatch information, the action uses bycatch information from the most recent assessments. Bycatch data from observer reports, vessel logbooks, or other sources must be rigorously reviewed before conclusions can be drawn on the extent and amount of bycatch. While additional observer data has been collected since the most recent assessments were completed, it has not been analyzed or reviewed through the stock assessment process and thus cannot be used.

The economic analyses in this document are based primarily on landings, revenue, and effort information collected through the NMFS data collection systems used for this fishery.

To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

The Preferred Alternatives manage each individual groundfish stock as a unit throughout its range. Management measures specifically designed for one stock are applied to the entire range of the stock. In addition, the groundfish complex as a whole is managed in close coordination. Management measures are designed and evaluated for their impact on the fishery as a whole.

Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

The Preferred Alternatives do not discriminate between residents of different states. They are applied equally to all permit holders, regardless of homeport or location. While the measures do not discriminate between permit holders, they do have different impacts on different participants. This is because of the differences in the distribution of fish and the varying stock levels in the complex. For example, potentially low ACLs on GOM cod could differentially impact fishermen in the northern states who rely more heavily on that particular stock. Some of these impacts may be localized, as often communities near the stock may have developed small boat fisheries that target it. These distributive impacts are difficult to avoid given the requirement to rebuild overfished stocks. These distributive impacts are difficult to avoid given the requirement to rebuild overfished stocks. Even if the measures are designed to treat all permit holders the same, the fact that fish stocks are not distributed evenly, and that individual vessels may target specific stocks, means that distributive impacts cannot be avoided.

Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

The Preferred Alternatives are not expected to significantly reduce the efficiency of fishing vessels. These measures are considered practicable since they allow rebuilding of depleted groundfish stocks and have considered efficiency to the greatest extent possible. None of the measures in this action have economic allocation as their sole purpose; all are designed to contribute to the control of fishing mortality.

Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

The primary effort controls used in this management plan - effort controls and sectors - allow each vessel operator to fish when and how it best suits his or her business. Vessels can make short or long trips, and can fish in any open area at any time of the year. The measures allow for the use of different gear, vessel size, and fishing practices. The specific measures adopted in this action do not reduce this flexibility.

Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

While some of the measures used in the management plan, and proposed by this action, tend to increase costs, those measures are necessary for achieving the plan's objectives. As an example, measures that reduce the efficiency of fishing vessels, including time area closures such as are proposed in the GOM cod protection measures for the groundfish fishery, tend to increase the costs of fishing vessels since fishing catches are reduced. These measures accomplish other goals, however, by allowing groundfish stocks to rebuild. The measures do not duplicate other regulatory efforts. Management of multispecies stocks in federal waters is not subject to coordinated regulation by any other management body. Absent Council action, a coordinated rebuilding effort to restore the health of the overfished stocks would not occur.

The Council considered the costs and benefits of a range of alternatives to achieve the goals and objectives of this FMP. It considered the costs to the industry of taking no action relative to adopting the measures herein. The expected benefits are greater in the long-term if stocks are rebuilt, though it is clear there are substantial short-term declines in revenue and possible increases in costs that can be expected.

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 impacts on such communities.

Consistent with the requirements of the Magnuson-Stevens Act to prevent overfishing and rebuild overfished stocks, the Preferred Alternatives may restrict fishing activity through the implementation-of low ACLs for GOM cod and time area closures identified as GOM cod protection measures in order to achieve rebuilding targets. Analyses of the impacts of these measures show that landings and revenues are likely to decline for many participants in upcoming years due to the rebuilding programs in place for many stocks. In the short term, these declines will probably have negative impacts on fishing communities throughout the region, but particularly on those ports that rely heavily on groundfish. These declines are unavoidable given the M-S Act requirements to rebuild overfished stocks. The need to control fishing mortality means that catches cannot be as high as would likely occur with less stringent management measures.

Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

Many measures adopted in Amendment 16 were designed to limit the discards of both groundfish and some other species, including the sector management program, and this action is expected to continue those benefits with no substantial changes.

Conservation and management measures shall, to the extent practicable, promote safety of human life at sea.

Measures adopted in Amendment 16 were designed to improve safety in spite of low ACLs anticipated by subsequent actions in the near future. The flexibility inherent in sector management and the ability to use common pool DAS at any time are key elements of the measures that promoted safety. The Preferred Alternative, in conjunction with Amendment 16 measures, is the best option for achieving the necessary mortality reductions while having the least impact on vessel safety.

8.1.2 Other M-SFCMA requirements

Section 303 (a) of FCMA contains 14 required provisions for FMPs. These are discussed below. It should be emphasized that the requirement is imposed on the FMP. In some cases noted below, the M-S Act requirements are met by information in the Northeast Multispecies FMP, as amended. Any fishery management plan that is prepared by any Council, or by the Secretary, with respect to any fishery, shall—

contain the conservation and management measures, applicable to foreign fishing and fishing by vessels of the United States, which are-- (A) necessary and appropriate for the conservation and

management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery; (B) described in this subsection or subsection (b), or both; and (C) consistent with the National Standards, the other provisions of this Act, regulations implementing recommendations by international organizations in which the United States participates (including but not limited to closed areas, quotas, and size limits), and any other applicable law;

Foreign fishing is not allowed under this management plan or this action and so specific measures are not included to specify and control allowable foreign catch. The measures in this management plan are designed to prevent overfishing and rebuild overfished stocks. There is one international agreement that is germane to multispecies management. On December 20, 2010, the International Fisheries Clarification Act stipulated that the U.S./Canada Resource Sharing Understanding, implemented through Amendment 13, can be considered an international agreement for the purposes of setting ACLs. The proposed measures are consistent with that Understanding.

contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any;

Amendment 16 included a thorough description of the multispecies fishery from 2001 through 2008, including the gears used, number of vessels, landings and revenues, and effort used in the fishery. This action provides a summary of that information and additional relevant information about the fishery in Section 6.5.

assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from, the fishery, and include a summary of the information utilized in making such specification;

The present biological status of the fishery is described in Section 6.2. Likely future conditions of the resource are describedin Section 7.1.1.2. Impacts resulting from other measures in the management plan other than the measures included here can be found in Amendment 16. The maximum sustainable yield for each stock in the fishery is defined in Amendment 16 and optimum yield for the fishery is defined in Amendment 9.

assess and specify-- (A) the capacity and the extent to which fishing vessels of the United States, on an annual basis, will harvest the optimum yield specified under paragraph (3); (B) the portion of such optimum yield which, on an annual basis, will not be harvested by fishing vessels of the United States and can be made available for foreign fishing; and (C) the capacity and extent to which United States fish processors, on an annual basis, will process that portion of such optimum yield that will be harvested by fishing vessels of the United States;

U.S. fishing vessels are capable of, and expected to, harvest the optimum yield from this fishery as specified in Amendment 16 and Frameworks 44, 45, 47, 49, 50, and 51. U.S. processors are also expected to process the harvest of U.S. fishing vessels. None of the optimum yield from this fishery can be made available to foreign fishing.

specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter fishing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, and the estimated processing capacity of, and the actual processing capacity utilized by, United States fish processors;

Current reporting requirements for this fishery have been in effect since 1994 and were originally specified in Amendment 5. They were slightly modified in Amendments 13 and 16, and VMS requirements were adopted in FW 42. The requirements include Vessel Trip Reports (VTRs) that are submitted by each fishing vessel. Dealers are also required to submit reports on the purchases of regulated groundfish from permitted vessels. Current reporting requirements are detailed in 50 CFR 648.7.

consider and provide for temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safe conduct of the fishery; except that the adjustment shall not adversely affect conservation efforts in other fisheries or discriminate among participants in the affected fishery;

Provisions in accordance with this requirement were implemented in earlier actions, and continue with this action. For common pool vessels, the carry-over of a small number of DAS is allowed from one fishing year to the next. If a fisherman is unable to use all of his DAS because of weather or other conditions, this measure allows his available fishing time to be used in the subsequent fishing year. Sectors will also be allowed to carry forward a small amount of ACE into the next fishing year. This will help sectors react should adverse weather interfere with harvesting the entire ACE before the end of the year. Neither of these practices requires consultation with the Coast Guard.

describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat;

Essential fish habitat was defined for Atlantic wolffish in Amendment 16, and for all stocks in an earlier action. A summary of the EFH can be found in Section 6.1.5.

in the case of a fishery management plan that, after January 1, 1991, is submitted to the Secretary for review under section 304(a) (including any plan for which an amendment is submitted to the Secretary for such review) or is prepared by the Secretary, assess and specify the nature and extent of scientific data which is needed for effective implementation of the plan;

Scientific and research needs are not required for a framework adjustment. Current research needs are identified in Amendment 16.

include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on-- (A) participants in the fisheries and fishing communities affected by the plan or amendment; and (B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants;

Impacts of this framework on fishing communities directly affected by this action and adjacent areas can be found in Section 7.5.

specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished (with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery) and, in the case of a fishery which the Council or the Secretary has determined is approaching an overfished condition or is overfished, contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery;

Objective and measurable Status Determination Criteria for all species in the management plan are presented in Amendment 16, and have been updated in subsequent frameworks, most recently FW 48 and this action, FW 53.

establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority-- (A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided;

The Standardized Bycatch Reporting Methodology (SBRM) omnibus amendment was dismissed by the U.S. Court of Appeals for the District of Columbia Circuit in 2011 (No. 10-5299 Oceana, Inc. v. Gary F. Locke). That method no longer applies to this framework. None of the measures in this framework are expected to increase bycatch beyond what was considered in Amendment 16. In 2014, the Councils approved and submitted a new SBRM amendment and it is under review by NMFS.

assess the type and amount of fish caught and released alive during recreational fishing under catch and release fishery management programs and the mortality of such fish, and include conservation and management measures that, to the extent practicable, minimize mortality and ensure the extended survival of such fish;

This management plan does not include a catch and release recreational fishery management program and thus does not address this requirement.

include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors;

As noted above, the description of the commercial, recreational, and charter fishing sectors was fully developed in Amendment 16, and the commercial sector is updated and summarized in this document (Section 6.5).

to the extent that rebuilding plans or other conservation and management measures which reduce the overall harvest in a fishery are necessary, allocate any harvest restrictions or recovery benefits fairly and equitably among the commercial, recreational, and charter fishing sectors in the fishery.

This preferred alternative does not allocate harvest restrictions or stock benefits to the fishery. Such allocations were adopted in Amendment 16, while this action adjusts management measures for some stocks within the existing allocation structure.

establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability.

The mechanism for establishing annual catch limits was adopted by Amendment 16. This action uses that mechanism to specify ACLs for future fishing years.

8.1.3 EFH Assessment

This essential fish habitat (EFH) assessment is provided pursuant to 50 CFR 600.920(e) of the EFH Final Rule to initiate EFH consultation with the National Marine Fisheries Service.

8.1.3.1 Description of Action

The purpose of the Framework 53 (Northeast Multispecies FMP) Preferred Alternative is to adopt modifications to management measures that will incorporate new information relative to effective program administration that are necessary to achieve the fishing mortality targets required by Amendment 16.

In general, the activity described by this action, fishing for groundfish species, occurs off the New England and Mid-Atlantic coasts within the U.S. EEZ. Thus, the range of this activity occurs across the designated EFH of all Council-managed species (see Amendment 11 to the Northeast Multispecies FMP for a list of species for which EFH was designated, the maps of the distribution of EFH, and descriptions of the characteristics that comprise the EFH). EFH designated for species managed under the Secretarial Highly Migratory Species FMPs are not affected by this action, nor is any EFH designated for species managed by the South Atlantic Council as all of the relevant species are pelagic and not directly affected by benthic habitat impacts.

The Preferred Alternatives are described in Section 4.0. The alternatives include the following general measures:

- Revised status determination criteria
- Revised groundfish specifications
- Revised rolling closures for the commercial fishery and no possession of GOM cod for the recreational fishery (i.e., GOM cod protection measures)
- Default groundfish specifications
- Revised sector ACE carryover provisions

8.1.3.2 Assessing the Potential Adverse Impacts

Refer to the Habitat Impacts of the Alternatives (Section 7.2, summarized in Section 7.2.3) for a tabular look at the summary impacts of the Preferred Alternative. Some of the measures are expected to have neutral impacts on habitat.

Measures with Potential Negative Effects on EFH

The measures have low negative effects with respect to EFH.

Measures with Potential Positive Effects on EFH

None of the measures have positive effects on EFH.

Table 94- Summary of possible effects to EFH as a result of the Preferred Alternative

	Preferred Alternative
Possible negative impacts	Revised rolling closures for the commercial fishery and no possession of GOM cod for the recreational fishery (i.e., GOM cod protection measures) Revised sector ACE carryover provisions
Neutral Impacts	Revised status determination criteria Revised groundfish specifications Default groundfish specifications
Possible Positive Impacts	N/A
Uncertain Impacts	N/A

8.1.3.3 Minimizing or Mitigating Adverse Impacts

Section 7.2, (habitat impacts of the alternatives) demonstrates that the overall habitat impacts of all the measures combined in this action have neutral impacts relative to the baseline habitat protections established under Amendment 13 to the Northeast Multispecies FMP. As such, additional measures to mitigate or minimize adverse effects of the multispecies fishery on EFH beyond those established under Amendment 13 are not necessary.

8.1.3.4 Conclusions

The Preferred Alternative is unlikely to have noticeable impacts on EFH when compared with recent fishing activity; there may be low negative impacts when compared to the other alternatives.

8.2 National Environmental Policy Act (NEPA)

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 M-S Act and NEPA. The Council on Environmental Quality (CEQ) has issued regulations specifying the requirements for NEPA documents (40 CFR 1500 – 1508), as has NOAA in its agency policy and procedures for NEPA in NAO 216-6 §5.04b.1. All of those requirements are addressed in this document, as referenced below.

8.2.1 Environmental Assessment

The required elements of an Environmental Assessment (EA) are specified in 40 CFR 1508.9(b) and NAO 216-6 §5.04b.1. They are included in this document as follows:

- The need for this action are described in Section 3.2;
- The alternatives that were considered are described in Section 4.0;
- The environmental impacts of alternatives are described in Section 7.0;
- The agencies and persons consulted on this action are listed in Section 8.2.3 and Section 8.2.4.

This document includes the following additional sections that are based on requirements for an Environmental Impact Statement (EIS).

- An Executive Summary can be found in Section 1.0.
- A Table of Contents can be found in Section 2.0.
- Background and purpose are described in Section 3.0.
- A summary of the document can be found in Section 1.0.
- A brief description of the affected environment is in Section 6.0.
- Cumulative impacts of the Preferred Alternatives are described in Section 7.6.
- A determination of significance is in Section 8.2.2.
- A list of preparers is in Section 8.2.3.
- The index is in Section

8.2.2 Finding of No Significant Impact (FONSI)

National Oceanic and Atmospheric Administration Order (NAO) 216-6 (revised May 20, 1999) provides criteria for determining the significance of the impacts of a final fishery management action. These criteria are discussed below:

(1) *Can the Preferred Alternatives reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?*

<u>Response:</u> The Preferred Alternatives cannot reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action. With respect to the target species in the Northeast

Multispecies fishery the Preferred Alternatives adopt management measures that are consistent with target fishing mortality rates that promote rebuilding and/or sustaining stock sizes.

(2) *Can the Preferred Alternatives reasonably be expected to jeopardize the sustainability of any non- target species?*

Response: For fishery resources that are caught incidental to groundfish fishing activity, there is no indication in the analyses that the alternatives will threaten sustainability. Since the fishery does not currently jeopardize non-target species it is not likely that these alternatives will change that status.

(3) *Can the Preferred Alternatives reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?*

Response: The Preferred Alternatives cannot reasonably be expected to cause substantial damage to the oceans and coastal habitats and/or essential fish habitat. Analyses described in Section 7.2 indicate that only minor impacts are expected.

(4) *Can the Preferred Alternatives be reasonably expected to have a substantial adverse impact on public health or safety?*

Response: Nothing in the Proposed Action can be reasonably expected to have a substantial adverse impact on public health or safety. Measures adopted in Amendment 16 were designed to improve safety in spite of low ACLs anticipated by subsequent actions in the near term future. The flexibility inherent in sector management and the ability to use common pool DAS at any time are key elements of the measures that promoted safety. The Preferred Alternatives, in conjunction with Amendment 16 measures, are the best options for achieving the necessary mortality reductions while having the least impact on vessel safety.

(5) *Can the Preferred Alternatives reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?*

Response: The Preferred Alternatives cannot be reasonably expected to adversely affect endangered or threatened species. As discussed in Section 7.3, these species are expected to have very minimal impacts from the minor changes in fishing effort that are proposed by this action.

(6) *Can the Preferred Alternatives be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?*

Response: The Preferred Alternatives are not expected to have a substantial impact on biodiversity and/or ecosystem function with the affected area. The use of ACLs and AMs will tightly control catches of target and incidental regulated groundfish stocks. Catches of target and incidental catch species under this program will be consistent with the mortality targets of Amendment 16, and thus will not have a substantial impact on predator-prey relationships or biodiversity. Particular measures within this action will have no more than minimal adverse impacts to EFH. It is therefore reasonable to expect that there will not be substantial impact on biodiversity or ecosystem function.

(7) *Are significant social or economic impacts interrelated with natural or physical environmental effects*?

Response: The Preferred Alternatives are designed to continue the groundfish rebuilding programs that were first adopted in Amendment 13 to the Northeast Multispecies Fishery Management Plan and modified in subsequent actions, including Amendment 16. The environmental assessment documents that no significant natural or physical effects will result from the implementation of the Preferred Alternative. As described in Section 7.1.1, the measures in this action are designed to continue rebuilding/ promote target catch levels. The action cannot be reasonably expected to have significant impacts on habitat or protected species, as the impacts are expected to fall within the range of those resulting from Amendments 13 and 16. The action's potential economic and social impacts are also addressed in the environmental assessment (Sections 7.4 and 7.5), as well as in the Executive Order 12866 review (Section 8.11.1) and the Initial Regulatory Flexibility Act review (Section 8.11.2).

NMFS has determined that despite the potential socio-economic impacts resulting from this action, there is no need to prepare an EIS. The purpose of NEPA is to protect the environment by requiring Federal agencies to consider the impacts of their proposed actions on the human environment, defined as " the natural and physical environment and the relationship of the people with that environment." The EA for FW 53 describes and analyzes the preferred alternatives and concludes that there will be no significant impacts to the natural and physical environment. While some fishermen, shore-side businesses, and others may experience impacts to their livelihood, these impacts, in and of themselves, do not require the preparation of an EIS, as supported by NEPA's implementing regulations at 40 C.F.R. 1508.14. Consequently, because the EA demonstrates that the action's potential natural and physical impacts are not significant, the execution of a FONSI remains appropriate under these criteria.

The Proposed Action is predicted to have an adverse impact on fishing vessels, purchasers of seafood products, ports, recreational anglers, and operators of party/charter businesses. The Preferred Alternatives would likely result in a decrease in groundfish fishing vessel revenues when compared to No Action. This is not informative, however, since the No Action alternative would not adopt specifications for several stocks and the majority of groundfish fishing activity would be curtailed. The preferred alternative would be expected to result in gross groundfish revenues for FY2015 predicted to be just under $55 million and all gross revenues on groundfish trips are predicted to be just over $75.3 million. This represents approximately a 10% reduction in all gross revenues on groundfish trips relative to FY2014. The economic impacts of the preferred alternatives are not expected to be uniformly distributed. The preferred alternatives for the management measures – specifically the GOM cod protection measures – would lead to low positive economic benefits. Impacts of the preferred alternatives are expected to be most severe in GOM ports north of Boston, and for smaller vessels with a limited range. Overall, the economic impacts of the proposed action are predicted to be negative.

(8) *Are the effects on the quality of the human environment likely to be highly controversial*?

Response: Some aspects concerning the science used to formulate the preferred alternatives on the quality of human environment are expected to be controversial. There is controversy over the scientific evaluation of current stock status that is used to determine future catches. This is particularly the case for GOM cod.

The 2014 GOM cod assessment review panel forwarded two assessment models for use in developing management advice. The two models differ in their assumption on natural mortality. One model is based on a fixed natural mortality rate while the other reflects an increase in natural mortality in recent years. Under either model, overfishing is occurring and the stock is overfished. There remains some question about the choice of reference points (fishing mortality and biomass) for the model that is based on an increase in natural mortality. While the status of the stock probably would not change, different reference points may lead to different short-term catch advice. Issues related to reference points do warrant further attention and the SSC has recommended that these be investigated further.

(9) *Can the Preferred Alternatives reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?*

Response: No, the Preferred Alternatives cannot be reasonably expected to result in substantial impacts to unique areas or ecological critical areas. The only designated HAPC in the areas affected by this action is protected by an existing closed area that would not be affected by this action. In addition, vessel operations around the unique historical and cultural resources encompassed by the Stellwagen Bank National Marine Sanctuary would not likely be altered by this action. As a result, no substantial impacts are expected from this action.

(10) *Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?*

Response: The Preferred Alternatives are not expected to result in highly uncertain effects on the human environment or involve unique or unknown risks. The measures used in this action are similar to those adopted in past management actions, and these prior actions have reduced fishing mortality on many stocks. While there is a degree of uncertainty over how fishermen will react to the proposed measures, the analytic tools used to evaluate the measures attempt to take that uncertainty into account and reflect the likely results as a range of possible outcomes. For example, the economic analysis in Section 7.4 illustrates the distribution of results that are expected rather than provide only a point estimate. Overall, the impacts of the Preferred Alternatives can be, and are, described with a relative amount of certainty. Overall, the economic impacts of the proposed action are predicted to be negative.

(11) *Is the Preferred Alternative related to other actions with individually insignificant, but cumulatively significant impacts?*

Response: The Proposed Action is not related to other actions with individually insignificant but cumulatively significant impacts. Recent management actions in this fishery include FW 42, FW 43, Amendment 16, FW 44, FW 45, FW 46, FW 47, FW 48, FW 49, FW 50, FW 51, and FW 52. FW 42 developed specific measures implementing programs adopted by Amendment 13; each was determined to be insignificant. FW 43 adopted limits on groundfish bycatch by mid-water trawl herring vessels and was not determined to have a significant effect on either the groundfish or herring fisheries. Amendment 16 had significant impacts and thus required the preparation of an EIS, while Frameworks 44 and 46 set specifications as required under Amendment 16 and made relatively minor adjustments to the sector administration program. Framework 46 modified the amount of haddock that may be caught by the midwater herring fishery. Framework 47 adjusted several ABCs/ACLs for FY 2012, FW 48 modified many of the ABC/ACL provisions, AMS, and monitoring provisions, and FW 49 adjusted the timing of scallop vessel access to access areas on GB. Framework 50 adjusted ABCs/ACLs for FY 2013. Framework 51 adjusted ABCs/ACLs for FY 204 and changes management measures. Framework Adjustment 52, submitted on October 28, 2014 is under review by NMFS and is intended to revise the accountability measures (AMs) for the groundfish fishery for the northern and southern windowpane flounder stocks. If adopted, revisions to the AMs could be applied retroactively for FY 2014 or any overages that occurred prior to FY 2014, where appropriate (i.e., AM would be revised in-season during FY 2014). The measures in this action were anticipated by Amendment 16 and thus cannot be said to have different cumulative impacts that were not foreseen and addressed in the amendment. Therefore, the Preferred Alternative, when assessed in conjunction with the actions noted above, would not have significant impacts on the natural or physical environment.

(12) *Are the Preferred Alternatives likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or cause loss or destruction of significant scientific, cultural or historical resources?*

Response: The Preferred Alternatives are not likely to affect objects listed in the National Register of Historic Places or cause significant impact to scientific, cultural, or historical resources. The only objects in the fishery area that are listed in the National Register of Historic Places are ship wrecks, including several in the Stellwagen Bank National Marine Sanctuary. The current regulations allow fishing within the Stellwagen Bank National Marine Sanctuary. The Preferred Alternative would not regulate current fishing practices within the sanctuary. However, vessels typically avoid fishing near wrecks to avoid tangling gear. Therefore, this action would not result in any adverse effects to wrecks.

(13) *Can the Preferred Alternatives reasonably be expected to result in the introduction or spread of a non-indigenous species?*

Response: This action would not result in the introduction or spread of any non-indigenous species, as it would not result in any vessel activity outside of the Northeast region.

(14) *Are the Preferred Alternatives likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?*

Response: No, the Preferred Alternatives are not likely to establish precedent for future actions with significant effects. The Preferred Alternatives adopt measures that are designed to react to the necessity to reduce fishing mortality for several groundfish stocks in order to achieve the fishing mortality targets adopted by Amendment 16 and subsequent framework actions. As such, these measures are designed to address a specific problem and are not intended to represent a decision about future management actions that may adopt different measures.

(15) *Can the Preferred Alternatives reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?*

Response: The Preferred Alternatives are intended to implement measures that would offer further protection of marine resources and would not threaten a violation of Federal, state, or local law or requirements to protect the environment.

(16) *Can the Preferred Alternatives reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?*

Response: As specified in the responses to the first two criteria of this section, the Preferred Alternatives are not expected to result in cumulative adverse effects that would have a substantial effect on target or non-target species. This action would maintain fishing mortality within M-S Act requirements for several groundfish stocks, with no expected increase in mortality for non-target and non-groundfish stocks.

FONSI STATEMENT:	
In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for Framework Adjustment 53 to the Northeast Multispecies Fishery Management Plan, it is hereby determined that Framework Adjustment 53 will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the Proposed Action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an EIS for this action is not required.	
Regional Administrator, Greater Atlantic Regional Fisheries Office, NOAA	Date

8.2.3 List of Preparers; Point of Contact

Questions concerning this document may be addressed to:

Mr. Thomas A. Nies, Executive Director
New England Fishery Management Council
50 Water Street, Mill 2
Newburyport, MA 01950 (978) 465-0492

This document was prepared by:

Gregory Ardini (NEFSC)
Michelle Bachman (NEFMC)
Daniel Caless, NMFS Greater Atlantic Regional Fisheries Office (GARFO)
Timothy Cardiasmenos (GARFO)
Steven Correia, Massachusetts Division of Marine Fisheries (MA DMF)
Dr. Jamie Cournane (NEFMC)
Micah Dean (MA DMF)
Chad Demarest, Northeast Fisheries Science Center, (NEFSC)
Rachel Feeney (NEFMC)
Sara Heil (GARFO)
Anna Henry (NEFSC)
Dr. Fiona Hogan (NEFMC)
Susan Murphy (GARFO)
Paul Nitschke (NEFSC)
Jonathon Peros (NEFMC)
Sally Sherman, Maine Department of Marine Resources
Michael Ruccio (GARFO)
Dr. William Whitmore (GARFO)

8.2.4 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
  - Rhode Island Department of Environmental Management
  - Massachusetts Division of Marine Fisheries
  - New Hampshire Fish and Game
  - Maine Department of Marine Resources
- National Marine Fisheries Service, NOAA, Department of Commerce
- United States Coast Guard, Department of Homeland Security

8.2.5 Opportunity for Public Comment

The Preferred Alternatives were developed during the period June 2014 through November 2014 and was discussed at the following meetings. Opportunities for public comment were provided at each of these meetings.

Date	Meeting Type	Location
6/17-19/14	Council Meeting	Holiday Inn by the Bay, Portland, ME
8/4/14	Groundfish Committee	DoubleTree by Hilton, Danvers, MA
9/16/14	Recreational Advisory Panel	DoubleTree by Hilton, S. Portland, ME
9/16/14	Groundfish Advisory Panel	DoubleTree by Hilton, S. Portland, ME
9/17/14	Groundfish Committee	DoubleTree by Hilton, S. Portland, ME
11/12/-13/14	Groundfish Committee	Four Points by Sheraton, Revere, MA
11/17-20/14	Council Meeting	Newport Marriott, Newport, RI

8.3 Endangered Species Act

Section 7 of the Endangered Species Act requires federal agencies conducting, authorizing or funding activities that affect threatened or endangered species to ensure that those effects do not jeopardize the continued existence of listed species. The NEFMC has concluded, at this writing, that the proposed framework adjustment and the prosecution of the multispecies fishery is not likely to jeopardize any ESA- listed species or alter or modify any critical habitat, based on the discussion of impacts in this document and on the assessment of impacts in the Amendment 16 Environmental Impact Statement.

The Council does acknowledge that endangered and threatened species may be affected by the measures proposed, but impacts should be minimal especially when compared to the prosecution of the fishery prior to implementation of Amendment 16. The NEFMC is now seeking the concurrence of the National Marine Fisheries Service with respect to Framework Adjustment 53.

For further information on the potential impacts of the fishery and the proposed management action on listed species, see Section 7.3 of this document.

8.4 Marine Mammal Protection Act

The NEFMC has reviewed the impacts of the Preferred Alternatives on marine mammals and has concluded that the management actions proposed are consistent with the provisions of the MMPA. Although they are likely to affect species inhabiting the multispecies management unit, the measures will not alter the effectiveness of existing MMPA measures, such as take reduction plans, to protect those species based on overall reductions in fishing effort that have been implemented through the FMP.

For further information on the potential impacts of the fishery and the proposed management action on marine mammals, see Section 7.3 of this document.

8.5 Coastal Zone Management Act

Section 307(c)(1) of the Federal CZMA of 1972 requires that all Federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. Pursuant to Section 930.36(c) of the regulations implementing the Coastal Zone Management Act, NMFS made a general consistency determination that the Northeast Multispecies Fishery Management Plan (FMP), including Amendment 16, and Framework Adjustment 53, is consistent to the maximum extent practicable with the enforceable policies of the approved coastal management program of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. This general consistency determination applies to the current NE Multispecies Fishery Management Plan (FMP), and all subsequent routine federal actions carried out in accordance with the FMP such as Framework Adjustments and specifications. A general consistency determination is warranted because Framework Adjustments to the FMP are repeated activities that adjust the use of management tools previously implemented in the FMP. A general consistency determination avoids the necessity of issuing separate consistency determinations for each incremental action. This determination was submitted to the above states on October 21, 2009. To date, the states of North Carolina, Rhode Island, Virginia, Connecticut, New Hampshire, and Pennsylvania have concurred with the General Consistency Determination. Consistency was inferred for those states that did not respond.

8.6 Administrative Procedure Act

This action was developed in compliance with the requirements of the Administrative Procedure Act, and these requirements will continue to be followed when the proposed regulation is published. Section 553 of the Administrative Procedure Act establishes procedural requirements applicable to informal rulemaking by federal agencies. The purpose of these requirements is to ensure public access to the federal rulemaking process, and to give the public adequate notice and opportunity for comment. At this time, the Council is not requesting any abridgement of the rulemaking process for this action.

8.7 Data Quality Act

Pursuant to NOAA guidelines implementing section 515 of Public Law 106-554 (the Data Quality Act), all information products released to the public must first undergo a Pre-Dissemination Review to ensure and maximize the quality, objectivity, utility, and integrity of the information (including statistical information) disseminated by or for Federal agencies. The following section addresses these requirements.

8.7.1 Utility of Information Product

The information presented in this document is helpful to the intended users (the affected public) by presenting a clear description of the purpose and need of the Preferred Alternatives on, the measures proposed, and the impacts of those measures. A discussion of the reasons for selecting the Preferred Alternatives is included so that intended users may have a full understanding of the Preferred Alternatives and its implications.

Until a proposed rule is prepared and published, this document is the principal means by which the information contained herein is available to the public. The information provided in this document is based on the most recent available information from the relevant data sources. The development of this document and the decisions made by the Council to propose this action are the result of a multi-

stage public process. Thus, the information pertaining to management measures contained in this document has been improved based on comments from the public, the fishing industry, members of the Council, and NOAA Fisheries Service.

This document is available in several formats, including printed publication, CD-ROM, and online through the Council's web page in PDF format. The Federal Register notice that announces the proposed rule and the final rule and implementing regulations will be made available in printed publication, on the website for the Northeast Regional Office, and through the Regulations.gov website. The Federal Register documents will provide metric conversions for all measurements.

8.7.2 Integrity of Information Product

Prior to dissemination, information associated with this action, independent of the specific intended distribution mechanism, is safeguarded from improper access, modification, or destruction, to a degree commensurate with the risk and magnitude of harm that could result from the loss, misuse, or unauthorized access to or modification of such information. All electronic information disseminated by NOAA Fisheries Service adheres to the standards set out in Appendix III, "Security of Automated Information Resources," of OMB Circular A-130; the Computer Security Act; and the Government Information Security Act. All confidential information (e.g., dealer purchase reports) is safeguarded pursuant to the Privacy Act; Titles 13, 15, and 22 of the U.S. Code (confidentiality of census, business, and financial information); the Confidentiality of Statistics provisions of the Magnuson-Stevens Act; and NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics.

8.7.3 Objectivity of Information Product

For purposes of the Pre-Dissemination Review, this document is considered to be a "Natural Resource Plan." Accordingly, the document adheres to the published standards of the Magnuson-Stevens Act; the Operational Guidelines, Fishery Management Plan Process; the Essential Fish Habitat Guidelines; the National Standard Guidelines; and NOAA Administrative Order 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act.

This information product uses information of known quality from sources acceptable to the relevant scientific and technical communities. Stock status (including estimates of biomass and fishing mortality) reported in this product are based on either assessments subject to peer-review through the Stock Assessment Review Committee or on updates of those assessments prepared by scientists of the Northeast Fisheries Science Center. These update assessments were reviewed for TRAC by the Integrated Peer Review, SAW/SARC 59, and 2014 Groundfish Updates and Peer Review which all included participation by independent stock assessment scientists. Landing and revenue information is based on information collected through the Vessel Trip Report and Commercial Dealer databases. Information on catch composition, by tow, is based on reports collected by the NOAA Fisheries Service observer program and incorporated into the sea sampling or observer database systems. These reports are developed using an approved, scientifically valid sampling process. In addition to these sources, additional information is presented that has been accepted and published in peer-reviewed journals or by scientific organizations. Original analyses in this document were prepared using data from accepted sources, and the analyses have been reviewed by members of the Groundfish Plan Development Team.

Despite current data limitations, the conservation and management measures proposed for this action were selected based upon the best scientific information available. The analyses conducted in support of the Preferred Alternative were conducted using information from the most recent complete calendar years, through 2013, and in some cases includes information that was collected during the first eight months of calendar year 2014. Complete data were not available for calendar year 2014. The data used in

the analyses provide the best available information on the number of harvesters in the fishery, the catch (including landings and discards) by those harvesters, the sales and revenue of those landings to dealers, the type of permits held by vessels, the number of DAS used by those vessels, the catch of recreational fishermen and the location of those catches, and the catches and revenues from various special management programs. Specialists (including professional members of plan development teams, technical teams, committees, and Council staff) who worked with these data are familiar with the most current analytical techniques and with the available data and information relevant to the groundfish fishery.

The policy choices are clearly articulated, in Section 4.0 of this document, as the management alternatives considered in this action. The supporting science and analyses, upon which the policy choices are based, are summarized and described in Section 7.0 of this document. All supporting materials, information, data, and analyses within this document have been, to the maximum extent practicable, properly referenced according to commonly accepted standards for scientific literature to ensure transparency.

The review process used in preparation of this document involves the responsible Council, the Northeast Fisheries Science Center, the Northeast Regional Office, and NOAA Fisheries Service Headquarters. The Center's technical review is conducted by senior level scientists with specialties in population dynamics, stock assessment methods, demersal resources, population biology, and the social sciences. The Council review process involves public meetings at which affected stakeholders have opportunity to provide comments on the document. Review by staff at the Regional Office is conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. Final approval of the action proposed in this document and clearance of any rules prepared to implement resulting regulations is conducted by staff at NOAA Fisheries Service Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget.

8.8 Executive Order 13132 (Federalism)

This E.O. established nine fundamental federalism principles for federal agencies to follow when developing and implementing actions with federalism implications. The E.O. also lists a series of policy making criteria to which Federal agencies must adhere when formulating and implementing policies that have federalism implications. However, no federalism issues or implications have been identified relative to the measures proposed in FW 53. This action does not contain policies with federalism implications sufficient to warrant preparation of an assessment under E.O. 13132. The affected states have been closely involved in the development of the proposed management measures through their representation on the Council (all affected states are represented as voting members of at least one Regional Fishery Management Council). No comments were received from any state officials relative to any federalism implications that may be associated with this action.

8.9 Executive Order 13158 (Marine Protected Areas)

The Executive Order on Marine Protected Areas requires each federal agency whose actions affect the natural or cultural resources that are protected by an MPA to identify such actions, and, to the extent permitted by law and to the maximum extent practicable, in taking such actions, avoid harm to the natural and cultural resources that are protected by an MPA. The E.O. directs federal agencies to refer to the MPAs identified in a list of MPAs that meet the definition of MPA for the purposes of the Order. The E.O. requires that the Departments of Commerce and the Interior jointly publish and maintain such a list of MPAs. As of the date of submission of this FMP, the list of MPA sites has not been developed by the departments. No further guidance related to this Executive Order is available at this time.

8.10 Paperwork Reduction Act

The purpose of the PRA is to control and, to the extent possible, minimize the paperwork burden for individuals, small businesses, nonprofit institutions, and other persons resulting from the collection of information by or for the Federal Government. The authority to manage information and recordkeeping requirements is vested with the Director of the Office of Management and Budget (OMB). This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

FW 53 does not modify existing collection of information requirements implemented by previous amendments to the FMP that are subject to the PRA, including:

- Reporting requirements for SAPs and the Category B (regular) DAS Program;
- Mandatory use of a Vessel Monitoring System (VMS) by all vessels using a groundfish DAS;
- Changes to possession limits, which will change the requirements to notify NMFS of plans to fish in certain areas; and
- Provisions to allow vessel operators to notify NMFS of plans to fish both inside and outside the Eastern U.S./CA area on the same fishing trip.

8.11 Regulatory Impact Review

8.11.1 Executive Order 12866

The purpose of E.O 12866 is to enhance planning and coordination with respect to new and existing regulations. This E.O. requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be "significant." Section 8.11 of this document represents the RIR, which includes an assessment of the costs and benefits of the Proposed Action in accordance with the guidelines established by E.O. 12866. The analysis included in the RIR shows that this action is not a "significant regulatory action" because it will not affect in a material way the economy or a sector of the economy.

E.O. 12866 requires a review of proposed regulations to determine whether or not the expected effects would be significant, where a significant action is any regulatory action that may:

1* Have an annual effect on the economy of $100 million or more, or adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

2* Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

3* Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

4* Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

8.11.1.1 Objectives

The goals and objectives of Framework Adjustment 52 derive from those detailed in Amendment 16 to the Northeast Multispecies Fishery FMP and are as follows:

Goal 1: Consistent with the National Standards and other required provisions of the Magnuson-Stevens Fishery Conservation and Management Act and other applicable law, manage the northeast multispecies complex at sustainable levels.

Goal 2: Create a management system so that fleet capacity will be commensurate with resource status so as to achieve goals of economic efficiency and biological conservation and that encourages diversity within the fishery.

Goal 3: Maintain a directed commercial and recreational fishery for northeast multispecies.

Goal 4: Minimize, to the extent practicable, adverse impacts on fishing communities and shoreside infrastructure.

Goal 5: Provide reasonable and regulated access to the groundfish species covered in this plan to all members of the public of the United States for seafood consumption and recreational purposes during the stock rebuilding period without compromising the Amendment 13 objectives or timetable. If necessary, management measures could be modified in the future to insure that the overall plan objectives are met.

Goal 6: To promote stewardship within the fishery.

Objective 1: Achieve, on a continuing basis, optimum yield (OY) for the U.S. fishing industry.

Objective 2: Clarify the status determination criteria (biological reference points and control rules) for groundfish stocks so they are consistent with the National Standard guidelines and applicable law.

Objective 3: Adopt fishery management measures that constrain fishing mortality to levels that are compliant with the Sustainable Fisheries Act.

Objective 4: Implement rebuilding schedules for overfished stocks, and prevent overfishing.

Objective 5: Adopt measures as appropriate to support international trans-boundary management of resources.

Objective 6: Promote research and improve the collection of information to better understand groundfish population dynamics, biology and ecology, and to improve assessment procedures in cooperation with the industry.

Objective 7: To the extent possible, maintain a diverse groundfish fishery, including different gear types, vessel sizes, geographic locations, and levels of participation.

Objective 8: Develop biological, economic and social measures of success for the groundfish fishery and resource that insure accountability in achieving fishery management objectives.

Objective 9: Adopt measures consistent with the habitat provisions of the M-S Act, including identification of EFH and minimizing impacts on habitat to the extent practicable.

Objective 10: Identify and minimize bycatch, which include regulatory discards, to the extent practicable, and to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

8.11.1.2 Description

A description of the entities affected by this Framework Adjustment, specifically the stakeholders of the New England Groundfish Fishery, is provided in Section 6.5 of this document.

8.11.1.3 Problem Statement

The need and purpose of the actions proposed in this Framework Adjustment are set forth in Section 3.2 of this document and are incorporated herein by reference.

8.11.1.4 Analysis of Alternatives

This section provides an analysis of each proposed alternative of FW53 as mandated by EO 12866. The focus will be on the expected changes (1) in net benefits and costs to stakeholders of the New England Groundfish Fishery, (2) changes to the distribution of benefits and costs within the industry, (3) changes in income and employment, (4) cumulative impacts of the regulation, and (5) changes in other social concerns. Much of this information is captured already in the detailed economic impacts and social

impacts analyses of Sections 7.4 and 7.5 of this document. This RIR will summarize and highlight the major findings of the economic impacts analysis provided in section 7.4 of this document, as mandated by EO 12866. For social impacts of each alternative, see Section 7.5.

When assessing benefits and costs of the regulations, it is important to note that the analysis will focus on the producer surplus generated by impacted fishing businesses. Consumer surplus is not expected to be affected by any of the regulatory changes proposed in FW53, as these regulations are unlikely to affect consumer welfare due to substitutes and imports.

8.11.1.4.1 Updates to Status Determination Criteria, Formal Rebuilding Programs, and Annual Catch Limits

8.11.1.4.1.1 Revised Status Determination Criteria

A detailed description of this alternative can be found in Section 4.0 of this document.

8.11.1.4.1.1.1 Option 1: No Action

Option 1/No Action is not expected to have any immediate economic impacts since it does not alter the current methodology used for setting the acceptable biological catch (ABC) for each species. Long term impacts of Option 1 would be that biomass targets will be based on outdated information. This does not constitute the use of best scientific information as stipulated by the Magnuson Stevens Act (Magnuson-Stevens 101-627, 104-297), and it is probable that ignoring the new SDCs determined by the latest stock assessments will result in overfishing and negative long term impacts..

8.11.1.4.1.1.2 Option 2: Revised Status Determination Criteria

Under Option 2 the revised status determination criteria updates MSY to be lowered for some groundfish stocks. In the short term, fishermen may experience lower net revenues as a result of anticipated catch reductions. Option 2 is expected to have positive long-term impacts through prevention of overfishing, yielding higher and more sustainable future landings than expected under the No Action alternative.

8.11.1.4.1.2 Annual Catch Limits

A detailed description of this alternative can be found in Section 4.1.2 of this document.

8.11.1.4.1.2.1 Option 1: No Action

By selecting Option 1, ACLs will be based on FW51 specifications for the years 2015-2016, which have missing values for many species, including pollock. As pollock is a unit stock, vessels enrolled in sectors would not be permitted to fish for groundfish under the No Action alternative. The common pool would also not be permitted to fish and there would be no directed groundfish fishery. Gross revenue by groundfish vessels is predicted to be $81 million in FY14 and around $75-$78 million in FY15. These revenues would be foregone if the fishery were closed.

GOM cod and GOM haddock are the only groundfish stocks that have recreational sub-ACLs. Under No Action, the sub-ACLs would not be revised for these stocks. The short term impacts for anglers targeting GOM cod would remain unchanged, and because there would not be a directed commercial groundfish fishery without ACLs being set, the long term impacts to the recreational fishery are expected to be

positive. For GOM haddock, No Action would not change the sub-ACL, resulting in negligible impacts. However, relative to the new sub-ACL under Option 2, No Action would have negative impacts for anglers catching haddock, due to a lower sub-ACL. Other groundfish stocks, such as GOM winter flounder, GOM yellowtail flounder, and pollock are also fished by recreational anglers. These stocks, and all other groundfish stocks outside of GOM cod and GOM haddock, have recreational catch estimated in the state waters and other subcomponents. No Action is expected to have little impact on anglers targeting these estimated catch stocks.

Under No Action, not only will the directed commercial groundfish fishery be unable to operate in the absence of ACLs for pollock and other groundfish stocks, but other fisheries will be affected. The ability to limit the impacts of other fisheries on some of the groundfish stocks is done so through the implementation of sub-ACLs. The No Action alternative would not identify scallop fishery sub-ACLs for GB yellowtail flounder, and the precise impacts this would have on the scallop fishery is largely unknown. While this would not prevent the scallop fishery from fishing in FY15, it is not clear if the absence of a sub-ACL would be treated as if the sub-ACL was zero. If this would be the case, then any catches of these stocks would lead to scallop fishery AMs being triggered in FY 2016 and/or later years. As a result, this option would result in large reductions in scallop fishery revenues when compared to Option 2. However, if this is not the case and the scallop fishery catches of these stocks do not trigger AMs, this option might allow for greater scallop fishery revenues than would be the case if AMs are triggered using the ACLs of Option 2.

The No Action alternative would result in no revised sub-ACLs for GOM and GB haddock in the Atlantic herring fishery for FY15. As a result, AMs would potentially be more likely to be triggered in FY15 for the Atlantic herring fishery than under the revised haddock sub-ACLs in Option 2. This would result in negative economic impacts in FY 2016 and possibly beyond.

Similarly, the No Action alternative would result in no sub-ACL for GB yellowtail flounder in the small mesh fishery. If this scenario would be treated as a zero sub-ACL for GB yellowtail flounder, AMs would be triggered for the small mesh fishery resulting in negative economic impacts in FY 2016 and possibly beyond. If the GB yellowtail flounder sub-ACL is considered non-existent in the absence of an overall ACL, the small mesh fishery could have potential positive impacts by avoiding any possibility of AMs attributed to catch of GB yellowtail flounder.

8.11.1.4.1.2.2 Option 2: Revised Annual Catch Limit Specifications

Under Option 2, groundfish trip revenues in FY15 are predicted to be $75 million, representing a $6 million decrease from current FY14 predictions. The economic impacts of Option 2 are positive compared to No Action, in which there would be no directed groundfish fishery for the sectors or common pool. The exact impacts of Option 2 depends upon the combination of sub-options selected regarding GOM Cod Spawning Area Closures (4.2.1.1), GOM Cod Protection Measures (4.2.1.3), and Prohibition on the Possession of GOM cod (4.2.1.2).

On a home-port state level, New Hampshire is expected to have the largest percentage decline (42%) in gross revenues from groundfish relative to FY14, assuming no new closure areas are added and zero retention is not adopted (Table 82). Maine and Massachusetts are also predicted to incur losses relative to FY14, with revenues falling by 16% and 8% respectively under the new ACLs alone. New York and Rhode Island are the two states expected to be positively impacted by the ACLs, with a 33% and 29% predicted increase in gross groundfish revenues relative to FY14. For major home-ports, Gloucester, MA is expected to have the largest percentage decline (28%) in gross revenue, while New Bedford, MA is expected to be the least affected with a 6% increase in gross groundfish revenues predicted (Table 83).

The impacts to gross revenues are expected to be distributed non-uniformly across different vessel length categories as well. The 30-50' category is predicted to see the largest drop in gross revenue compared to FY14, with a predicted 33% reduction resulting from the ACL changes alone. This increases up to a possible 56% reduction depending upon the other alternatives selected (Table 84). Larger vessel classes are not expected to be impacted as heavily by the new ACLs, with the largest vessel size class (75'+) predicted to see a 3% decline in gross revenues. Among the reasons for the difference in predicted revenues by vessel size are the variation in scalability and an inability for smaller vessels to cover the same geographic range as larger vessels, particularly given the status of inshore GOM cod stocks.

The QCM incorporated sector vessel only in the analysis, as they make up the vast majority of groundfish landings and revenue. As the sector-based fishery incorporates all the same fishing vessel types and port locations one would find in the common pool, it is expected that most vessels in the common pool groundfish fishery will incur economic loses relative to FY14. However, because there would be no directed groundfish fishery under the No Action Alternative, the economic impacts of Option 2 are positive compared to Option 1.

For the recreational fishery, Option 2 lowers the sub-ACL for GOM cod and raises the sub-ACL for GOM haddock compared to No Action. The increase in the haddock GOM recreational sub-ACL will have a positive impact on anglers in FY15, but due to the magnitude of the reduction in the recreational sub-ACL for GOM cod, the overall impact of Option 2 on anglers in FY15 is expected to be negative. However, these revisions are likely to have positive impacts over the long term through rebuilding of the cod stock and a higher sustainable catch for haddock.

8.11.1.4.2 Commercial and Recreational Fishery Measures

8.11.1.4.2.1 GOM Cod Management Measures

8.11.1.4.2.1.1 GOM Cod Spawning Area Closures

A detailed description of this alternative can be found in Section 4.2.1 of this document.

8.11.1.4.2.1.1.1 Option 1: No Action (Preferred Alternative)

The economic impacts associated with the No Action Alternative are neutral compared to the FW53 ACLs alone. Generally, maintaining the current GOM cod spawning area closures is predicted to have lower gross revenues (in aggregate) than the predicted revenue associated with additional closures in sub-option A or sub-option B of Option 2. This points to a situation where inshore GOM vessels are not being offered sufficiently high ACE lease prices or, alternatively, have been (and modeling indicates will continue to be) unwilling to accept such lease arrangements.

Option 1 would not create any additional GOM cod spawning area closures for the recreational fishery, and short term economic impacts would be minimal, as recreational anglers would not face further restrictions on where they can fish. There may be some negative economic impacts in the long term if the GOM cod biomass remains low, though these impacts cannot be quantified at this time.

8.11.1.4.2.1.1.2 Option 2: Additional GOM cod Spawning Protection Measures

The Council may select Sub-Option A or Sub-Option B.

Adding additional GOM cod spawning area closures is expected to force the groundfish fleet to fish further east. Smaller vessels with a limited range may not be able to prosecute the fishery during inshore closures. The shift toward fishing eastward and by larger vessels under all scenarios considered in FW 53 is shown in Table 84 & Table 86. The model assumes that, if smaller inshore vessels are not able to prosecute the fishery, their quota will flow to those (larger) vessels that can use it. Specific impacts of each sub-option on the commercial fishery are listed below.

For the recreational fishery, the proposed GOM cod spawning closure areas encompass the principal bottom fishing locations in the GOM and the majority of the recreational fishing access points in the GOM. As a result, all three state management agencies would likely be unwilling to prohibit recreational fishermen from bottom fishing in their waters. A prohibition on any type of rod and reel recreational fishing activity has never been adopted by any state fishery management agency in the U.S. to reduce mortality.

Approximately 85-90% of GOM cod and haddock mortality generally occurs in Federal waters though, so if anglers only catch GOM cod and haddock in state waters during FY15 a mortality reduction would likely occur from the proposed closures. The larger unknown, however, is the level of noncompliance that will occur in federal waters under the closures. A portion of the noncompliance will be deliberate, but most will likely be from private boat anglers that are simply unaware of the prohibition on bottom fishing in federal waters or whether or not they have crossed into federal waters. Even marginal differences in state and federal regulations increase noncompliance, so an unprecedented change of prohibiting bottom fishing in federal waters, combined with allowing anglers to continue to bottom fish in state waters, will almost certainly increase noncompliance in federal waters during FY15 – thereby reducing the conservation benefit of the closures.

The economic consequences of the spawning closures on the for-hire industry and businesses that support the recreational fishing industry in the GOM would be extensive. Landings during the proposed closure areas accounted for approximately 75 percent of the annual for-hire landings of Atlantic cod, haddock, pollock, white hake, and redfish. Although possession of GOM cod could be prohibited in FY15 with or without implementation of the closure areas, catch of the remaining species over the past 5 years is concentrated in the areas and time periods under consideration for closures. This high degree of concentration implies that it will be difficult for for-hire businesses to move to alternative areas that hold bottom fish for their customers.

The sheer size of the proposed closed areas will also make it difficult for for-hire vessels, particularly the larger head boat vessels, to steam up to 60 miles through the closed areas to open water fishing sites. The travel time required to traverse through the closed areas will exceed the total time allotted for the two most common types of trips offered by for-hire businesses in the GOM: 4 or 6 hour fishing trips. Thus, implementation of the proposed closures would likely have a devastating effect on for-hire businesses operating in the GOM.

The impact of the closures on private boat fishing in the GOM is less certain. Spatial data on fishing locations are not available for private boat anglers, so the extent to which private boat anglers fish in the proposed closed areas to bottom fish is unknown. However, since approximately 80-85% of private boat catch of GOM cod and haddock takes place in federal waters, it's likely that the vast majority occurs in the proposed closed areas. Although the closures would legally exclude private boat anglers from bottom fishing within the closed areas, some level of bottom fishing will likely continue by private boat anglers within the closed areas in FY15. Private boat anglers would also still be allowed to use pelagic gear to target bluefish, striped bass, etc. within the proposed closures, thereby exacerbating the enforcement problem.

Businesses that support the recreational fishing industry will also be impacted if recreational fishing effort declines because of the prohibition of bottom fishing in the closed areas. Bait and tackle shops, marinas, boat repair shops, convenience stores, restaurants, hotels, and many other indirectly affected businesses would face revenue declines due to lower angler spending.

Sub-Option A:

Under Sub-Option A, gross groundfish revenues for FY15 are predicted to be over $59 million and all gross revenues on groundfish trips are predicted to be almost $77 million (Table 72). This represents approximately a 8% reduction in gross groundfish revenues and a 5% reduction in gross revenues on groundfish trips relative to those predicted in FY14 (Table 71). While these are not insignificant reductions, gross revenues are predicted to be about $1.5mil higher under closure Sub-Option A than the No Action spawning alternative.

On a home-port state level, New Hampshire is expected to have the largest percentage decline (46%) in gross revenues from groundfish relative to FY14 although this decline increases up to 50% if zero retention options are selected as well (Table 82). New York and Rhode Island are expected to be positively impacted by the closures, with a 11% and 24% predicted increase in gross groundfish revenues relative to FY14, however these increases are reduced relative to the FW53 ACL option with no additional closures (Table 83). For major home-ports, Gloucester, MA is expected to have the largest percentage decline (20%) in gross revenue and New Bedford, MA is expected to be the least affected with a 10% increase in gross groundfish revenues predicted (Table 83).

The impacts to gross revenues are expected to be distributed non-uniformly across different vessel length categories as well, with the 30-50 foot category experiencing the largest drop in gross revenue compared to FY14, with a predicted 44% reduction resulting from the closures in Sub-Option A. Larger vessel classes are predicted to experience smaller impacts, with the largest vessel size class (75+ ft) predicted to see a 3% increase in gross revenues resulting from closure Sub-Option A (Table 85).

The overall economic impacts of Sub-option A are negative, and represent a sizable decline in revenues when compared to FY14. However, when compared to the predicted economic impacts of the ACLs associated with section 8.4.1.2.2, the economic impacts of sub-Option A are expected to be less negative.

Sub-Option B:

Under Sub-Option B, gross groundfish revenues for FY15 are predicted to be just under $59 million and all gross revenues on groundfish trips are predicted to be just over $76 million (Table 72). This represents approximately a 9% reduction in gross groundfish revenues and a 6% reduction in gross revenues on groundfish trips relative to those predicted in FY14 (Table 72). If the zero retention option is selected in conjunction with Closure B, overall revenues decline slightly further. While these are not insignificant reductions, gross revenues are predicted to be almost $1mil higher under closure Sub-Option B than the No Action spawning alternative (assuming FW53 ACLs).

On a home-port state level, New Hampshire is expected to have the largest percentage decline (46%) in gross revenues from groundfish relative to FY14 although this decline increases up to 50% if zero retention options are selected as well (Table 82). New York and Rhode Island are expected to be positively impacted by the closures, with a 11% and 24% predicted increase in gross groundfish revenues relative to FY14, however these increases are reduced relative to the FW53 ACL option with no additional closures (Table 83). For major home-ports, Gloucester, MA is expected to have the largest

percentage decline (21%) in gross revenue and New Bedford, MA is expected to be the least affected with a 9% increase in gross groundfish revenues predicted (Table 83).

The impacts to gross revenues are expected to be distributed non-uniformly across different vessel length categories as well, with the 30-50 foot category experiencing the largest drop in gross revenue compared to FY14, with a predicted 44% reduction resulting from the closures in Sub-Option B. Larger vessel classes are predicted to experience smaller impacts, with the largest vessel size class (75+ ft) predicted to see no change in gross revenues resulting from closure Sub-Option B (Table 85).

The overall economic impacts of Sub-option B are negative, and represent a sizable decline in revenues when compared to FY14. However, when compared to the predicted economic impacts of the ACLs associated with section 7.4.1.2.2, the economic impacts of sub-Option B are expected to be less negative. The economic impacts of sub-Option B are expected to be more negative than those associated with Sub-Option A as closure Sub-Option B is predicted to realize about $500k less in gross revenues than Sub-Option A.

8.11.1.4.2.1.2 Prohibition on the Possession of GOM cod

A detailed description of this alternative can be found in Section 4.2.1.2 of this document.

8.11.1.4.2.1.2.1 Option 1: No Action (Preferred Alternative)

The economic impacts associated with the No Action Alternative are neutral compared to the implementation of the FW53 ACLs alone. In the long term, the concern of overfishing is likely slightly higher with the commercial fishery allowed to land GOM cod, however, the revised ACLs (Section 4.1.2) are designed to address this concern.

Continuing to allow possession of GOM cod in the recreational fishery in FY15 would result in positive impacts to anglers relative to a prohibition on the possession of GOM cod. However, long term impacts could be negative if the ability of the GOM cod stock to recover is compromised by recreational landings. However, the issues of discard mortality and noncompliance in the recreational fishery if a prohibition on landings is adopted mean the long term benefits of GOM cod to the recreational fishery are hard to project, no matter the regulations selected.

8.11.1.4.2.1.2.2 Option 2: Prohibition on the possession of GOM cod

The predicted impact of zero retention is expected to be $2.5M higher aggregate gross revenues than the FW53 ACLs alone.(Table 72).

On a home-port state level, New Hampshire is expected to have the largest percentage decline (46%) in gross revenues from groundfish relative to FY14 although this decline increases up to 50% if additional spawning closure options are selected as well (Table 82). New York and Rhode Island are expected to be positively impacted by the closures, with a 33% and 29% predicted increase in gross groundfish revenues relative to FY14. For major home-ports, Gloucester, MA is expected to have the largest percentage decline (29%) in gross revenue and New Bedford, MA is expected to be the least affected with a 6% increase in gross groundfish revenues predicted (Table 83).

The impacts to gross revenues are expected to be distributed non-uniformly across different vessel length categories as well, with the 30-50 foot category experiencing the largest drop in gross revenue compared to FY14, with a predicted 33% reduction resulting from zero retention. This is the same reduction

associated with just the changes in ACL, and would increases up to a possible 56% reduction if additional spawning closures are selected (Table 85). Larger vessel classes are predicted to experience smaller declines in gross revenues, with the largest vessel size class (75'+) predicted to see an increase in gross revenues resulting from the zero retention option, an increase that gets larger with the implementation of additional closures (Table 85).

Zero retention options are predicted to see higher gross revenues compared to No Action because the assumed discard rate for trawl and gillnet vessels (75% and 80% respectively) allows captains to land 20-25% more groundfish per unit of GOM cod ACE when that ACE is and concurrent species catch are not fully utilized Table 85 indicates that vessels may make $40 or more per pound of GOM cod ACE in FY15—even when backing out the lost revenue from cod (say, $3/lbs) the ability to leverage 25% more revenue may mean an extra $10 or more per pound of ACE from discards than landed catch.

The analysis of zero retention options presented in the QCM will underestimate realized revenues for all size classes and GOM ports, because these models assume that cod caught and discarded will be accounted for. Because GOM cod is the primary constraint on fishing in the GOM, vessels may fish under two different sets of incentives depending on whether or not a trip is observed.
All told, the economic impacts of a zero possession limit on GOM cod are expected to be negative relative to FY14, but slightly less than the FW53 ACLs alone for FY15. In the long term, unaccounted for discarding of GOM cod could compromise stock rebuilding efforts, resulting in negative impacts to the commercial fishery.

Under Option 2, recreational anglers would not be constrained by where they can fish, but they would be subject to a zero possession limit of GOM cod. Thus, anglers fishing aboard private boats and head boats will be negatively impacted from the inability to keep cod. The exact impacts are difficult to quantify, but a zero possession limit for cod would likely reduce angler satisfaction to the point where some anglers would no longer book trips on for-hire boats. Thus, the value that many anglers receive from their fishing trips would decline as well as for-hire revenues if angler effort declines in response to the cod zero possession limit. A decline in private boat angler trips may also occur in response to the zero possession limit. A reduction in angler effort, and therefore trip-related spending by anglers, would negatively impact bait and tackle shops, marinas, and other shore-side businesses that rely either directly or indirectly on angler spending.

8.11.1.4.2.1.3 Gulf of Maine Cod Protection Measures

A detailed description of this alternative can be found in Section 4.2.1.3 of this document.

8.11.1.4.2.1.3.1 Option 1: No Action

The economic impacts under No Action would be neutral relative to the FW53 ACLs alone, as there would be no prohibition on possession of GOM cod and no change in closure areas to either the commercial or recreational fisheries. These impacts will be negative relative to FY14.

8.11.1.4.2.1.3.2 Option 2: Gulf of Maine Cod Protection Measures *(Preferred Alternative)*

Option 2 of prohibiting the possession of GOM cod in the recreational fishery and modifying the rolling closure areas in the sector and common pool fisheries would, according to the QCM, result in positive economic impacts relative to the FW53 ACLs alone, with total revenue on groundfish trips expected to be around $77 million in FY15. Beyond FY15, it is difficult to quantify the economic impacts of the protection measures relative to No Action. Option 2 is designed to allow the GOM cod stock to rebuild by protecting key areas from the commercial fishery and minimizing mortality from the recreational fishery.

The added rolling closures from November through January should allow for increased spawning potential for the GOM cod stock.

is the QCM predicts that GOM cod will be fully utilized in FY15 under the FW53 ACLs, irrespective of whether or not other alternatives in this document are implemented. Therefore, the pertinent economic questions are: 1) how can the GOM cod ACE be best utilized in the commercial fishery? 2) What will be the impacts of a zero possession limit on GOM cod for the recreational fishery and will it be sufficient to reduce GOM cod mortality to a level that is in line with the FY15 recreational sub-ACL?

Table 82 indicates that mid-size and large vessels will benefit from the proposed action relative to FW53 ACLs alone, and small vessels will see a decrease in revenue relative to the ACLs. It is difficult to say how the lease market for GOM cod will operate in FY15 compared to the QCM.

The impacts to the recreational fishery under Option 2 are expected to be negative in the short term due to a lost opportunity to land GOM cod, though the impacts are difficult to quantify. Data from MRIP show that 180,000-195,000 angler trips (from head boats, charter boats, and private anglers) have targeted or caught GOM cod or GOM haddock each FY from 2012-2014 (Table 56). There is likely to be a reduction in angler effort in FY15 due to not only a zero possession limit on GOM cod, but a relatively low possession limit on GOM haddock. The reduction in angler effort will negatively affect for-hire businesses and numerous other supporting businesses, including stores selling fishing gear, bait and tackle shops and boat maintenance shops, among others.

Under Option 2, anglers would not be constrained by where they can fish, but they would be subject to a zero possession limit of GOM cod. Thus, anglers fishing aboard private boats and head boats will be negatively impacted from the inability to keep cod. The exact impacts are difficult to quantify, but a zero possession limit for cod would likely reduce angler satisfaction to the point where some anglers would no longer book trips on for-hire boats. The preference to target certain species is a product of, among other things, upbringing and history/tradition (Hickley, 1998). As GOM cod has deep-rooted history in the recreational fishery, it is likely that some anglers will be turned away from fishing to a certain extent if cod fishing is not an option. Thus, if angler effort declines in response to the cod zero possession limit for-hire revenues would decline as well. A reduction in angler effort, and therefore trip-related spending by anglers, would also negatively impact bait and tackle shops, marinas, and other shore-side businesses that rely either directly or indirectly on angler spending. In the long term, cod that are discarded by the recreational fishery and survive would contribute to rebuilding the stock. However, , noncompliance in the recreational fishery and discard mortality for GOM cod would factor into the long term benefits of Option 2. The changes to rolling closures in the commercial fishery would not have a major impact on the recreational fishery in the short term, but could potentially help the recreational fishery in the long term through GOM cod stock rebuilding.

8.11.1.4.2.2 Default Groundfish Specifications

A detailed description of this alternative can be found in Section 4.2.2 of this document.

8.11.1.4.2.2.1 Option 1: No Action

Under the No Action alternative, there would be no rollover of groundfish specifications. As fishing cannot occur until the specifications are finalized, there are potential negative economic impacts to No Action.

8.11.1.4.2.2.2 Option 2: Percentage Rollover Provisions for Default Specification *(Preferred Alternative)*

The Council may select either sub-option A, B, or C.

Sub-Option A: Default Rollover 35% of all groundfish stocks to the following FY. *(Preferred Alternative)*

Under Sub-Option A, a situation where there is no ACE available to fish due to a delay in the specifications being implemented would likely be avoided. The economic impacts of Sub-Option A are likely to be positive, as it is more likely than Option 1 to allow fishermen to operate at the beginning of the following FY.

Sub-Option B: Default Rollover 20% of all groundfish stocks to the following FY.

Under Sub-Option B, a situation where there is no ACE available to fish due to a delay in the specifications being implemented would be less likely to occur relative to Option 1. The economic impacts of Sub-Option B are likely to be positive, as it is more likely than Option 1 to allow fishermen to operate at the beginning of the following FY. However, the positive impacts may not be as far-reaching as Sub-Option A, as the rollover would not be as large.

Sub-Option C: Default Rollover 10% of all groundfish stocks to the following FY.

Under Sub-Option C, a situation where there is no ACE available to fish due to a delay in the specifications being implemented would be less likely to occur than Option 1. The economic impacts of Sub-Option C are likely to be positive, as it is more likely than Option 1 to allow fishermen to operate at the beginning of the following FY. However, the positive impacts may not be as far-reaching as Sub-Options A and B, as the rollover would not be as large.

8.11.1.4.2.3 Sector ACE Carryover

A detailed description of this alternative can be found in Section 4.2.3 of this document.

8.11.1.4.2.3.1 Option 1: No Action

The No Action alternative would continue to allow groundfish sectors to carry forward up to 10% of their unused sector ACE, as outline in Amendment 16 to the Northeast multispecies FMP. There would be no new economic impacts.

8.11.1.4.2.3.2 Option 2: Modification to Sector ACE carryover *(Preferred Alternative)*

Option 2 would allow groundfish sectors to carry forward up to 10% of unused ACE provided that the total unused sector ACE carried forward for all sectors from the previous FY plus the total ACL does not exceed the ABC for the fishing year in which the carryover would be harvested. The accountability measure criteria previously adopted by NMFS' May 2014 carryover action would not be affected. The economic impacts of Option 2 are likely minor. If the unused ACE in a FY is followed by a FY with a decreased ABC (and ACE), then negative economic impacts are possible.

Summary

In summary, the revised status determination criterion lowers the MSY for some groundfish stocks, and some foregone revenue is possible. Implementing the FW53 ACLs is expected to decrease the revenue on groundfish trips to $75 million in FY15 from $81 million in FY14. Of all the management alternatives, the new ACLs are almost certainly to cause the largest impacts, though by not updating the ACLs, there would be no directed groundfish fishery in FY15. The impacts of the ACLs are not predicted to be as sharp if other management actions are taken in conjunction. For instance, the GOM cod protection measures are predicted to result in $77 million in groundfish trip revenue in FY15. The rollover of groundfish specifications would not impact revenues for FY15, but could prevent a late start to FY16. The modification to sector ACE carryover potentially causes a decrease in the amount of ACE a sector can carryover, but the impacts of this provision are minor relative to the FW53 ACLs.

8.11.1.5 Determination of Significance

The Proposed Action is not predicted to have an adverse impact on fishing vessels, purchasers of seafood products, ports, recreational anglers, and operators of party/charter businesses in excess of $100 million. This action proposes to implement: Option 2- Status Determination Criteria; Option 2- Annual Catch Limits; Option 1- GOM Cod Spawning Area Closures; Option 1- Zero Possession Limit on GOM Cod; Option 2- GOM Cod Protection Measures; Option 2-Default Groundfish Specifications; Option 2-Sector ACE Carryover. Not all alternatives have impacts that could be quantified, but the FW53 ACLs are predicted to result in a drop of revenue on groundfish trips from $81 million in FY14 to $75 million in FY15, or $6 million. If Option 2- GOM Cod Protection Measures is adopted, predicted revenue for the commercial groundfish fishery enrolled in Sectors (greater than 99% of the commercial landings) will be $77 million in FY15, a $4 million predicted decrease from FY14.

Recreational fishery losses are expected, but are difficult to quantify. A reduction in angler fishing effort is expected as a result of the change in regulations, and this will negatively affect for-hire businesses and other supporting businesses, but the magnitude of the reduction is uncertain. A reduction of any kind will have an impact on for-hire revenues, but the combined annual gross revenue of the 106 federally permitted for-hire vessels that actively participated in the GOM recreational cod and haddock fishery in FY14 is estimated to be under $10 million. Inclusion of the multiplier effect on supporting businesses, estimated in Steinback and Brinson (2013), raises total gross revenues associated with recreational fishing for GOM cod and haddock to approximately $24 million. Thus, in combination with the predicted decrease of commercial fishing revenue, total gross revenue losses from the proposed action are not estimated to be in excess of $100 million.

8.11.2 Initial Regulatory Flexibility Act

8.11.2.1 Introduction

The purpose of the Regulatory Flexibility Analysis (RFA) is to establish a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure such proposals are given serious consideration. The RFA does not contain any decision criteria; instead the purpose of the RFA is to inform the agency, as well as the public, of the expected economic impacts of various alternatives contained in the FMP or amendment (including framework management measures and other regulatory actions) and to ensure the agency considers alternatives that minimize the expected impacts while meeting the goals and objectives of the FMP and applicable statutes.

With certain exceptions, the RFA requires agencies to conduct an Initial Regulatory Flexibility Analysis (IRFA) for each proposed rule. The IRFA is designed to assess the impacts various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those impacts. An IRFA is conducted to primarily determine whether the proposed action would have a “significant economic impact on a substantial number of small entities.” In addition to analyses conducted for the RIR, the IRFA provides: 1) A description of the reasons why action by the agency is being considered; 2) a succinct statement of the objectives of, and legal basis for, the proposed rule; 3) a description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; 4) a description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirements of the report or record; and, 5) an identification, to the extent practicable, of all relevant federal rules, which may duplicate, overlap, or conflict with the proposed rule.

8.11.2.2 Description of reasons why action by the Agency is being considered

The need and purpose of the actions are set forth in Section 3.2 of this document and are incorporated herein by reference.

8.11.2.3 Statement of the objectives of, and legal basis for, the proposed rule

The goals and objectives of FW53 are the same as those detailed in Amendment 16 to the Northeast Multispecies Fishery FMP. In general, FW53is intended to set annual catch limits for several Northeast groundfish stocks in FY15, provide management measures that will improve the long term sustainability and profitability of the GOM cod stock, and set groundfish specifications rollover and sector ACE carryovers.

8.11.2.4 Description and estimate of the number of small entities to which the proposed rule will apply

Small entities include "small businesses," "small organizations," and "small governmental jurisdictions." The Small Business Administration (SBA) has established size standards for all major industry sectors in the U.S. including commercial finfish harvesters (NAICS code 114111),

commercial shellfish harvesters (NAICS code 114112), other commercial marine harvesters (NAICS code 114119), for-hire businesses (NAICS code 487210), marinas (NAICS code 713930), seafood dealers/wholesalers (NAICS code 424460), and seafood processors (NAICS code 311710). A business primarily involved in finfish harvesting is classified as a small business if it is independently owned and operated, is not dominant in its field of operation (including its affiliates), and has combined annual receipts not in excess of $20.5 million for all its affiliated operations worldwide. For commercial shellfish harvesters, the other qualifiers apply and the receipts threshold is $5.5 million. For other commercial marine harvesters, for-hire businesses, and marinas, the other qualifiers apply and the receipts threshold is $7.5 million. A business primarily involved in seafood processing is classified as a small business if it is independently owned and operated, is not dominant in its field of operation (including its affiliates), and has combined annual employment, counting all individuals employed on a full-time, part-time, or other basis not in excess of 500 employees[27] for all its affiliated operations worldwide. For seafood dealers/wholesalers, the other qualifiers apply and the employment threshold is 100 employees. A small organization is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. Small governmental jurisdictions are governments of cities, boroughs, counties, towns, townships, villages, school districts, or special districts, with population of fewer than 50,000.

This proposed action regulates recreational party/charter fishing businesses as well as commercial fish harvesting entities engaged in the Northeast multispecies limited access fishery, the small mesh multispecies fishery, the herring mid-water trawl fishery and the scallop fishery, since the Northeast Multispecies FMP allows for sub-allocations of regulated groundfish stocks for the purposes of bycatch in other fisheries. A description of the specific entities that are likely to be impacted is included below for informational purposes, followed by a discussion of those regulated entities likely to be impacted by the proposed regulations. For the purposes of the RFA analysis, the ownership entities, not the individual vessels, are considered as regulated entities.

Ownership entities in regulated commercial harvesting businesses

Individually-permitted vessels may hold permits for several fisheries, harvesting species of fish that are regulated by several different fishery management plans, even beyond those impacted by the proposed action. Furthermore, multiple permitted vessels and/or permits may be owned by entities affiliated by stock ownership, common management, identity of interest, contractual relationships, or economic dependency. For the purposes of this analysis, ownership entities are defined by those entities with common ownership personnel as listed on permit application documentation. Only permits with identical ownership personnel are categorized as an ownership entity. For example, if five permits have the same seven personnel listed as co-owners on their application paperwork, those seven personnel form one ownership entity, covering those five permits. If one or several of

[27] In determining a concern's number of employees, SBA counts all individuals employed on a full-time, part-time, or other basis. This includes employees obtained from a temporary employee agency, professional employee organization or leasing concern. SBA will consider the totality of the circumstances, including criteria used by the IRS for Federal income tax purposes, in determining whether individuals are employees of a concern. Volunteers (i.e., individuals who receive no compensation, including no in-kind compensation, for work performed) are not considered employees. Where the size standard is number of employees, the method for determining a concern's size includes the following principles: (1) the average number of employees of the concern is used (including the employees of its domestic and foreign affiliates) based upon numbers of employees for each of the pay periods for the preceding completed 12 calendar months; (2) Part-time and temporary employees are counted the same as full-time employees. [*PART 121—SMALL BUSINESS SIZE REGULATIONS §121.106*]

the seven owners also own additional vessels, with sub-sets of the original seven personnel or with new co-owners, those ownership arrangements are deemed to be separate ownership entities for the purpose of this analysis.

Regulated Commercial Fish Harvesting Entities

Ownership entities are identified on June 1st of each year based on the list of all permit numbers, for the most recent complete calendar year, that have applied for any type of Northeast Federal fishing permit. The current ownership data set is based on calendar year 2013 permits and contains gross sales associated with those permits for calendar years 2011 through 2013.

As of June 1, 2014 there were 1,386 commercial business entities potentially regulated by the proposed action. These entities participate in or are permitted for the northeast multispecies, small mesh multispecies, herring mid-water trawl and scallop fisheries. 1,362 of these entities are classified as small businesses. 813 entities are primarily engaged in fishing for finfish (that is, obtain the greatest amount of their 2013 gross sales from sales of finfish) and all are classified as small businesses (average gross revenues from 2011-13 are less than $20.5 million). 573 entities are primarily engaged in fishing for shellfish, and 549 of these are classified as small businesses (average gross revenues from 2011-13 are less than $5.5 million) (Table 95 and Table 96).

Table 95 – Entities regulated by the proposed action.

Type	Number	Number small
Primarily finfish	813	813
Primarily shellfish	573	549
Total	**1386**	**1362**

Table 96 – Description of regulated entities by gross sales.

Sales category	Number	Number small	Mean gross sales	Median gross sales	Mean permits per entity	Max permits per entity
<$50K	504	504	$ 9,664	$ 2,646	3.5	90
$50-100K	143	143	$ 74,876	$ 74,088	3.6	12
$100-500K	404	404	$ 229,987	$ 199,335	4.0	15
$500K-1mil	105	105	$ 726,343	$ 723,438	4.8	15
$1-5.5mil	208	205	$ 2,015,363	$ 1,648,353	5.6	39
$5.5-20.5mil	16	1	$ 7,752,497	$ 6,892,317	19.5	39
$20.5mil+	6	0	$ 22,908,082	$ 21,930,755	56.0	84

Directly regulated groundfish harvesting entities

While 1,386 commercial entities are potentially regulated by the proposed action, not all of these entities derive a substantial portion of their gross sales in fisheries that are likely to be meaningfully impacted by the proposed action. In the case of commercial harvesters, the proposed action will

directly impact entities engaged in the limited access groundfish fishery the most. The limited access groundfish[28] fisheries are further sub-classified as those enrolled in the sector allocation program and those in the common pool. Sector vessels are subject to sector-level stock-specific Annual Catch Entitlements (ACE) that limit catch of allocated groundfish stocks. Accountability measures (AMs) include a prohibition on fishing inside designated areas once 100 percent of available Sector ACE has been caught, as well as area-based gear and effort restrictions that are triggered when catch of non-allocated groundfish stocks exceed Allowable Catch Limits (ACLs). Common pool vessels are subject to various days-at-sea and trip limits designed to keep catches below ACLs set for vessels enrolled in this program. In general, sector-enrolled businesses rely more heavily on sales of groundfish species than common pool-enrolled vessels. All limited access multispecies permit holders are eligible to participate in the sector allocation program, however many permit holders select to remain in the common pool fishery as a result of low catch histories and in turn, low Potential Sector Contributions (PSC) for groundfish stocks.

As of May 1, 2014 (beginning of fishing year 2014) there were 1,046 individual limited access permits[29]. 613 of these permits were enrolled in the sector program and 433 were in the common pool. Of these 1,046 limited access multispecies permits, 708 had landings of any species and 360 had groundfish landings in FY 2013.

Potentially impacted regulated commercial groundfish fishing entities

Matching the potentially impacted permits described above (FY2014) to the calendar year 2013 ownership data, results in 868 distinct ownership entities. Of these, 855 are categorized as small and 13 are categorized as large entities per the SBA guidelines (Table 97 and Table 98). Note that the 39 charter businesses included here are entities affiliated with limited access commercial groundfish permits, but derive greater than 50% of their gross sales from party/charter operations.

These totals may mask some diversity among the entities. Many, if not most, of these ownership entities maintain diversified harvest portfolios, obtaining gross sales from many fisheries and not dependent on any one. However, not all are equally diversified. Those that depend most heavily on sales from harvesting species impacted directly by the proposed action are most likely to be affected. By defining dependence as deriving greater than 50% of gross sales from sales of regulated species associated with a specific fishery, we are able to identify those ownership groups most likely to be impacted by the proposed regulations[30]. Using this threshold, 114 entities are groundfish-dependent, all of which are small and all of which are finfish commercial harvesting businesses (Table 99). Of the 114 groundfish-dependent entities, 102 have some level of participation in the sector program and 12 operate exclusively in the common pool.

[28] The species managed under the Northeast multispecies FMP are commonly referred to as groundfish.
[29] For purposes of this analysis, groundfish limited access eligibilities held as Confirmation of Permit History (CPH) are not included because although they may generate revenue from ACE leasing, they do not generate any gross sales from fishing activity and thus would not be classified as commercial fishing entities.[30]Charter/party vessels are prohibited from selling fish though some ownership entities may have recreational and commercial permits. Entities designated as charter businesses derive the largest part of their gross sales from for-hire fees from passengers.
[30]Charter/party vessels are prohibited from selling fish though some ownership entities may have recreational and commercial permits. Entities designated as charter businesses derive the largest part of their gross sales from for-hire fees from passengers.

Table 97 – Description of impacted regulated groundfish fishing entities by business type* and size.

Business Type	Small	Large	Total
Charter	39	0	39
Finfish	378	0	378
Shellfish	291	13	304
No Revenues	147	0	147
Total	**855**	**13**	**868**

** Business type is based on the fishing activity that generated the highest gross sales for each entity. Ownership entities with zero sales were defaulted into the finfish category.*

Table 98 - Description of impacted regulated commercial groundfish fishing entities by gross sales.

Sales	Number of entities	Number of small businesses	Average number of fishing permits owned per entity	Maximum fishing permits per entity	Median gross sales per entity	Mean gross sales per entity
<$50K	268	268	1.2	36	$2,082	$9,740
$50-100K	96	96	1.1	2	$74,169	$74,710
$100-500K	323	323	1.3	5	$211,812	$236,344
$500K-1mil	78	78	1.4	5	$729,500	$733,243
$1-5.5mil	87	87	1.8	12	$1,574,360	$1,925,144
$5.5-20.5mil	11	3	1.7	6	$7,716,052	$8,257,405
$20.5mil+	5	0	7.8	25	$22,967,309	$23,312,445
Total ownership entities	**868**	**855**				

Table 99- Description of groundfish-dependent impacted regulated commercial groundfish entities by

Sales	Number of entities	Number of large businesses	Average number of fishing permits owned per entity	Maxi-mum fishing permits per entity	Median gross sales per entity	Mean gross sales per entity	Median groundfish sales per entity	Mean groundfish sales per entity
<$50K	10	0	1.3	3	$10,665	$18,467	$3,363	$5,366
$50-100K	5	0	1.2	2	$80,138	$77,862	$20,063	$25,307
$100-500K	57	0	1.5	4	$193,021	$232,008	$104,450	$134,790
$500K-1mil	18	0	2.1	5	$738,240	$771,419	$477,286	$490,127
$1-5.5mil	24	0	3.1	12	$1,492,711	$1,928,132	$1,109,154	$1,252,107
$5.5-20.5mil	0	0	0.0	0	$0	$0	$0	$0
$20.5mil+	0	0	0.0	0	$0	$0	$0	$0
Total ownership entities gross sales.	**114**	**0**						

Regulated Recreational Party/Charter Fishing Entities

Party/charter permits are issued as an open access Category I permit under the Northeast Multispecies FMP. During calendar year 2014, 732 party/charter permits were issued. 267 of those open access party/charter permit holders reported taking and retaining any regulated groundfish species on at least one for-hire trip. 204 party/charter permits reported catching at least one cod in 2014. While all party/charter fishing businesses that catch cod may be affected by the proposed action, it is important to note that of 204 active party/charter businesses reported to have caught cod, 106 reported catching cod in the Gulf of Maine stock area (Table 100). A 2013 report by Steinback and Brinson indicated that the mean gross sales of a party/charter business in the northeast U. S. was $27.6K with a 95th percentile confidence limit of $36.1K (Steinback and Brinson 2013). Party boats, of which there are approximately 20 operating in the Gulf of Maine region, have mean gross sales of $213K. No business in their survey approached the $7.5 million large business threshold, and therefore all 267 potentially regulated entities are considered here as small businesses.

Table 100 - Party/charter fishing trips and participating vessels, 2010-2014.

Year	Total trips taken	Total entities	Trips catching cod	Entities catching cod	Trips catching cod in the Gulf of Maine	Entities catching cod in the Gulf of Maine
2010	17,622	351	10,790	305	13,283	169
2011	17,281	356	10,215	302	12,214	155
2012	15,536	280	8,274	224	11,236	120
2013	16,328	309	8,371	240	12,274	137
2014	14,038	267	7,253	204	10,021	106

Regulated Scallop Fishing Entities

If scallop vessels participating in either open-area or access-area trips exceed their sub-allocation of GB yellowtail flounder bycatch and either the total GB yellowtail flounder ACL is exceeded or the scallop fishery exceeds its ACL by 50 percent or more, GB yellowtail AMs for that stock will go into effect the following FY, as defined in Amendment 15 of the Atlantic Sea Scallop FMP and modified in FW23. Because the proposed action will decrease the available GB yellowtail flounder ABC for the groundfish fishery, vessels permitted in the scallop fishery are technically regulated by this action. The length of the AM area closures would be determined by the overage percent. If the total ACL is exceeded, the fishery that caused the overage would also be subject to a pound for pound payback under the US/Canada resource sharing agreement.

The limited access scallop fisheries are further sub-classified as Limited Access (LA) scallop permits and Limited Access General Category (LAGC) scallop permits. LA scallop permit businesses are subject to a mixture of days-at-sea (DAS) and dedicated area trip restrictions. LAGC scallop permit businesses are able to acquire and trade LAGC scallop quota and there is an annual cap on quota/landings. In 2014, there were 171 distinct ownership entities. Of these, 149 are categorized as small and 22 are categorized as large entities under the SBA guidelines (Table 101 and Table 102)[31].

Table 101 – Description of impacted regulated scallop fishing entities by business type and size.

business	Number entities	Number small entities
Primarily finfish	4	4
Primarily shellfish	167	145
Total	**171**	**149**

Table 102 – Description of impacted regulated scallop fishing entities by gross sales.

Sales category	Number	Number small	Mean gross sales	Median gross sales	Mean permits per entity	Max permits per entity
<$50K	1	1	$ -	$ -	6	6
$100-500K	1	1	-	-	3	3
$500K-1mil	7	7	$ 780,241	$ 842,487	4	6
$1-5.5mil	143	140	$ 2,099,919	$ 1,696,380	5	39
$5.5-20.5mil	13	0	$ 7,352,126	$ 6,719,658	20	36
$20.5mil+	6	0	$ 22,908,082	$ 21,930,755	56	84

Regulated Small-Mesh Multispecies Fishing Entities

FW 48 created the small-mesh multispecies fishery sub-ACL for GB yellowtail flounder and FW 51 adopted a gear-based AM. If the small-mesh sub-ACL for GB yellowtail flounder is exceeded, a gear-based AM will go into effect at the start of the next fishing year. Additionally if the total ACL

[31] The number of scallop entities reported in Table 7 and 8 is slightly lower than the numbers reported in the RFA analyses for Atlantic Sea Scallop Framework Adjustment 26 due to the different cut-off dates used in determining permits. Tables 7 to 8 uses June 1, 2014 as the cut-off date to determine the number of entities, while the Atlantic Sea Scallop Framework included all the vessels with landings of scallops if they had a permit in the corresponding fishing years.

is exceeded, the fishery that caused the overage would also be subject to a pound for pound payback under the US/Canada resource sharing agreement. Because the proposed action will decrease the available GB yellowtail flounder ABC for the groundfish fishery, vessels permitted in small mesh fisheries are technically regulated by this action.

The small-mesh exempted fishery allows vessels to harvest species in designated areas using mesh sizes smaller than the minimum mesh size required by Regulated Mesh Area (RMA) regulations. To participate in the small-mesh multispecies (whiting) exempted fishery, vessels must hold either a limited access multispecies permit (categories A-F) or an open access multispecies permit (category K). Limited access multispecies permit holders can only target whiting when not fishing under a DAS and while declared out of the fishery using VMS. In 2014, there were 570 distinct ownership entities. Of these, 550 are categorized as small and 20 are categorized as large entities per the SBA guidelines (Table 103 and Table 104).

Table 103 – Description of impacted regulated small-mesh multispecies fishing entities by business type and size.

business	Number entities	Number small entities
Primarily finfish	309	309
Primarily shellfish	261	241

Table 104 – Description of impacted regulated small-mesh multispecies fishing entities by gross sales.

Sales category	Number	Number small	Mean gross sales	Median gross sales	Mean permits per entity	Max permits per entity
<$50K	244	244	$ 10,208	$ 3,116	4	90
$50-100K	97	97	$ 74,437	$ 73,470	4	9
$100-500K	314	314	$ 237,328	$ 210,849	4	15
$500K-1mil	76	76	$ 728,954	$ 727,452	5	15
$1-5.5mil	86	84	$ 1,914,431	$ 1,585,093	7	39
$5.5-20.5mil	11	1	$ 8,257,405	$ 7,716,052	22	39
$20.5mil+	5	0	$ 23,312,445	$ 22,967,310	58	84

Regulated Active Small-Mesh Multispecies Fishing Entities

Active small-mesh multispecies fishing entities are defined as those landing whiting, and are a subset of those described in the previous section. In 2014, there were 25 distinct ownership entities. Of these, 24 are categorized as small and 1 is categorized as large entities per the SBA guidelines (Table 105 and Table 106).

Table 105 - Description of impacted regulated active small-mesh multispecies fishing entities by business type and size.

business	Number entities	Number small entities
Primarily finfish	7	7
Primarily shellfish	18	17
Total	25	24

Table 106 – Description of impacted regulated active small mesh multispecies fishing entities by gross sales.

Sales category	Number	Number small	Mean gross sales	Median gross sales	Mean permits per entity	Max permits per entity
<$50K	3	3	$ 28,855	$ 28,880	3	3
$100-500K	14	14	$ 221,650	$ 166,208	4	9
$500K-1mil	4	4	$ 791,614	$ 745,525	4	6
$1-5.5mil	3	3	$ 1,807,091	$ 1,526,741	4	6
$5.5-20.5mil	1	0	$ 7,064,976	$ 7,064,976	24	24

Regulated Herring Fishing Entities

FW 46 created separate MWT sub-ACLs for GB haddock and GOM haddock equal to 1% of the respective ABCs. Because the proposed action will increase the available GOM and GB haddock ABC for the groundfish fishery, vessels permitted in the Atlantic herring fishery are technically regulated by this action. In the event that the MWT herring fishery exceeds their sub-allocation of haddock for either stock, harvesting restrictions in GB and GOM AM areas for herring will go into effect and the total amount of the overage will be deducted from the following fishing year's sub-ACL as well.

In 2014, there were 71 distinct ownership entities. Of these, 64 are categorized as small and 7 are categorized as large entities per the SBA guidelines (Table 107 and Table 108).

Table 107 – Description of impacted regulated herring fishing entities by business type and size.

business	Number entities	Number small entities
Primarily finfish	43	43
Primarily shellfish	28	21
Total	71	64

Table 108 – Description of impacted herring fishing entities by gross sales.

Sales category	Number	Number small	Mean gross sales	Median gross sales	Mean permits per entity	Max permits per entity
<$50K	3	3	$ 9,133	$ -	3	3
$50-100K	3	3	$ 70,180	$ 65,490	5	9
$100-500K	14	14	$ 292,883	$ 287,396	5	9
$500K-1mil	14	14	$ 751,900	$ 745,156	5	15
$1-5.5mil	29	29	$ 2,244,176	$ 1,890,452	7	30
$5.5-20.5mil	4	1	$ 8,881,823	$ 8,237,991	20	39
$20.5mil+	4	0	$ 21,387,281	$ 20,890,234	58	84

8.11.2.5 Description of the projected reporting, record-keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records

The proposed rules in FW 53 are not expected to create any additional reporting, record-keeping or other compliance requirements.

8.11.2.6 Identification of all relevant Federal rules, which may duplicate, overlap or conflict with the proposed rule

No relevant Federal rules have been identified that would duplicate or overlap with the proposed action.

8.11.2.7 Significance of economic impacts on small entities

Substantial number criterion

In colloquial terms, substantial number refers to "more than a few." The vast majority of the regulated entities impacted by this action are considered small, and this proposed measure will impact some of them in a negative way.

Significant economic impacts

The outcome of "significant economic impact" can be ascertained by examining two factors: disproportionality and profitability.

Disproportionality refers to whether or not the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities.

- Profitability refers to whether or not the regulations significantly reduce profits for a substantial number of small entities.

8.11.2.8 Description of impacts on small entities

This IRFA analysis is intended to analyze the impacts of the alternatives described in Section 4.0 on small entities. These measures are expected to negatively impact gross sales of small entities regulated by this action. The vast majority (1362 out of 1386) of potentially regulated entities are classified as small businesses by SBA business size standards.

Impacts to groundfish-dependent small entities

Of these 1362 entities, 868 entities derive gross sales, or may derive gross sales from, the limited access groundfish fishery and are likely to be impacted by the proposed action. 855 of these entities are considered small businesses. 114 entities are directly regulated and dependent on the groundfish fishery for greater than 50% of their gross sales. All 114 of these entities are considered small. All 267 party/charter entities, and all 106 landing cod at least once in the Gulf of Maine, are considered small.

Therefore, this action can be expected to adversely affect the gross sales and profits of small businesses to a greater degree than large businesses, as the large businesses identified here are:

- more diversified, as all are classified as primarily shellfish and not finfish businesses; and

- less dependent upon the commercial groundfish fishery for a substantial portion of their revenue, as all 114 entities obtaining more than 50% of their gross sales are classified as small businesses.

Analytical techniques used to develop impact analyses of the proposed action (see Section 8.2 and Section 8.11) do not detect gross sales and/or profit changes at the individual entity level. However, for the reasons noted above, the anticipated $4.1 million aggregate gross revenues losses are expected to be absorbed primarily by small businesses (see Table 99).While profits for nearly all of these small entities are expected to be adversely affected by the proposed action (see, again, Section 4.0), commercial groundfish fishery gross revenues reductions are predicted to be approximately 5% relative to the baseline of FY 2014.

The economic impacts of the proposed action are not expected to be uniformly distributed, such that smaller inshore vessels would be most affected. Impacts of this preferred alternative on the commercial fishery are expected to be most severe in GOM ports north of Boston, and for smaller vessels with a limited range.

Impacts to scallop-dependent small entities

Under the proposed action, the sea scallop fishery sub-ACL for GB yellowtail flounder is expected to decrease by 12.4 mt (-24.4%) relative to FY 2014. Based on recent catch performance, AMs for GB yellowtail flounder have never been implemented for the sea scallop fishery as a result of an overage. Additionally, based on sea scallop management measures that are proposed in 2015, it is not expected that scallop effort will increase on GB relative to recent years. Although the proposed action could have negative economic impacts if the AM is triggered, the sea scallop fishery is not expected to exceed its GB yellowtail allocation in 2015. In addition, LAGC vessel effort is minimal in the GB yellowtail flounder stock area and as such the proposed action is expected to have negligible if any impact on LAGC vessels. As such, it is unlikely that a significant overage will occur and thus scallop dependent small entities are not expected to be significantly impacted in terms of profitability. As a result, small regulated entities that derive revenues from the sea scallop fishery are not expected to be impacted by changes to the GB yellowtail flounder sub-ACLs proposed by this action.

Impacts to herring-dependent small entities

The MWT sub-ACL for GB haddock is expected to increase by 65 mt (+40%) under the proposed action. The MWT sub-ACL for GOM haddock is also expected to increase by 11 mt (+467%). Because the ABCs are based off of latest stock assessment information and the MWT haddock sub-ACLs will be calculated at a fixed rate of 1%, it is less likely that the MWT haddock AMs will be triggered under the proposed action. The GOM haddock catch cap has never been triggered and it is unlikely to be given status quo conditions. However, in FY 2013, the AM for GB haddock was triggered. Although the proposed action could have negative economic impacts if the AM is triggered, the MWT fishery is not expected to exceed its GOM or GB haddock allocation in 2015. As a result, small regulated entities that derive revenues from the herring fishery are not expected to be negatively impacted by changes to the MWT sub-ACLs proposed by this action.

Impacts to small-mesh multispecies small entities

The GB yellowtail flounder allocation for small-mesh fisheries would be a decrease in 2015 (4.6 mt) compared to 2014 (6.1 mt), which could increase the likelihood of triggering AMs. However, based on recent catch performance an AM for GB yellowtail flounder has never been implemented for this fishery as a result of an overage (e.g., GB yellowtail flounder catch in FY 2014 was 2.5 mt, roughly 64% of the sub-ACL); estimated catches of GB yellowtail flounder in some previous years have exceeded 4 mt). Although the catch limit under the proposed action could have negative economic impacts, small-mesh fisheries are unlikely to exceed their GB yellowtail flounder allocation in 2015. If the AM is triggered due to increases in GB yellowtail flounder catch by the small-mesh multispecies fishery or by the lower proposed sub-ACL, vessels that participate in the small-mesh multispecies fishery in the following year would be required to use a modified small mesh nets that has been shown to substantially reduce GB yellowtail flounder catch. With enough forewarning of implementation at the start of the next fishing year, this expense would not be much greater than that associated with normal gear maintenance and replacement. As long as the small-mesh multispecies fishery catch of GB yellowtail flounder remain below the specifications, small regulated entities that derive revenues from the small mesh fisheries would not be negatively impacted by changes to the GB yellowtail flounder sub-ACLs proposed by this action.

9.0 References

9.1 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 B_{MSY} and F_{MSY} 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.

B_{MSY}: The stock biomass that would produce MSY when fished at a fishing mortality rate equal to F_{MSY}. For most stocks, B_{MSY} is about ½ of the carrying capacity. The proposed overfishing definition control rules call for action when biomass is below ¼ or ½ B_{MSY}, depending on the species.

$B_{threshold}$: 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 $B_{threshold}$. A determination of overfished triggers the SFA requirement for a rebuilding plan to achieve B_{target} as soon as possible, usually not to exceed 10 years except certain requirements are met. In Amendment 9 control rules, $B_{threshold}$ is often defined as either $1/2B_{MSY}$ or $1/4\ B_{MSY}$. $B_{threshold}$ is also known as $B_{minimum}$.

B_{target}: A desirable biomass to maintain fishery stocks. This is usually synonymous with B_{MSY} 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 (B_{MSY} or proxy) as a management objective. The biomass threshold ($B_{threshold}$ or B_{min}) 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).

$F_{0.1}$: a conservative fishing mortality rate calculated as the F associated with 10 percent of the slope at origin of the yield-per-recruit curve.

F_{MAX}: a fishing mortality rate that maximizes yield per recruit. F_{MAX} is less conservative than $F_{0.1}$.

F_{MSY}: a fishing mortality rate that would produce MSY when the stock biomass is sufficient for producing MSY on a continuing basis.

$F_{threshold}$: 1) The maximum fishing mortality rate allowed on a stock and used to define overfishing for status determination. Amendment 9 frequently uses F_{MSY} or F_{MSY} proxy for $F_{threshold}$. 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. A_{50} 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. L_{25} is the length where 25% of the fish encountered are retained by the mesh. L_{50} 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 $B_{threshold}$ (defines overfished) and $F_{threshold}$ (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). B_{MSY} 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, F_{MSY}, B_{MSY}, 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.

9.2 Literature Cited

Acheson JM. 1997. The Politics of Managing the Maine Lobster Industry: 1860 to the present. Human Ecol. 25(1):1-25.
Acheson, JM. 2004. The Development of the Maine Lobster Co-management Law. Workshop in Political Theory and Policy Analysis. Bloomington Indiana June (pp. 2-6).
Acheson, JM. 2010. Failure and Success in Fisheries Management in the Gulf of Maine. Anthropology News, 51(7): 25-25.
Acheson, J. M., & Gardner, R. 2011. Modeling Disaster: The Failure of the Management of the New England Groundfish Industry. North American Journal of Fisheries Management, 31(6): 1005-1018.
Aguilar, A. 2002. Fin whale, Balaenoptera physalus. In W.F. Perrin, B. Würsig, and J.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals (p. 435-438). San Diego: Academic Press.
Almeida, F.P. 1987. Status of the silver hake resources off the northeast coast of the United States. Nat. Mar. Fish. Serv. NE Fish. Sci. Center, Woods Hole Lab., Woods Hole, MA, Ref. Doc. 87-03, 60 pp.
Ames, T. 2004. Atlantic cod stock structure in the Gulf of Maine. Fisheries 29 (1): 10-28.
Armstrong, M. P., M. J. Dean, W. S. Hoffman, D. R. Zemeckis, T. A. Nies, D. E. Pierce, P. J. Diodati, and D. J. Mckiernan. 2013. The application of small scale fishery closures to protect Atlantic cod spawning aggregations in the inshore Gulf of Maine. Fisheries Research 141:62-69.
Atlantic States Marine Fisheries Commission Technical Committee (ASMFC TC). 2007. Special Report to the Atlantic Sturgeon Management Board: Estimation of Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic. August 2007. 95 pp.
Atlantic States Marine Fisheries Commission. 2009. American Lobster Stock Assessment Report for Peer Review. Stock Assessment report No. 09-01 (Supplement). 316 pp. Available at: http://www.asmfc.org/
Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status review of Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus). National Marine Fisheries Service. February 23, 2007. 188 pp.
Attard, J. and C. Hudon. 1987. Embryonic development and energetic investment in egg production in relation to size of female lobster (Homarus americanus). Canadian Journal of Fisheries and Aquatic Sciences 44: 1157 – 1164.
Bain, M. B., N . Haley, D. Peterson, J. R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River Estuary: Lessonsfor Sturgeon Conservation. Instituto Espanol de Oceanografia. Boletin 16: 43-53.
Baum, E.T. 1997. Maine Atlantic Salmon - A National Treasure. Atlantic Salmon Unlimited, Hermon, Maine.
Baumgartner, M.F., T.V.N. Cole, R.G. Campbell, G.J. Teegarden and E.G. Durbin. 2003. Associations between North Atlantic right whales and their prey, Calanus finmarchicus, over dieand tidal time scales. Mar. Ecol. Prog. Ser. 264: 155–166.
Baumgartner, M.F. and B.R. Mate. 2003. Summertime foraging ecology of North Atlantic right whales. Mar. Ecol. Prog. Ser. 264: 123–135.
Best, P.B., J. L. Bannister, R.L. Brownell, Jr., and G.P. Donovan (eds.). 2001. Right whales:worldwide status. J. Cetacean Res. Manage. (Special Issue). 2. 309 pp.

Blaxter, J.H.S., D. Danielssen, E. Moksness, and V. Oiestad. 1983. Description of the early development of the halibut, Hippoglossus hippoglossus and attempts to rear the larvae past first feeding. Marine Biology 73: 99 – 107.

Bolles, K.L., and G.A. Begg. 2000. Distinction between silver hake (*Merluccius bilinearis*) stocks in US waters of the northwest Atlantic based on whole otolith morphometrics. Fishery Bulletin 98:3.

Bowen, B.W., A.L. Bass, S.-M. Chow, M. Bostrom, K.A. Bjorndal, A.B. Bolten, T. Okuyama, B.M. Bolker., S. Epperly, E. Lacasella, D. Shaver, M. Dodd, S.R. Hopkins-Murphy, J.A. Musick, M. Swingle, K. Rankin-Baransky, W. Teas, W.N. Witzell, and P.H. Dutton. 2004. Natal homing in juvenile loggerhead turtles (Caretta caretta). Molecular Ecology 13:3797-3808.

Braun-McNeill, J., and S.P. Epperly. 2004. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). Marine Fisheries Review 64(4):50-56.

Braun-McNeill J., Epperly, S.P., Avens, L., Snover, M.L. and Taylor, J.C. 2008. Life stage duration and variation in growth rates of loggerhead (*Caretta caretta*) sea turtles from the western north Atlantic. Herpetological Conservation and Biology 3(2): 273-281.

Brodziak, J.K.T., and W.K. Macy III. 1996. Growth of long-finned squid, *Loligo pealei*, in the northwest Atlantic. Fishery Bulletin 94 (2): 212 – 236.

Brown, M.B., O.C. Nichols, M.K. Marx, and J.N. Ciano. 2002. Surveillance of North Atlantic right whales in Cape Cod Bay and adjacent waters. 2002. Final report to the Division of Marine Fisheries, Commonwealth of Massachusetts. 29 pp., September 2002.

Burdge RJ. 1998. A Conceptual Approach to Social Impact Assessment. Revised ed. Madison (WI): Social Ecology Press. 284 p.

Burdge, R. J., & Vanclay, F. 1995. Social impact assessment. Environmental and social impact assessment, 31–66.

Carr, H.A. and H.O. Milliken. 1998. Conservation engineering: options to minimize fishing's impacts to the sea floor. Pp. 100–103 in E.M. Dorsey and J. Pederson, eds. Effects of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation, Boston, MA. 160 pp.

Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report or the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.

Chang, S., P. L. Berrien, et al. 1999. Essential Fish Habitat Source Document: Windowpane, Scophthalmus aquosus, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-137. 40pp.

Clapham, P.J., S.B. Young, R.L. Brownell, Jr. 1999. Baleen whales: conservation issues and the status of the most endangered populations. Mammal Review 29(1): 35-60.

Clark, S.H. (editor) 1998. Status of fishery resources off the Northeastern United States for 1998. NOAA Technical Memorandum NMFS-NE-115. 149 pp.

Clark, S.H., and R. Livingstone, Jr. 1982. Ocean pout Macrozoarces americanus. Fish distribution, Marine Ecosystem Analysis (MESA) New York Bight Atlas Monograph 15: 76 – 79.

Clay, P. M. 2007, Defining Fishing Communities: Issues in Theory and Practice. NAPA Bulletin, 28: 27–42. doi: 10.1525/napa.2007.28.1.27

Clay, P.M., L.L Colburn, J. Olson, P. Pinto da Silva. 2008. Community Profiles for the Northeast US Fisheries. Available at: http://www.nefsc.noaa.gov/read/socialsci/community_profiles/.

Clay PM, Colburn LL, Olson J, Pinto da Silva P, Smith SL, Westwood A, Ekstrom J. Community Profiles for the Northeast US Fisheries. August 22, 2012. Woods Hole (MA): Northeast Fisheries Science Center; Available from:

http://www.nefsc.noaa.gov/read/socialsci/communityProfiles.html.

Cohen, A.C. 1976. The systematics and distribution of Loligo (Cephalopoda, Myopsida) in the western North Atlantic, with descriptions of two new species. Institute of Malacology.

Cole, T.V.N., P. Hamilton, A.G. Henry, P. Duley, R.M. Pace III, B.N. White, T. Frasier. Evidence of a North Atlantic right whale *Eubalaena glacialis* mating ground. Endang Species Res 21: 55–64.

Coles, W.C., and J.A. Musick. 2000. Satellite sea surface temperature analysis and correlation with sea turtle distribution of North Carolina. Copeia 2000:551–554

Collette, B.B. and G. Klein-MacPhee. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine, Smithsonian Books, Washington, D.C.

Collins, M. R. and T. I. J. Smith. 1997. Distribution of shortnose and Atlantic sturgeons in South Carolina. North American Journal of Fisheries Management. 17: 995-1000.

Colvocoresses, J.A. and J.A. Musik. 1984. Species associations and community composition of middle Atlantic bight continental shelf demersal fishes. U.S. Fisheries Bulletin 82(2):295-313.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (Caretta caretta) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.

Cooper, R.A., and J.R. Uzmann. 1971. Migrations and growth of deep-sea lobsters, Homarus americanus. Science 171: 288 – 290.

Cournane, J.M. 2010. Spatial management of groundfish resources in the Gulf of Maine and Georges Bank. Dissertation, University of New Hampshire.

Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. Fisheries 31: 218-229.

Dadswell, M. J., B. D. Taubert, T. S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on Shortnose Sturgeon, Acipenser brevirostrum, LeSuer 1818.

Damon-Randall, K., M. Colligan, and J. Crocker. 2013. Composition of Atlantic Sturgeon in Rivers, Estuaries, and Marine Waters. National Marine Fisheries Service, NERO, Unpublished Report. February 2013. 33 pp.

DeAlteris, J. 1998. Effects of the T/B North Cape oil spill on the surf clam, Spisula solidissima, in the coastal waters of Southern Rhode Island. Report to Beak Consultants, 30 March 1998.

Dodge, K.L., B. Galuardi, T. J. Miller, and M. E. Lutcavage. 2014. Leatherback Turtle Movements, Dive Behavior, and Habitat Characteristics in Ecoregions of the Northwest Atlantic Ocean. PLOS ONE 9 (3) e91726: 1-17.

Dovel, W. L. and T. J. Berggren. 1983. Atlantic sturgeon of the Hudson River estuary, New York. New York Fish and Game Journal 30: 140-172.

Dunton, K.J., A. Jordaan, K.A. McKown, D.O. Conover, and M.G. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (Acipenser oxyrinchus) within the Northwest Atlantic Ocean determined from five fishery-independent surveys. Fish. Bull. 108:450-465.

Everhart, W.H., and W.D. Youngs. 1981. Principles of Fishery Science. Ithaca, NY, Cornell University Press.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bulletin of Marine Science 56(2):547-568.

Erickson, D. L., A. Kahnle, M. J. Millard, E. A. Mora, M. Bryja, A. Higgs, J. Mohler, M. DuFour, G. Kenney, J. Sweka, and E. K. Pikitch. 2011. Use of pop-up satellite archival tags to identify oceanic-migratory patterns for adult Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*

Mitchell, 1815. J. Appl. Ichthyol. 27: 356–365.

Falk-Petersen, I.R., and T.K. Hasen. 1991. Reproductive biology of wolffish *Anarhichas lupus* from north-Norwegian waters. Int. Coun. Explor. Mer., Demersal Fish. Comm. ICES CM 1991/G:14:17.

Fay, C., M. Bartron, S. Craig, A. Hecht, J. Pruden, R. Saunders, T. Sheehan, and J. Trial. 2006. Status Review for Anadromous Atlantic Salmon (Salmo salar) in the United States. Report to the National Marine Fisheries Service and U.S. Fish and Wildlife Service. 294 pages.

Fogarty, M. 2007. "Efficacy of fishery closures in the Gulf of Maine." In Bayley, H, C. Cavanaugh, and P. Galardi, eds. Western Gulf of Maine Closure Area 2007 Symposium Report. University of New Hampshire.

Gabriel, W. 1992. Persistence of demersal fish assemblages between Cape Hatteras and Nova Scotia, northwest Atlantic. Journal of Northwest Atlantic Fisheries Science 14:29-46.

Griffin, D.B., S. R. Murphy, M. G. Frick, A. C. Broderick, J. W. Coker, M. S. Coyne, M. G. Dodd, M. H. Godfrey, B. J. Godley, L. A. Hawkes, T. M. Murphy, K. L. Williams, and M. J. Witt. 2013. Foraging habitats and migration corridors utilized by a recovering subpopulation of adult female loggerhead sea turtles: implications for conservation. Mar. Biol. 160: 3071–3086.

Grosslein, M.D., and T.R. Azarovitz. 1982. Fish distribution. Monograph 15. MESA New York Bight Atlas. New York Sea Grant Institute, Albany, New York.

Guidelines for Economic Review of National Marine Fisheries Services Regulatory Actions. 2007. Retrieved December 3, 2012, from NOAA Fisheries Policy Directives: http://www.nmfs.noaa.gov/sfa/domes_fish/EconomicGuidelines.pdf

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf. Reports of the International Whaling Commission 42: 653-669.

Halliday, R.G., and A.T. Pinhorn. 2002. A review of the scientific and technical bases for policies on the capture of small fish in North Atlantic groundfish fisheries. Fisheries Research 57 (3): 211 – 222.

Hamilton, P.K., and C.A. Mayo. 1990. Population characteristics of right whales (*Eubalaena glacialis*) observed in Cape Cod and Massachusetts Bays, 1978-1986. Reports of the International Whaling Commission, Special Issue No. 12: 203-208.

Hart D.R. and A.S. Chute. 2004. Essential Fish Habitat Source Document: Sea Scallop, Placopecten magellanicus, Life History and Habitat Characteristics (2nd ed.), NOAA/NMFS Tech. Mem. NE-198.

Haug, T., and B. Gulliksen. 1988. Fecundity and oocyte sizes in ovaries of female Atlantic halibut, Hippoglossus hippoglossus (L.). Sarsia 73: 259 – 261.

Hayes, M.L. 1983. Active fish capture methods in Nielson, L.A.; Johnson, D.L., eds. Fisheries techniques. Bethesda, MD: Am. Fish. Soc.; p. 123-145.

Hickley, Phil. 1998. *Recreational Fisheries- Social, Economic, and Management Aspects.* 137-158. Hoboken, New Jersey: Wiley-Blackwell.

Holland, B.F., Jr., and G.F. Yelverton. 1973. Distribution and biological studies of anadromous fishes offshore North Carolina. Division of Commercial and Sports Fisheries, North Carolina Dept. of Natural and Economic Resources, Special Scientific Report No. 24. 130 pp.

Holland DS, Pinto da Silva P, Wiersma J. 2010. A Survey of Social Capital and Attitudes Toward Management in the New England Groundfish Fishery. In: Northeast Fisheries Science Center Reference Document. Woods Hole (MA): US Dept. of Commerce Northeast Fisheries Science Center. Ref. Doc. 10-12. 13 p.

Horwood, J. 2002. Sei whale, Balaenoptera borealis. In W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds., Encyclopedia of Marine Mammals (pp. 1069-1071). San Diego: Academic

Press.

Hyvarinen, P., P. Suuronen and T. Laaksonen. 2006. Short-term movement of wild and reared Atlantic salmon smolts in brackish water estuary – preliminary study. Fish. Mgmt. Eco. 13(6): 399 -401.

International Council for the Exploration of the Seas (ICES). 2000. Effects of Different Types of Fisheries on North Sea and Irish Sea Benthic Ecosystems. Report of the ICES Advisory Committee on the Marine Environment 2000. ICES Coop. Res. Rep. No. 241, 27 pp.

Interorganizational Committee on Principles and Guidelines for Social Impact Assessment. 1994. Guidelines and Principles for Social Impact Assessment. Impact Assessment. 12(2), 107-152.

Interorganizational Committee on Principles and Guidelines for Social Impact Assessment. (2003). Principles and guidelines for SIA in the USA. Impact Assess. Proj. Appraisal 21(3):231–250.

Jacobson, L. 2005. Essential fish habitat source document: longfin inshore squid, *Loligo pealeii*, life history and habitat characteristics, Second Edition. NOAA Tech. Memo. NMFS-NE- 193, 42 p. http://www.nefsc.noaa.gov/nefsc/publications/tm/tm193/

James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005. Behaviour of leatherback sea turtles, Dermochelys coriacea, during the migratory cycle. Proc. R. Soc. B, 272: 1547-1555.

James, M.C., S.A. Sherrill-Mix, K. Martin, and R. A. Myers. 2006. Canadian waters provide critical foraging habitat for leatherback sea turtles. Biological Conservation 133: 347-357.

Jefferson, T.A., D. Fertl, J. Bolanos-Jimenez and A.N. Zerbini. 2009. Distribution of common dolphins (*Delphinus spp.*) in the western North Atlantic: a critical re-examination. Mar. Biol. 156:1109-1124.

Jennings, S., M.J. Kaiser, and J.D. Reynolds. 2001. Marine Fisheries Ecology. Blackwell Science, Oxford.

Jepson, M., L.L. Colburn. 2013. Development of Social Indicators of Fishing Community Vulnerability and Resiliance in the U.S. Southeast and Northeast Regions. Silver Spring (MD): Department of Commerce. NOAA Tech. Memo. NMFS-F/SPO-129. 64 pp.

Kahnle, A.W., K.A. Hattala, and K.A. McKown. 2007. Status of Atlantic sturgeon of the Hudson River Estuary, New York, USA. American Fisheries Society Symposium 56:347-363.

Kahnle, A.W., K.A. Hattala, K. McKown. 2007. Status of Atlantic sturgeon of the Hudson River estuary, New York, USA. In J. Munro, D. Hatin, K. McKown, J. Hightower, K. Sulak, A. Kahnle, and F. Caron (editors). Proceedings of the symposium on anadromous sturgeon: Status and trend, anthropogenic impact, and essential habitat. American Fisheries Society, Bethesda, Maryland.

Katona, S.K., V. Rough and D.T. Richardson, A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland, Smithsonian Institution Press: Washington, DC, 316 pp., 1993.

Kaufman, L. 2007. Stable isotopic signatures in catch composition in groundfishes indicate local processes at work in the WGOMCA. In Bayley, H, C. Cavanaugh, and P. Galardi, eds. Western Gulf of Maine Closure Area 2007 Symposium Report. University of New Hampshire.

Keats, D.W., G.R. Smith, and D.H. Steele. 1985. Reproduction and egg guarding by Atlantic wolffish (Anarchichas lupus: Anarhichidae) and ocean pout (Macrozoarces americanus: Zoarcidae) in Newfoundland waters. Can. J. Zool. 63: 2565 – 2568.

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginias sea turtles: 1979-1986. Virginia J. Sci. 38(4): 329-336.

Kenney, R.D., M.A.M. Hyman, R.E. Owen, G.P. Scott and H.E. Winn. 1986. Estimation of prey densities required by western North Atlantic right whales. Mar. Mamm. Sci. 2: 1–13.

Kenney, R.D., H.E. Winn and M.C. Macaulay 1995. Cetaceans in the Great South Channel, 1979-1989: right whale (*Eubalaena glacialis*). Cont. Shelf Res. 15: 385–414.

Kenney, R.D. 2002. North Atlantic, North Pacific and Southern Right Whales. pp. 806-813, In: W.F. Perrin, B. Würsig, and J.G.M. Thewissen (eds.). Encyclopedia of Marine Mammals. Academic Press, San Diego, CA.

Kenney, R.D. 2001. Anomalous 1992 spring and summer right whale (*Eubalaena glacialis*) distribution in the Gulf of Maine. Journal of Cetacean Research and Management (special Issue) 2: 209-23.

Khan, C., T.V.N. Cole, P. Duley, A. Glass, M. Niemeyer, and C. Christman. 2009. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2008 Results Summary. NEFSC Reference Document 09-05. 7 pp.

Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2010. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2009 Results Summary. NEFSC Reference Document 10-07. 7 pp.

Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2011. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2010 Results Summary. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-05. 6 pp.

Khan C., T. Cole, P. Duley, A. Glass, and J. Gatzke, J. Corkeron. 2012. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2011 Results Summary. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-09; 6 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

King, D. & J. G. Sutinen. 2010. Rational Compliance and the liquidation of Northeast groundfish resources. Marine Policy, 34(1), 7-21.

Kitts A, Bing-Sawyer E, McPherson M, Olson J, Walden J. 2011. Report for Fishing Year 2010 on the Performance of the Northeast Multispecies (Groundfish) Fishery (May 2010 - April 2011). December 2011. Woods Hole (MA): NOAA Fisheries Northeast Fisheries Science Center. 11-12. 44 p.

Kocik, J., Lipsky, C., Miller, T., Rago, P., & Shepherd, G. 2013. An Atlantic Sturgeon Population Index for ESA Management Analysis. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-06; 36 p. Available at: www.nefsc.noaa.gov/nefsc/publications/.

Kocik, J.F, and T.F. Sheehan. 2006. Atlantic Salmon. http://www.nefsc.noaa.gov/sos/spsyn/af/salmon/archives/41_AtlanticSalmon_2006.pdf

Kovach, Adrienne I, Timothy S. Breton, David L. Berlinsky, Lorraine Maceda, Isaac Wirgin. 2010. Fine-scale spatial and temporal genetic structure of Atlantic cod off the Atlantic coast of the USA. *Marine Ecology Progress Series* 410:177-195.

Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitat used by shortnose sturgeon in two Massachusetts rivers, with notes on estuarine Atlantic sturgeon: A hierarchical approach. Transactions of the American Fisheries Society 129: 487-503.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic sturgeon, Acipenser oxyrinchus oxyrinchus, and shortnose sturgeon, A. brevirostrum, with notes on social behavior. Environmental Behavior of Fishes 63: 137-150.

Lacroix, G.L., D. Knox and M.J.W. Stokesbury. 2005. Survival and behavior of post-smolt Atlantic salmon in coastal habitat with extreme tides. Journal of Fish Biology. 66(2): 485 – 498.

Laney, R.W., J.E. Hightower, B.R. Versak, M.F. Mangold, W.W. Cole Jr., and S.E. Winslow. 2007. Distribution, habitat use, and size of Atlantic sturgeon captured during cooperative winter tagging cruises, 1988-2006. In Anadromous sturgeons: habitats, threats, and management (J. Munro, D. Hatin, J.E. Hightower, K. McKown, K.J. Sulak, A.W. Kahnle, and F. Caron (eds.)), p. 167-182. Am. Fish. Soc. Symp. 56, Bethesda, MD.

Lazzari, M.A. and B.Z. Stone. 2006. Use of submerged aquatic vegetation as habitat by young-of-the-year epibenthic fishes in shallow Maine nearshore waters. Estuarine, Coastal and Shelf

Science 69:591-606.

Lindeboom, H.J., and S.J. de Groot. 1998. Impact II. The effects of different types of fisheries on the North Sea and Irish Sea benthic ecosystems. NIOZ Rapport 1998-1. 404 p.

Lindholm, J., P. J. Auster, et al. 2007. Site fidelity and movement of adult Atlantic cod Gadus morhua at deep boulder reefs in the western Gulf of Maine, USA. Marine Ecology Progress Series 342: 239-247.

Lock, M.C. and D.B. Packer. 2004. Essential Fish Habitat Source Document: Silver Hake, Merluccius bilinearis, Life History and Habitat Characteristics, Second Edition. NOAA Technical Memorandum NMFS-NE-186. http://www.nefsc.noaa.gov/nefsc/pulications/tm/tm186/tm186.pdf

Lough, R. G., P. C. Valentine, et al. 1989. Ecology and distribution of juvenile cod and haddock in relation to sediment type and bottom currents on eastern Georges Bank. Marine Ecology Progress Series 56(1-2): 1-12.

Mansfield, K.L., V.S. Saba, J. Keinath, and J.A. Musick. 2009. Satellite telemetry reveals a dichotomy in migration strategies among juvenile loggerhead sea turtles in the northwest Atlantic. Marine Biology 156:2555-2570.

Matulich, S., and Clark, M. 2001. Efficiency and Equity Choices in Fishery Rationalization Policy Design: An examination of the North Pacific and Sablefish IFQ policy impacts on processor. State of Alaska, Alaska Department of Fish and Game, Washington State University.

Mayo, C.A. and M.K. Marx. 1990. Surface foraging behaviour of the North Atlantic right whale, *Eubalaena glacialis*, and associated zooplankton characteristics. Can. J. Zool. 68: 2214–2220.

Mercer, S., G. E. Brown, S. Clearwater and Z. Yao. 1993. Observations of the copulatory behavior of the ocean pout, *Macrozoarces americanus*. Can. Field Nat. 107:243-244.

Methratta, E. T. and J. S. Link 2000. Seasonal variation in groundfish habitat associations in the Gulf of Maine-Georges Bank region. Marine Ecology Progress Series 326: 245-256.

Methratta, E. T. and J. S. Link 2007. Ontogenetic variation in habitat associations for four flatfish species in the Gulf of Maine-Georges Bank region. Journal of fish biology 70(6): 1669-1688.

Methven, D.A. and J.A. Brown. 1991. Time of hatching affects development, size, yolk volume and mortality of newly hatched *Macrozoarces americanus* (Pisces: *Zoarcidae*). Canadian Journal of Zoology 69(8): 2161 – 2167.

Miller, J.M., Burke, J.S., Fitzhugh, G.R., 1991. Early life history patterns of Atlantic North American flatfish: likely (and unlikely) factors controlling recruitment. Neth. J. Sea Res. 27, 261–275.

Mirarchi, F. 1998. Bottom trawling on soft substrates in E.M. Dorsey; J. Pederson, eds. Effects of fishing gear on the sea floor of New England. MIT Sea Grant Pub. 98-4.

Moore, E. 1947. Studies on the marine resources of southern New England. VI. The sand flounder, Lophopsetta aquosa (Mitchill): a general study of the species with special emphasis on age determination by means of scales and otoliths. Bull. Bingham Oceanogr. Collect. 11(3): 1 – 79.

Morgan, L.E. and R. Chuenpagdee. 2003. Shifting Gears: Addressing the collateral impacts of fishing methods in U.S. waters, Pew Science Series on Conservation and the Environment, Washington D.C., Island Press, 41 p.

Morreale, S.J. and E.A. Standora. 2005. Western North Atlantic waters: Crucial developmental habitat for Kemp's ridley and loggerhead sea turtles. Chel. Conserv. Biol. 4(4):872-882.

Morreale, S.J. 1999. Oceanic Migrations of Sea Turtles. A Dissertation Presented to the Faculty of the Graduate School of Cornell University. 152pp.

Morse, W.W., Able, K.W., 1995. Distribution and life history of windowpane, *Scophthalmus aquosos*, off the Northeastern United States. Fishery Bulletin 93, 674-693.

Morse, W.W., M.P. Fahay, and W.G. Smith. 1987. MARMAO surveys of the continental shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia (1977 – 1984). Atlas No. 2. Annual distribution patterns of fish larvae. NOAA Tech. Mem. NMFS-F/NEC-47. 215 pp.

Murawski, S.A., R. Brown, H.-L. Lai, P.J. Rago and L. Hendrickson. 2000. Large-scale closed areas as a fishery-management tool in temperate marine systems: the Georges Bank experience. Bull. Mar. Sci. 66: 775-798.

Murawski, S.A., Wigley, S.E., Fogarty, M.J., Rago, P.J., and Mountain, D.G. 2005. Effort distribution and catch patterns adjacent to temperate MPAs. ICES Journal of Marine Science, 62: 1150-1167.

Murphy, T., Kitts, A., Demarest, C., and Walden, J. 2015. 2013 Final Report on the Performance of the Northeast Multispecies (Groundfish) Fishery (May 2013 - April 2014). Woods Hole: NEFSC. NOAA Fisheries Northeast Fisheries Science Center. 15-01. 121 pp.

Murphy, T., Kitts, A., Records, D., Demarest, C., Caless, D., Walden, J., and Benjamin, S. 2014. 2012 Final Report on the Performance of the Northeast Multispecies (Groundfish) Fishery (May 2012 – April 2013). Woods Hole: NEFSC. NOAA Fisheries Northeast Fisheries Science Center. 14-01. 121 p.or online at http://www.nefsc.noaa.gov/nefsc/publications/.

Murphy, T., Kitts, A., Records, D., Demarest, C., McPherson, M., Walden, J., et al. 2012. 2011 Final Report on the Performance of the Northeast Multispecies (Groundfish) Fishery (May 2011 – April 2012). Woods Hole: NEFSC.

Murray, K.T. 2006. Estimated average annual bycatch of loggerhead sea turtles (Caretta caretta) in U.S. Mid-Atlantic bottom otter trawl gear, 1996-2004. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 06-19, 26pp.

Murray, K.T. 2009. Characteristics and magnitude of sea turtle bycatch in U.S. Mid-Atlantic gillnet gear. Endangered Species Research 8:211-224.

Murray, K.T. and Orphanides, C.D. 2013. Estimating the risk of loggerhead turtle *Caretta caretta* bycatch in the US mid-Atlantic using fishery-independent and -dependent data. Mar.Ecol. Prog. Ser. 477:259-270.

Musick, J.A., and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pages 137-164 in P.L. Lutz and J.A. Musick, eds. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1991. Recovery plan for U.S. population of Atlantic green turtle Chelonia mydas. Washington, D.C.: National Marine Fisheries Service. 58 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992a. Recovery plan for the Kemp's ridley sea turtle. National Marine Fisheries Service, Washington, D.C. 40 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992b. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1993. Recovery plan for the Hawksbill turtle (*Eretmochelys imbricate*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 58 pp

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2005. Recovery plan for the Gulf of Maine distinct population segment of the Atlantic salmon (*Salmo salar*). National Marine Fisheries Service, Silver Spring, MD.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007a. Loggerhead sea turtle (Caretta caretta) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 65 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007b. Leatherback sea turtle (Dermochelys coriacea) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 79 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007c. Kemp's ridley sea turtle (Lepidochelys kempii) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 50 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007d. Green sea turtle (Chelonia mydas) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 102 pp.

National Marine Fisheries Service, U.S. Fish and Wildlife Service, and SEMARNAT. 2009. National Recovery Plan for the Loggerhead sea turtle (*Caretta caretta*), Second Revision. National Marine Fisheries Service. Silver Spring, MD. 325pp.

National Marine Fisheries Service, U.S. Fish and Wildlife Service, and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, MD. 156 pp. + appendices

National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC). 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-455. 343 pp.

National Marine Fisheries Service (NMFS). 1991a. Final recovery plan for the humpback whale (Megaptera novaeangliae). Prepared by the Humpback Whale Recovery Team for the national Marine Fisheries Service, Silver Spring, Maryland. 105 pp.

National Marine Fisheries Service (NMFS). 2005. Revision- recovery plan for the North Atlantic right whale (*Eubalaena glacialis*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 137 pp.

National Marine Fisheries Service (NMFS). 2010a. Biological Assessment of Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Status Review Team for the National Marine Fisheries Service, Gloucester MA. 417pp.

National Marine Fisheries Service (NMFS). 2010b. Final recovery plan for the fin whale (*Balaenoptera physalus*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 121 pp.

National Marine Fisheries Service (NMFS). 2011. Final recovery plan for the sei whale (*Balaenoptera borealis*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 108 pp.

National Marine Fisheries Service (NMFS). 2012. North Atlantic Right Whale (*Eubalaena glacialis*) five year review: summary and evaluation. NOAA Fisheries Service, Northeast Regional Office, Gloucester, MA. 36pp.

National Marine Fisheries Service (NMFS). 2009a. Hawksbill Turtle (Eretmochelys imbricate). Available at http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm

National Marine Fisheries Service (NMFS). 2009b. Endangered Species Act Section 7 Consultation on the Atlantic Sea Scallop Fishery Management Plan. Biological Opinion. February 5, 2009.

National Marine Fisheries Service (NMFS). 2010. Interactive Fisheries Economic Impacts Tool. Available at: https://www.st.nmfs.noaa.gov/pls/apex32/f?p=160:7:3415449084930703.

National Marine Fisheries Service (NMFS). 2007. Guidelines for Assessment of the Social Impact of Fishery Management Actions. In: NMFS Council Operational Guidelines - Fishery Management Process. Silver Spring (MD): National Oceanic and Atmospheric Administration. 39 p.

National Marine Fisheries Service (NMFS). 2007b. Guidelines for the Economic Review of National Marine Fisheries Service Regulatory Actions. Washington (DC): NMF Service. 49 p.

National Marine Fisheries Service (NMFS). December 1, 2008. Final List of Fisheries for 2009. Federal Register Vol. 73, No. 231, p. 73032-73076.

National Marine Fisheries Service (NMFS). 2009. Fishing Communities of the United States, 2006. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-98, 84 p. Available at: http://www.st.nmfs.noaa.gov/st5/publication/index.html

National Marine Fisheries Service. (NMFS) 2010. Recovery plan for the fin whale (Balaenoptera physalus). National Marine Fisheries Service, Silver Spring, MD. 121 pp.

National Marine Fisheries Service (NMFS). 2013. Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries. Consultation No. F/NER/2012/0196.

National Marine Fisheries Service (NMFS) and Southeast Fisheries Science Center (SEFSC). 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. US Department of Commerce, National Marine Fisheries Service, Miami, Florida, SEFSC Contribution PRD-00/01-08: 46.

National Oceanic and Atmospheric Administration (NOAA). 2007a. Status of Fishery Resources off the Northeastern US Aggregate Resource and Landings Trends. Available at: http://www.nefsc.noaa.gov/sos/agtt/.

National Oceanic and Atmospheric Administration (NOAA). 2007b. An Assessment of the Leatherback Turtle Population in the Atlantic Ocean. A Report of the Turtle Expert Working Group. NOAA Tech Memo NMFS-SEFSC- 555, Miami, Fl. 116pp.

National Oceanic and Atmospheric Administration (NOAA). 2008. High numbers of right whales seen in Gulf of Maine: NOAA researchers identify wintering ground and potential breeding ground. NOAA press release. December 31, 2008.

National Oceanic and Atmospheric Administration (NOAA). 2009. Small Entity Compliance Guide. June 24, 2009.

National Research Council (NRC). 1990. Decline of sea turtles: causes and prevention. National Academy Press, Washington D.C. 259 pages.

National Research Council (NRC). 2002. Effects of Trawling and Dredging on Seafloor Habitat. National Academy Press. 126 p.

Neilson,J.D., J.F. Kearney, P.Perley, and H. Sampson. 1993. Reproductive biology of Atlantic halibut (Hippoglossus hippoglossus) in Canadian waters. Canadian Journal of Fisheries and Aquatic Sciences 50: 551 – 563.

Nelson, G.A., and M.R. Ross. 1992. Distribution, growth and food habits of the Atlantic wolffish (Anarhichas lupus) from the Gulf of Maine-Georges Bank region. Journal of Northwest Atlantic Fishery Science 13: 53 – 61.

Neuman, M.J., D.A. Witting, and K.W. Able. 2001. Relationships between otolith microstructure, otolith growth, somatic growth and ontogenetic transitions in two cohorts of windowpane. Journal of fish Biology 58: 967 – 984.

New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC). 1998. Monkfish Fishery Management Plan. Newburyport, MA. Available at: http://www.nefmc.org/monk/index.html.

New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC). 2003. Framework Adjustment 2 to the Monkfish Fishery Management Plan. 97 pp. with appendixes. Newburyport, MA. Available at:

http://www.nefmc.org/monk/index.html.

New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC). 2007. Northeast Region Standardized Bycatch Reporting Methodology. Available at: http://www.nefmc.org/issues/sbrm/index.html.

New England Fishery Management Council (NEFMC). 1985. The Northeast Multispecies Fishery Management Plan.

New England Fishery Management Council (NEFMC). 1994. Amendment 5 to the Northeast Multispecies Fishery Management Plan.

New England Fishery Management Council (NEFMC). 1996. Amendment 7 to the Northeast Multispecies Fishery Management Plan.

New England Fishery Management Council (NEFMC). 2000. Amendment 12 to the Northeast Multispecies Fishery Management Plan. http://www.nefmc.org/mesh/index.html

New England Fishery Management Council (NEFMC). 2003. Final Amendment 13 to the Northeast Multispecies Fishery Management Plan Including a Final Supplemental Environmental Impact Statement and an Initial Regulatory Flexibility Analysis. Newburyport, MA. Available at: http://www.nefmc.org/nemulti/index.html.

New England Fishery Management Council (NEFMC). 2007. Final Amendment 11 to the Atlantic Sea Scallop Fishery Management Plan with Environmental impact Statement, Regulatory Impact Review, and Regulatory Flexibility Analysis. Newburyport, MA. Approximately 550 pp. plus 4 appendices. Available at http://www.nefmc.org/scallops/index.html.

New England Fishery Management Council (NEFMC). 2009a. Draft Final Amendment 3 to the Fishery Management Plan (FMP) for the Northeast Skate Complex and Final Environmental Impact Statement (FEIS). Newburyport, MA. 459 pp. Available at: http://www.nefmc.org/skates/index.html.

New England Fishery Management Council (NEFMC). 2009b. Final Amendment 16 to the Northeast Multispecies Fishery Management Plan Including a Final Supplemental Environmental Impact Statement and an Initial Regulatory Flexibility Analysis. Newburyport, MA. Available at: http://www.nefmc.org/nemulti/index.html.

New England Fishery Management Council (NEFMC). 2010. Framework Adjustment 44 to the Northeast Multispecies Fishery Management Plan, Including an Environmental Assessment, Regulatory Impact Review, Initial Regulatory Flexibility Analysis. Newburyport, MA. 306 pp. Available at: http://www.nefmc.org/nemulti/index.html.

New England Fishery Management Council (NEFMC). 2011a. Framework Adjustment 46 to the Northeast Multispecies Fishery Management Plan, Including an Environmental Assessment, Regulatory Impact Review, Initial Regulatory Flexibility Analysis. Newburyport, MA. 299 pp. Available at: http://www.nefmc.org/nemulti/index.html.

New England Fishery Management Council (NEFMC). 2011b. Framework Adjustment 45 to the Northeast Multispecies Fishery Management Plan, Including an Environmental Assessment, Regulatory Impact Review, Initial Regulatory Flexibility Analysis. Newburyport, MA. 408 pp. Available at: http://www.nefmc.org/nemulti/index.html.

New England Fishery Management Council (NEFMC). 2013. Framework 24 to the Scallop Fishery Management Plan and Framework 49 to the Northeast Multispecies Fishery Management Plan. http://www.nefmc.org/scallops/index.html.

New England Fishery Management Council (NEFMC). 2014. Omnibus Essential Fish Habitat Amendment 2: Draft Environmental Impact Statement; Appendix E- Synopsis of Closed Area Technical Team analysis of juvenile groundfish habitats and groundfish spawning areas.

Northeast Data Poor Stocks Working Group (NDPSWG). 2009. The Northeast Data Poor Stocks Working Group Report, December 8-12, 2008 Meeting. Part A. Skate Species Complex, Deep Sea Red Crab, Atlantic Wolffish, Scup, and Black Sea Bass. US Dept. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 09-02; 496 p.

Northeast Fisheries Science Center (NEFSC). 2002a. Assessment of 20 Northeast Groundfish Stocks through 2001: a report of the Groundfish Assessment Review Meeting (GARM), Northeast Fisheries Science Center, Woods Hole, MA, October 8-11, 2001.

Northeast Fisheries Science Center (NEFSC). 2002b. Report of the 30th Northeast regional Stock Assessment Workshop (30th SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. Northeast Fisheries Science Center, Woods Hole, MA. NEFSC Reference Document 00-03.

Northeast Fisheries Science Center (NEFSC). 2002c. Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States, October 23-25, 2001, Boston, Massachusetts. Woods Hole (MA): US Department of Commerce. Northeast Fisheries Science Center Reference Document 02-01. 86 p.

Northeast Fisheries Science Center (NEFSC). 2005. Assessment of 19 Northeast Region Groundfish Stocks through 2004: Groundfish Assessment Review Meeting (2005 GARM; GARM II). NEFSC Reference Document 05-13.

Northeast Fisheries Science Center (NEFSC). 2007. 44th Northeast Regional Stock Assessment Workshop (44th SAW): Assessment Report. U.S. Dept. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 07-10; 661 pp. Available at: http://www.nefsc.noaa.gov/publications/crd/crd0710/crd0710.pdf.

Northeast Fisheries Science Center (NEFSC). 2007. 45th Northeast Regional Stock Assessment Workshop (45th SAW). 2007. 45th SAW assessment summary report. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 07-11; 37 pp. Available at: http://www.nefsc.noaa.gov/publications/crd/crd0711/crd0711.pdf.

Northeast Fisheries Science Center (NEFSC). 2008a. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep. Commer., NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 p.

Northeast Fisheries Science Center (NEFSC). 2008b. 47th Northeast Regional Stock Assessment Workshop (47th SAW). 2008. 47th SAW assessment summary report. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 08-11; 22 pp. Available at: http://www.nefsc.noaa.gov/publications/crd/crd0811/

Northeast Fisheries Science Center (NEFSC). 2010. 50th Northeast Regional Stock Assessment Workshop (50th SAW): Assessment Report. U.S. Dept. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 10-17; 844 pp. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1017/crd1017.pdf.

Northeast Fisheries Science Center (NEFSC). 2011a. 51st Northeast Regional Stock Assessment Workshop (51st SAW) Assessment Report. U.S. Dept. Commer, Northeast Fish. Sci. Cent. Ref. Doc. 11-02; 856 pp. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1102/1102.pdf.

Northeast Fisheries Science Center (NEFSC). 2011b. 52nd Northeast Regional Stock Assessment Workshop (52nd SAW): Assessment Report. U.S. Dept. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 11-17; 968 pp. Available at: http://www.nefsc.noaa.gov/saw/saw52/crd1117.pdf.

Northeast Fisheries Science Center (NEFSC). 2012a. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010. Northeast Fisheries Science Center Reference Document 12-06. Available at: http://nefsc.noaa.gov/publications/crd/crd1206/.

Northeast Fisheries Science Center (NEFSC). 2012b. 54th Northeast Regional Stock Assessment Workshop (54th SAW): Assessment Summary Report. U.S. Dept. Commer., Northeast Fish.

Sci. Cent. Ref. Doc. 12-14; 45 pp. Available at: http://www.nefsc.noaa.gov/saw/saw52/crd1214.pdf

Northeast Fisheries Science Center (NEFSC). Social Sciences Branch. 2012. Woods Hole (MA): NMFS Northeast Fisheries Science Center; Available from: http://www.nefsc.noaa.gov/read/socialsci/index.html.

Northeast Fisheries Science Center (NEFSC). 2013a. 55th Northeast Regional Stock Assessment Workshop (55th SAW): Assessment Report. U.S. Dept. Commer., Northeast Fish. Sci. Cent. Ref Doc. Available at: http://www.nefsc.noaa.gov/saw/reports.html.

Northeast Fisheries Science Center (NEFSC). 2013b. 56th Northeast Regional Stock Assessment Workshop (56th SAW) Assessment Summary Report. Woods Hole (MA): U.S. Department of Commerce. Northeast Fisheries Science Center Ref. Doc. 13-04. 42 p.

Northeast Fisheries Science Center (NEFSC). 2013c. 57th Northeast Regional Stock Assessment Workshop (57th SAW): Assessment Report. U.S. Dept. Commer. Northeast Fish. Sci. Cent. Ref. Doc. 13-16; 967

Northeast Region Essential Fish Habitat Steering Committee (NREFHSC). 2002. Workshop on the Effects of Fishing Gear on Marine Habitats Off the Northeastern United States, October 23-25, 2001, Boston, Massachusetts. Northeast Fish Sci Cent Ref Doc 02-01; 86.

O'Brien, L. J. Burnett, and R.K. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985 – 1990. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

O'Leary, S.J., K. J. Dunton, T. L. King, M. G. Frisk, and D.D. Chapman. 2014. Genetic diversity and effective size of Atlantic sturgeon, *Acipenser oxyrhinchus oxyrhinchus,* river spawning populations estimated from the microsatellite genotypes of marine-captured juveniles. Conserv Genet: DOI 10.1007/s10592-014-0609-9; ISSN 1566-0621.

Olsen, Y.H., and D. Merriman. 1946. Studies on the marine resource of Southern New England. IV. The biology and economic importance of the ocean pout, Macrozoarces americanus (Bloch and Schneider). Bull. Bing. Oceanogr. Collect. 9(4): 1 – 184.

Olson J, Clay PM. 2001. An Overview of the Social and Economic Survey Administered during Round II of the Northeast Multispecies Fishery Disaster Assistance Program." Reference: US Dep. Commer., NOAA Tech. Memo. NMFS NE 164; 69 p.

Orach-Meza, F.L. 1975. Distribution and abundance of Ocean Pout, Macrozoarces americanus (Bloch and Schneider) 1801 in the western North Atlantic Ocean. MS thesis. University of Rhode Island.

Overholtz, W.J. and A.V. Tyler. 1985. Long-term responses of the demersal fish assemblages of Georges Bank. U.S. Fisheries Bulletin 83(4):507-520.

Palmer, M.C., and Wigley, S.E. 2009. Using Positional Data from Vessel Monitoring Systems to Validate the Logbook-Reported Area Fished and the Stock Allocation of Commercial Fisheries Landings. North American Journal of Fisheries Management, 29: 928-942.

Palmer M. C. 2014. 2014 Assessment update report of the Gulf of Maine Atlantic cod stock. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-14; p. 84 Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/. Accessed on December 18th, 2014.

Pavlov, D.A. and E. Moksness. 1994. Production and quality of eggs obtained from wolffish (Anarhichas lupus) reared in captivity. Aquaculture 122(4): 295 – 312.

Pavlov, D.A. and G.G. Novikov. 1993. Life history and peculiarities of common wolffish (Anarhichas lupus) in the White Sea. ICES Journal of Marine Science 50(3): 271 – 277.

Payne, P.M. and D.W. Heinemann. 1993. The distribution of pilot whales (*Globicephala sp.*) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Rep. Int. Whal. Comm. (Special Issue) 14: 51- 68.

Payne, P.M., L. A. Selzer, and A. R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Marine Fisheries Service-NEFSC, Woods Hole, MA. 294pp.

Payne, P.M., J.R. Nicholas, L. O'Brien and K.D. Powers 1986. The distribution of the humpback whale, *Megaptera novaeangliae*, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, *Ammodytes americanus*. Fish. Bull. 84: 271-277.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham and J.W. Jossi 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fish. Bull. 88: 687-696.

Pereira, J.J., R. Goldberg, J.J. Ziskowski, P.L. Berrien, W.W. Morse and D.L. Johnson. 1999. Essential Fish Habitat Source Document: Winter flounder, Pseudopleuronectes americanus, life history and habitat characteristics. NOAA Tech. Mem. NMFS-NE-138. National Marine Fisheries Service, Woods Hole, MA.

Pereira, J., E.T. Schultz, and P.J. Auster. 2012. Site dependence or density dependence: using geospatial analysis to test models of habitat use and inform conservation and management. I. Yellowtail flounder (Limanda ferruginea) on Georges Bank. Mar. Eco. Prog. Ser. (In press).

Perrin, W.F., B. Wursig, and J.G.M. Thewissen (eds.). 2002. Encyclopedia of Marine Mammals. Academic Press, San Diego, CA.

Perry, S.L., D.P. DeMaster, and G.K. Silber. 1999. The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. Mar. Fish. Rev. Special Edition. 61(1): 59-74.

Pinkerton, E., and Edwards, D.N. 2009. The elephant in the room: the hidden costs of leasing individual transferable fishing quotas. Marine Policy, 33, 707-713.

Pratt, S. 1973. Benthic fauna. Pp. 5-1 to 5-70 in: Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. University of Rhode Island, Marine Publication Series No. 2. Kingston, RI.

Reddin, D.G. 1985. Atlantic salmon (*Salmo salar*) on and east of the Grand Bank. J. Northwest Atl. Fish. Soc. 6(2):157-164.

Reddin, D.G and P.B. Short. 1991. Postsmolt Atlantic salmon (*Salmo salar*) in the Labrador Sea. Can. J. Fish Aquat. Sci. 48:2-6.

Reddin, D.G and K.D. Friedland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. 4th Int. Atlantic Salmon Symposium. St. Andrews, N.B. Canada.

Richards, R. A., Nitschke, P. C., and Sosebee, K. A. 2008. Population biology of monkfish Lophius americanus. ICES Journal of Marine Science, 65: 1291 - 1305.

Roper, C.F.E., M.J. Sweeney, and C.E. Nauen. 1984. Cephalopods of the World. An annotated and illustrated catalogue of species of interest to fisheries. FAO Fisheries Synopsis. 125, 227 pp.

Sainsbury, J. C. 1996. Commercial fishing methods: an introduction to vessels and gears, Fishing News Books, Third Edition.

Savoy, T., and D. Pacileo. 2003. Movements and important habitats of subadult Atlantic sturgeon in Connecticut waters. Transactions of the American Fisheries Society. 132: 1-8.

Schevill, W.E., W.A. Watkins, and K.E. Moore. 1986. Status of *Eubalaena glacialis* off Cape Cod. Report of the International Whaling Commission, Special Issue 10: 79-82.

Schilling, M. R., I. Seipt, M. T. Weinrich, S. E. Frohock, A. E. Kuhlberg, and P. J. Clapham. 1992. Behavior of individually-identified sei whales *Balaenoptera borealis* during an episodic influx into the southern Gulf of Maine in 1986. Fishery Bulletin 90:749–755.

Schueller, P. and D. L. Peterson. 2006. Population status and spawning movements of Atlantic

sturgeon in the Altamaha River, Georgia. Presentation to the 14th American Fisheries Society Southern Division Meeting, San Antonio, February 8-12th, 2006. Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 966 pp.

Scott, J.S. 1982. Depth, temperature and salinity preferences of common fishes of the Scotian Shelf. J. Northwest Atl. Fish. Sci. 3: 29-39.

Scott, W.B. and M.G. Scott. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219, 731 pp.

Sears, R. 2002. Blue whale, Balaenoptera nusculus. Pages 112-116 in W.F. Perrin, B. Wursig, and J.G.M. Thewissen, eds. Encyclopedia of Marine Mammals. San Diego: Academic Press.

Sheehan, T.F., D.G. Reddin, G. Chaput and M.D. Renkawitz. 2012. SALSEA North America: A pelagic ecosystem survey targeting Atlantic salmon in the Northwest Atlantic. ICES Journal of Marine Science, doi:10.1093/icesjms/fss052.

Sherman, K., N.A. Jaworski, T.J. Smayda, eds. 1996. The northeast shelf ecosystem – assessment, sustainability, and management. Blackwell Science, Cambridge, MA. 564 p.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Sigourney, D.B., M.R. Ross, J. Brodziak, and J. Burnett. 2006. Length at age, sexual maturity and distribution of Atlantic halibut, Hippoglossus hippoglossus L., off the Northeast USA. NW Atl Fish Sci 36: 81 – 90.

Steimle, F.W. and C. Zetlin. 2000. Reef habitats in the middle Atlantic bight: abundance, distribution, associated biological communities, and fishery resource use. Mar. Fish. Rev. 62: 24-42.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004a. Atlantic sturgeon marine bycatch and mortality on the continental shelf of the Northeast United States. North American Journal of Fisheries Management 24: 171-183.

Stein, A.B., K. D. Friedland, and M. Sutherland. 2004b. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. Transaction of the American Fisheries Society 133:527-537.

Steinback S, Brinson A. 2013. The Economics of the Recreational For-hire Fishing Industry in the Northeast United States. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-03; 49 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/

Stevenson, D., L. Chiarella, D. Stephan, R. Reid, K. Wilhelm, J. McCarthy, and M. Pentony. 2004. Characterization of the fishing practices and marine benthic ecosystems of the northeast U.S. shelf, and an evaluation of the potential effects of fishing on essential fish habitat. NOAA Tech. Memo. NMFS-NE-181. 179 p.

Sullivan, M. C., R. K. Cowen, et al. 2006. Applying the basin model: Assessing habitat suitability of young-of-the-year demersal fishes on the New York Bight continental shelf. Continental Shelf Research 26(14): 1551-1570.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan, and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9: 309-315.

Taning, A. V. 1936. On the eggs and young stages of the halibut. Medd. Fra Kom. For Havundersokelser, Serie Fiskeri, Vol IO 4: 1 – 23.

Templeman, W. 1986. Some biological aspects of Atlantic wolffish (Anarhichas lupus) in the Northwest Atlantic. Journal of Northwest Atlantic Fishery Science. 7(7): 57 – 65.

Theroux, R.B. and M.D. Grosslein. 1987. Benthic fauna. Pp. 283-195 in: R.H. Backus (ed.), Georges Bank. MIT Press, Cambridge, MA.

Theroux, R.B. and R.L. Wigley. 1998. Quantitative composition and distribution of the macrobenthic invertebrate fauna of the continental shelf ecosystems of the northeastern United States. NOAA Technical Report NMFS 140. U.S. Dept. of Commerce, Seattle, WA.

Thunberg, E.M. 2007. Demographic and economic trends in the Northeastern United States lobster (Homarus americanus) fishery, 1970–2005. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 07-17; 64 p.

Thunberg, E.M. 2008. Trends in Selected Northeast Region Marine Industries. NOAA Technical Memorandum NMFS NE 211; 107 p.

Timoshkin, V. P. 1968. Atlantic sturgeon (*Acipenser sturio* L.) caught at sea. Prob. Ichthyol. 8(4):598.

Transboundary Resources Assessment Committee (TRAC). 2011. Proceedings of the Transboundary Resources Assessment Committee for Eastern Georges Bank Cod and Haddock, and Georges Bank Yellowtail Flounder: Report of Meeting held 21-24 June 2011. Available at: http://www2.mar.dfo-mpo.gc.ca/science/trac/proceedings/TRAC_pro_2011_01.pdf.

Tuler S, Agyeman J, Pinto da Silva P, LoRusso KR, Kay R. 2008. Assessing vulnerabilities: Integrating information about driving forces that affect risks and resilience in fishing communities. Human Ecology Review. 15(2): 171-184.

Turtle Expert Working Group (TEWG). 1998. An assessment of the Kemp's ridley (Lepidochelys kempii) and loggerhead (Caretta caretta) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409:1-96.

Turtle Expert Working Group (TEWG). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444:1-115.

Turtle Expert Working Group (TEWG). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555, 116 pp.

Turtle Expert Working Group (TEWG). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575:1-131.

Tyler, A.V. 1971. Periodic and resident components in communities of Atlantic fishes. J. Fish. Res. Board Can. 28: 935-946.

U.S. Atlantic Salmon Assessment Committee (USASAC). Annual reports 2001 through 2012. Annual Report of the U.S. Atlantic Salmon Assessment Committee.

Uzmann, J.R., R.A. Cooper and K.J. Pecci. 1977. Migration and dispersion of tagged American lobsters, Homarus americanus, on the southern New England continental shelf. NOAA Tech. Rep. NMFS-SSRF 705, p. 1 – 91.

Valentine, P.C. and R.G. Lough. 1991. The sea floor environment and the fishery of eastern Georges bank. Dept. of Interior, U.S. Geological Survey, Open File Report 91-439.

Vanclay, F. (2002). Conceptualizing social impacts. Environmental Impact Assessment Review, 22(3), 183-211.

VMS/Enforcement meeting Sheraton Harborside Portsmouth, NH. 2011. (October 20). Retrieved December 8, 2012, from New England Fishery Management Council: http://www.nefmc.org/issues/enforce/meetsum/enforcement_oct11.pdf

Vu, E., D. Risch, C. Clark, S. Gaylord, L. Hatch, M. Thompson, D. Wiley, and S. Van Parijs.2012. Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aq. Biol.14(2):175–183.

Waldman, J. R., J. T. Hart, and I. I. Wirgin. 1996. Stock composition of the New York Bight Atlantic sturgeon fishery based on analysis of mitochondrial DNA. Transactions of the American Fisheries Society 125: 364-371.
Warden, M.L. 2011. Modeling loggerhead sea turtle (*Caretta caretta*) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. Biological Conservation 144: 2202–2212.
Waring G.T.,E. Josephson, C.P. Fairfield-Walsh , K. Maze-Foley K, editors. 2007. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2007. NOAA Tech Memo NMFS-NE- 205. 415 pp.
Waring, G.T., E. Josephson, K. Maze-Foley, Rosel, P.E. (eds). 2010. US Atlantic and Gulf of Mexico marine mammal stock assessments -- 2010. NOAA Tech Memo NMFS NE 219; 598 pp.
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2014. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2013. NOAA Tech Memo NMFS- NE-228. 475 pp.
Waring, G.T., J. M. Quintal and C. P. Fairfield. 2002. U. S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2002. NOAA Tech. Memo. NMFS-NE-169, 318 pp.
Watkins, W.A., and W.E. Schevill. 1982. Observations of right whales (*Eubalaena glacialis*) in Cape Cod waters. Fish. Bull. 80(4):875-880.
Watling, L. 1998. Benthic fauna of soft substrates in the Gulf of Maine. Pp. 20-29 in: Effects of fishing gear on the sea floor of New England, E.M. Dorsey and J. Pederson (eds.). MIT Sea Grant Pub. 98-4.
Whitehead, H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. Mar. Ecol. Prog. Ser. 242: 295-304.
Wiley, D.N., R.A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortality of humpback whales, Megaptera novaeangliae, in the Mid-Atlantic and southeast United States, 1985-1992. Fishery Bulletin 93(1):196-205.
Williamson, J. 1998. Gillnet fishing in E.M. Dorsey, J. Pederson, eds. Effects of fishing gear on the sea floor of New England. MIT Sea Grant Pub. 98-4:87-89.
Winn, H.E., C.A. Price, and P.W. Sorensen. 1986. The distributional biology of the right whale (*Eubalaena glacialis*) in the western North Atlantic. Reports of the International Whaling Commission (Special issue). 10: 129-138.
Wirgin, I., L. Maceda, J.R. Waldman, S. Wehrell, M. Dadswell, and T. King. 2012. Stock origin of migratory Atlantic sturgeon in the Minas Basin, Inner Bay of Fundy, Canada, determined by microsatellite and mitochondrial DNA analyses.
Wolff, T. 1978. Maximum size of lobsters (Homarus) (Decapoda, Nephropidae). Crustaceana 1 – 14.
Yao, Z. and L.W. Crim. 1995. Copulation, spawning and parental care in captive ocean pout. Journal of Fish Biology 47: 171 – 173.
Zemeckis, D., Dean, M., Cadrin, S. 2014a. Spawning dynamics and associated management implications for Atlantic cod (Gadus morhua). *North American Journal of Fisheries Management*. 34:424-442.
Zemeckis, D., Hoffman, W., Dean, M., Armstrong, M. 2014b. Spawning site fidelity by Atlantic cod (Gadus morhua) in the Gulf of Maine: implications for population structure and rebuilding. *ICES Journal of Marine Science*. 71: 1356-1365.

9.3 Index

Accountability Measure
AM, 3, 20, 24, 25, 65, 66, 67, 105, 188, 220, 241, 271, 286, 296, 299, 322
Annual Catch Entitlement (ACE), 3, 5, 6, 7, 20, 26, 28, 61, 62, 63, 188, 214, 215, 217, 222, 232, 233, 234, 235, 238, 240, 241, 255, 256, 263, 268, 270, 271, 281, 286, 287, 305, 307, 309, 315, 317, 318, 347, 356, 365
Annual Catch Limit
ACL, 3, 4, 5, 6, 20, 24, 25, 27, 28, 32, 33, 34, 35, 37, 38, 39, 48, 61, 62, 63, 64, 65, 66, 67, 103, 182, 188, 189, 199, 204, 207, 211, 212, 214, 215, 216, 217, 218, 220, 222, 224, 226, 229, 232, 233, 235, 236, 238, 240, 241, 243, 244, 245, 246, 247, 248, 249, 250, 258, 259, 260, 262, 265, 266, 267, 271, 273, 274, 275, 276, 277, 281, 282, 283, 285, 286, 287, 293, 297, 307, 322, 365
Atlantic wolffish, 34, 39, 90, 97, 303, 381
Biological Impacts, 5, 7, 186, 194, 204, 205, 308
Bycatch, 102, 107, 311, 316, 358, 359, 380
Closed Area Technical Team, 42, 201, 203
Cod
GB, 4, 31, 35, 40, 68, 69, 90, 91, 217, 218, 224, 257, 260, 277, 292
GOM, 3, 4, 5, 6, 26, 28, 30, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 51, 54, 55, 68, 71, 72, 90, 181, 189, 190, 191, 192, 194, 195, 196, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 216, 217, 218, 219, 220, 221, 224, 226, 228, 229, 230, 231, 234, 235, 236, 239, 240, 241, 242, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 263, 264, 265, 266, 267, 268, 269, 270, 273, 274, 275, 276, 277, 279, 280, 281, 282, 283, 284, 285, 305, 311, 317, 318, 321, 335
Cumulative Effects, 5, 234, 288, 289, 290, 302, 303, 307, 308, 319
Days-at-sea (DAS), 20, 27, 40, 84, 102, 103, 187, 188, 224, 292, 293, 299, 313, 315, 320, 330, 331, 347, 350, 351, 358, 359
Category A, 359
Category B, 27, 102, 224, 331, 359
Category C, 359
Economic impacts, 5, 6, 234, 257, 258, 259, 260, 262, 263, 265, 266, 267, 268, 269, 270, 271, 281, 288, 299, 301, 309, 320, 321, 322, 333, 344, 353
Essential Fish Habitat, 5, 7, 20, 22, 73, 79, 80, 82, 83, 84, 85, 86, 88, 89, 101, 105, 186, 216, 217, 218, 219, 220, 221, 222, 290, 295, 296, 298, 306, 307, 309, 315, 317, 318, 320, 329, 333, 356, 360, 364, 367, 368, 371, 373, 376, 382, 383, 384
Exclusive Economic Zone, 20, 24, 150, 288, 317, 360
Greater Atlantic Regional Fisheries Office, 21, 238, 325
Groundfish Assessment Review Meeting
GARM, 89, 91, 101, 187, 381
Gulf of Maine Cod Protection Closures, 5, 51, 55, 206, 209
Habitat impacts, 5, 7, 88, 216, 217, 219, 220, 301, 304, 317, 318
Habitat Impacts, 317
Haddock
GB, 4, 27, 31, 35, 91, 217, 218, 224, 238, 257, 258, 259, 262, 275, 276, 291
GOM, 4, 30, 35, 91, 189, 192, 194, 197, 216, 217, 218, 224, 257, 258, 260, 273, 274, 275, 276, 311
Halibut, 34, 39, 80, 97, 100, 243, 244, 245, 246, 247, 248, 249, 250, 303
Incidental Catch TACs, 26, 35, 40, 224, 296
Magnuson-Stevens Fishery Conservation and Management Act, 3, 4, 6, 7, 21, 24, 27, 29, 30, 31, 36, 61, 64, 187, 224, 234, 299, 307, 311, 313, 319, 320, 323, 329, 332, 333
Marine mammals, 126, 127, 129, 133, 136, 142, 224, 227, 228, 231, 288, 320, 327

Ocean pout, 96, 371
Overfishing Level
OFL, 22, 32, 33, 34, 37, 38, 39, 61, 188, 286, 306
Plaice, American, 26, 28, 33, 38, 40, 76, 77, 81, 89, 91, 92, 99, 100, 198, 206, 208, 210, 239, 243, 244, 245, 246, 247, 248, 249, 250, 259, 303, 363, 365
Pollock, 29, 30, 31, 34, 39, 80, 89, 94, 100, 189, 190, 195, 198, 217, 218, 223, 243, 244, 245, 246, 247, 248, 249, 250, 259, 303
Potential Sector Contribution (PSC), 22, 241, 347, 356, 365
Protected species, 126
Redfish, 33, 38, 89, 94, 100, 189, 194, 195, 243, 244, 245, 246, 247, 248, 249, 250, 303
Social Impact Analysis, 22, 374
Social impacts, 6, 8, 272, 276
Special Access Program, 22, 27
Closed Area I Hook Gear Haddock SAP, 40
Status Determination Criteria, 6, 29, 30, 187, 216, 217, 223, 257, 273, 316
White hake, 81, 95
Windowpane flounder, 3, 24, 28, 64, 65, 66, 67, 68, 76, 77, 78, 82, 89, 95, 96, 199, 206, 208, 210, 238, 241, 297, 298, 299, 308, 309, 322, 363, 365
Winter flounder
GB, 30, 31, 35, 93, 188, 193, 194, 195, 197, 216, 217, 218, 223, 224, 239, 241, 257, 259, 273, 274, 276, 277, 311
GOM, 4, 30, 31, 35, 92, 93, 188, 194, 216, 217, 218, 223, 224, 257, 258, 273, 274, 276, 311
SNE/MA, 27, 40, 89, 95, 296
Witch flounder, 81, 92
Wolffish, Atlantic, 34, 39, 97, 190, 303, 381
Yellowtail flounder
CC/GOM, 40
GB, 4, 30, 31, 35, 40, 93, 187, 188, 194, 199, 216, 217, 218, 223, 224, 257, 258, 259, 260, 262, 273, 274, 275, 276, 277, 294, 296, 311
SNE/MA, 93, 100

Framework Adjustment 53

To the

Northeast Multispecies FMP

Appendix I: SSC Recommendations for

Northeast Multispecies ABCs, FY 2015-FY 2017

#2

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
Ernest F. Stockwell III, *Chairman* | Thomas A. Nies, *Executive Director*

To: Tom Nies, Executive Director
From: Scientific and Statistical Committee
Date: August 29, 2014

Subject: Overfishing levels (OFLs) and acceptable biological catch (ABC) recommendations for Gulf of Maine haddock and Georges Bank yellowtail flounder

The SSC met on August 25, 2014 in Boston, Massachusetts, to address the following terms of reference (TORs):

Gulf of Maine haddock
Review the SAW/SARC 59 assessment and the work of the Groundfish Plan Development Team (PDT) and provide the OFL and ABC for each year for fishing years 2015-2017 that will prevent overfishing and is consistent with the default control rule.

To meet this TOR, the SSC considered the following documents:

1.1. Memo from PDT to SSC re GOM haddock ABCs (August 14, 2014)
1.2. SARC 59 Assessment Summary for GOM haddock (August 2014) Prepublication Copy
1.3. 59th Northeast Regional Stock Assessment Workshop (59th SAW) Assessment Report
1.4. SAW SARC 59 Panelist Reports

Georges Bank yellowtail flounder
Provide the OFL and an ABC for each year for fishing years 2015 and 2016 that will meet management objectives and prevent overfishing.

To meet this TOR, the SSC considered the following documents:

2.1. Memo from PDT to SSC re GB yellowtail flounder ABCs (August 14, 2014)
2.2. Transboundary Resources Assessment Committee (TRAC) Status Report (June 2014)
2.3. DRAFT TRAC Stock Assessment Report for 2014(June 2014)
2.4. Summary of the Diagnostic Benchmark for GB Yellowtail Flounder (April 2014)
2.5. 2014-2015 SSC ABC and OFL recommendations for GB Yellowtail flounder (September 3, 2013 Memo from SSC to Tom Nies)

Gulf of Maine haddock

The SSC recommends the OFL and ABC values based upon the Final Model as provided in Table 1 and Table 2 of the PDT report. These values are:

Year	OFL	ABC
2015	1,871mt	1,454mt
2016	2,270mt	1,772mt
2017	2,707mt	2,125mt

An important source of uncertainty in the assessment is the estimated size of recent strong recruitment events in 2010 and 2012. Overestimation of those cohorts can lead to overestimation of spawning stock biomass in both the assessment and projections, resulting in catch advice that is too high. The 2010 cohort has been sampled over several years, and there is greater confidence in its estimation. In contrast, the estimated size of the 2012 year class is based on only two surveys, creating less confidence in its estimation. This led the Groundfish PDT to recommend OFL and ABC values based on the "sensitivity run" from the assessment that constrained the estimated size of the 2012 year class.

Although the SSC sees the rationale for the PDT recommendation, we felt that the Final Model is a sufficient basis for catch advice for several reasons. First, the SAW/SARC endorsed the Final Model as the best available science. Second, the status of the stock is strong and extra precaution is unwarranted. Third, an operational assessment is forthcoming in 2015, which means we are unlikely to rely on longer term projections for 2016 and 2017. The PDT's consequence analysis suggests that if the Final Model is overly optimistic and the sensitivity run is closer to the state of nature, the probability of overfishing in 2015 would reach the risk-neutral level of 50% that contemporary management strives to stay below.

Exchange of haddock between the larger Georges Bank stock and the Gulf of Maine stock remains a topic of discussion. The SSC reiterates our earlier conclusion, which corroborates that of the PDT, that data are insufficient to estimate mixing rates, and therefore to incorporate mixing into the assessment and catch advice. Furthermore, the SAW identified the "sabbatical" model, which allows for non-permanent movement between the two stock areas, as the most biologically plausible. The outcomes of catch projections using the sabbatical model do not differ greatly from projections assuming no mixing. It should be noted, however, that the SARC did not address the plausibility of different mixing scenarios, and therefore neither supported nor refuted the SAW's conclusion about the sabbatical model. The SSC endorsed the SARC conclusion that additional empirical research is needed to resolve mixing rates.

Summary of recommendations

1. **OFL and ABC for 2015, 2016 and 2017 are based on the Final Model from SAW/SARC59 as reported in Tables 1 and 2 of the PDT report, and listed above.**
2. **Catch advice for 2016 and 2017 should be updated based upon the operational assessment planned for 2015, especially in light of the uncertainties associated with the size of large 2012 cohort.**
3. **Data remain insufficient to confidently estimate mixing rates for assessment and management purposes, and additional empirical research is needed to resolve this uncertainty.**

Georges Bank yellowtail flounder

The SSC recommends an ABC for 2015 of 354mt based on an exploitation rate of 16% applied to the most recent estimate of average survey-based biomass. For the time being, the SSC recommends an ABC for 2016 of 354mt, assuming in the absence of additional information that biomass will not change. However, the SSC expects that the 2016 ABC will be revisited and revised in 2015 based on a new TRAC assessment. OFL remains unknown for this stock.

These ABC values represent a modest reduction from the current ABC of 400mt, and the target exploitation rate represents a reduction from the fishing mortality limit, F_{ref}. Such reductions are appropriate for a stock estimated to be at low biomass and trending downward. Despite the estimated stock condition and trend, the SSC is not recommending a greater reduction because the fishery does not seem to be the main factor influencing the stock and in light of the expected impacts of a drastic reduction on the industry.

In offering this ABC advice, the SSC highlights the variability and uncertainty in survey estimates. Future ABCs based on this approach could vary considerably if survey indices change substantially. This leads the SSC to recommend that time and resources be dedicated to a more thorough analysis and discussion of other survey-based control rules (e.g., those based on moving averages rather than point estimates), relative to the ad hoc approach adopted herein, in advance of the 2015 TRAC and application of its outcomes.

Finally, the SSC wishes to thank and commend NEFSC and the TRAC for such a thorough response to our recommendation that empirical approaches be considered and adopted.

Summary of recommendations

1. **ABC for 2015 is 354mt, based on an exploitation rate of 16% applied to the most recent estimate of average survey-based biomass.**
2. **ABC for 2016 should be revisited based on the outcomes of the expected 2015 TRAC. If new information is not available in 2015, ABC for 2016 remains 354mt assuming no change from the most recent estimate.**
3. **More thorough analysis and discussion of survey-based control rules for the stock should take place before applications of the 2015 TRAC outcomes.**

#5

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
Ernest F. Stockwell III, *Chairman* | Thomas A. Nies, *Executive Director*

To: Tom Nies, Executive Director
From: Scientific and Statistical Committee
Date: September 24, 2014

Subject: Overfishing levels (OFLs) and acceptable biological catch (ABC) recommendations for Gulf of Maine cod

The SSC met on September 15, 2014 in Boston, Massachusetts, to address the following term of reference (TOR):

Review the 2014 assessment update for Gulf of Maine (GOM) cod and the work of the Groundfish Plan Development Team (PDT) and provide the OFL and ABC for each year for fishing years 2015-2017 that will prevent overfishing, provide for rebuilding and is consistent with the default control rule.

To meet this TOR, the SSC considered the following documents:

1. Memo from Groundfish PDT to SSC re Gulf of Maine cod ABCs, dated September 11, 2014
2. Gulf of Maine Atlantic Cod 2014 Assessment Update, Draft Working Paper, (NEFSC) – dated September 3, 2014
3. Gulf of Maine Cod 2014 Assessment Update Peer Review Report, August 28-29, 2014 (NEFSC) – dated September 5, 2014
4. SAW 55 Stock Assessment Report (NEFSC), CRD 1311, dated June 2013
5. SAW 55 Assessment Summary Report (NEFSC), CRD 1301, dated January 2013
6. Memo from Groundfish PDT to SSC re FY 2013-2015 ABCs, dated January 13, 2013
7. SSC Memo to Executive Director Paul Howard re Georges Bank cod, Gulf of Maine cod and Southern New England/Mid-Atlantic winter flounder ABCs for FY2013-2015, dated January 29, 2013
8. Presentation: Gulf of Maine Atlantic Cod 2014 Assessment Update – Mike Palmer (NEFSC) – dated September 15, 2014
9. Presentation: Groundfish Plan Development Team Report: Gulf of Maine Cod ABCs and OFLs for FY 2015- FY 2017– Jamie Cournane (NEFMC) and Paul Nitschke (NEFSC) – dated September 15, 2014

The 2014 operational assessment of GOM cod used the two formulations of the ASAP model approved during SAW/SARC 55: one in which M=0.2 throughout the time series, and a second in which M increases linearly from 0.2 to 0.4 ("M-ramp"). The PDT developed three sets of catch alternatives using the outcomes of each formulation as a starting point. For the M-ramp model, two scenarios were considered: one in which M remains at 0.4 and another in which M declines back to 0.2.

Because all three scenarios are plausible and the resulting OFL values are comparable, the SSC recommends an OFL for 2015 that is the average of the three: 514mt. However, based on recent experiences, the SSC is concerned with the uncertainties inherent in projections of GOM cod and other stocks, and does not recommend changing the OFL for 2016 and 2017 based on projections. Therefore, OFL should remain at 514mt for 2016 and 2017 in the absence of new information warranting a change.

The PDT developed ABC alternatives based on estimates of $F_{rebuild}$ given that the stock is overfished, and projections suggest that catches at 75% F_{MSY} will not achieve rebuilding targets (i.e., $F_{rebuild}$ is less than 75% F_{MSY}). Among the alternatives presented, the PDT included a constant catch ABC alternative of 200mt, which is intermediate between the values developed for the scenario in which M remains 0.2 (180mt) and the scenario in which M ramps up to 0.4 but then returns to 0.2 (207mt), and follows a similar logic as that used by the SSC in developing the OFL recommendation. The SSC provisionally recommends an ABC for 2015 of 200mt. ABCs for 2016 and 2017 would remain at 200mt in the absence of additional information warranting a change due to the concerns about projections raised above.

The SSC offers 200mt as a provisional ABC because an important difference in proposing OFL and ABC values based on average or intermediate values among the scenarios considered is that the ABC alternative of 200mt does not include values based on the scenario in which M ramps up to 0.4 and remains at that rate. Projections suggest that the stock cannot rebuild to the biomass target within 10 years even with F=0 in that scenario due to assumptions about natural mortality used in the projections. The model suggests that the stock cannot rebuild unless natural morality switches back to 0.2 by 2016, but whether and why that would occur is uncertain. For these reasons, the PDT did not recommend utilizing that projection since it is difficult to know for how long natural mortality would remain high. The PDT raised additional concerns that the stock might not be able to recover within 10 years under the scenarios with M=0.2 from the outset given that projections have often proved to be too optimistic in hindsight.

The ABC control rule addresses the possibility of rebuilding that cannot be achieved within 10 years with the following approach:

> *c. For stocks that cannot rebuild to BMSY in the specified rebuilding period, even with no fishing, the ABC should be based on incidental bycatch, including a reduction in bycatch rate (i.e., the proportion of the stock caught as bycatch).*

Therefore, the SSC requests that the PDT produce estimates of incidental, non-target bycatch of GOM cod under the prevailing operating conditions of the fishery in time for the October 20, 2014 SSC meeting. If possible, these estimates should be specific to different fleets and gears, including spatial patterns. The SSC would like to see these estimates in order to determine whether some fine-tuning of the ABC is warranted to account for the third mortality scenario and accommodate operations of the fleet.

It is important to bear in mind that the OFL of 514mt would not change in light of these requested analyses and sets an upper bound for the final ABC. Furthermore, the SSC might not make adjustments to the ABC if the PDT is not able to conduct the requested analyses due to time or analytical constraints, or if the uncertainties in the outcomes are too great.

In requesting additional analyses on unavoidable, non-target bycatch, the SSC is not yet endorsing any particular strategy for keeping catch within that limit. The SSC discussed the potential for spatial management strategies to help achieve the targets in light of the high spatial concentration of both the stock and catch. The SSC did not strive to reach consensus on whether and how spatial or other approaches should be used, and is interested in continuing that discussion to develop advice on spatial and other strategies for achieving the catch reductions.

In anticipation of a continued discussion about strategies for achieving catch reductions, the SSC has requested, via the PDT Chair, that the Groundfish Advisory Panel and Recreational Advisory Panel provide input on the level of incidental, non-target bycatch by the fleet, as well as the reductions in catch that can be achieved via new fishing strategies. There is an important tradition of industry collaboration in both science and management in New England, and the current status of both the GOM cod stock and fishery make those collaborations especially important. The SSC is interested in discussing and advising on how those collaborations can help meet science and management needs.

In making these recommendations, the SSC recognizes that an operational assessment is scheduled for 2015, and we expect that OFLs and ABCs for 2016 and 2017 to be updated as a result.

In light of the continued poor status of GOM cod and uncertainties concerning the nature and implications of prevailing environmental conditions, the SSC reiterates the following previous recommendations:

- The process to re-evaluate stock structure of cod begun by NEFSC should be resumed and completed as soon as possible.
- A process to define criteria for identifying significant changes in environmental conditions, especially regime shifts, and to determine whether those changes have occurred in and develop scientific and management responses, should be undertaken as soon as possible.

The first recommendation is especially important given that the majority of the catch of GOM cod comes from an increasingly contracted region of the western GOM. This led to discussion among the SSC about the potential for spatial management strategies to both achieve the needed reductions in fishing mortality and help the fleet, issues the SSC is interested in addressing at its next meeting.

The second recommendation is important because the implications of assuming M=0.2 versus M=0.4 in the future are significant for setting reference points, determining stock status, and developing catch advice. The SSC was informed that an NEFSC work group is addressing the issue of regime shift, and is interested in being briefed by and providing feedback to that group.

<u>Summary of recommendations</u>

1. **OFL for GOM cod in 2015, 2016 and 2017 is 514mt.**
2. **ABC for GOM cod in 2015, 2016 and 2017 is provisionally 200mt.**
3. **The SSC requests that the PDT produce estimates of incidental, non-target bycatch of GOM cod, including spatial patterns of bycatch, in time for the October 20, 2014 SSC meeting so that the SSC can consider adjusting the ABC in light of that information and providing additional advice.**
4. **OFL and ABC for 2016 and 2017 should be updated following the planned 2015 GOM cod operational assessment.**

5. **The process to re-evaluate stock structure of cod begun by NEFSC should be resumed and completed as soon as possible.**
6. **A briefing on the progress of the NEFSC regime shift work group should be provided to the SSC.**

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
Ernest F. Stockwell III, *Chairman* | Thomas A. Nies, *Executive Director*

To: Tom Nies, Executive Director
From: Scientific and Statistical Committee
Date: November 4, 2014

Subject: Overfishing levels (OFLs) and acceptable biological catch (ABC) recommendations for pollock, Georges Bank (GB) winter flounder, Gulf of Maine (GOM) winter flounder, and GOM cod.

The SSC met on October 20, 2014 in Danvers, Massachusetts, to address the following terms of reference (TORs):

Pollock, GB winter flounder, and GOM winter flounder

- Review the 2014 operational assessments for pollock, GB winter flounder, and GOM winter flounder and the work of the Groundfish Plan Development Team (PDT) and provide the OFL and ABC for each year for fishing years 2015-2017 that will prevent overfishing, provide for rebuilding and is consistent with the default control rule. (See list of documents for the assessment summary and PDT report under Information below).

GOM cod

- Review information provided through the PDT that estimates the amount of incidental catch of GOM cod that may be caught if the stock is not targeted. Determine whether the estimates provide information that can help inform ABC recommendations.
- Provide advice on appropriate spawning stock biomass reference points (i.e, SSBMSY), Frebuild and projections of catches and SSBs, that is consistent with the 2014 stock assessment update for the Mramp model with M=0.4 continuing indefinitely.
- Review the 2014 update assessment of GOM cod, previous SSC recommendation, and additional information provided for this meeting. Determine whether the SSC's provisional ABC of 200 mt for FY 2015-2017 should be revised in light of the additional information considered. If so, provide a revised ABC for each year for fishing years 2015-2017 that will prevent overfishing, provide for rebuilding and is consistent with the default control rule. (See list of documents for the assessment summary and PDT report under Information below).

To meet these TORs, the SSC considered the following documents:

1. Memo from Groundfish PDT to SSC re Pollock, Georges Bank winter flounder, and Gulf of Maine winter flounder ABCs, dated October 14, 2014
2. 2014 Operational Assessments and Peer Review Reports for Georges Bank winter flounder, Gulf of Maine Winter Flounder, and Pollock, prepublication draft dated October 2014.

3. Documents from the last benchmark assessments for pollock (SAW/SARC 50) and GB winter flounder and GOM winter flounder (SAW/SARC 52) are located here: http://www.nefsc.noaa.gov/saw/reports.html
4. Memo from Groundfish PDT to SSC re Gulf of Maine cod ABCs, dated September 11, 2014
5. Gulf of Maine Atlantic Cod 2014 Assessment Update, Draft Working Paper, (NEFSC) – dated September 3, 2014
6. Gulf of Maine Cod 2014 Assessment Update Peer Review Report, August 28-29, 2014 (NEFSC) – dated September 5, 2014
7. Documents from the most recent benchmark assessments for GOM cod (SAW/SARC 55 and SAW/SARC 53) are located here: http://www.nefsc.noaa.gov/saw/reports.html
8. Memo from Groundfish PDT to SSC re FY 2013-2015 ABCs, dated January 13, 2013
9. SSC Memo to Executive Director Paul Howard re Georges Bank cod, Gulf of Maine cod and Southern New England/Mid-Atlantic winter flounder ABCs for FY2013-2015, dated January 29, 2013
10. Presentation: Gulf of Maine Atlantic Cod 2014 Assessment Update – Mike Palmer (NEFSC) – dated September 15, 2014
11. Presentation: Groundfish Plan Development Team Report: Gulf of Maine Cod ABCs and OFLs for FY 2015- FY 2017– Jamie Cournane (NEFMC) and Paul Nitschke (NEFSC) – dated September 15, 2014
12. Memo from Groundfish PDT to SSC re Gulf of Maine cod bycatch, dated October 16, 2014
13. Presentation: Groundfish Plan Development Team Report: Gulf of Maine Cod bycatch– Jamie Cournane (NEFMC) – dated October 20, 2014
14. Memo from Groundfish PDT to the Groundfish Committee on GOM cod status determination criteria, dated April 7, 2013
15. SSC Memo to Executive Director Tom Nies re OFLs and ABC recommendations for Gulf of Maine cod, dated September 24, 2014
16. Presentation on the operational update of pollock – Brian Linton (NEFSC) – dated October 20, 2014
17. Presentation on the operational updates of Georges Bank and Gulf of Maine winter flounder – Paul Nitschke (NEFSC) – dated October 20, 2014
18. Presentation on the PDT report on pollock and winter flounder ABC and OFL alternatives – Jamie Cournane (NEFMC) and Paul Nitschke (NEFSC), dated October 20, 2014
19. Presentation on the quota change model – Chad Demarest (NEFSC) – dated October 20, 2014

Pollock

The operational assessment for pollock concluded that the biomass is above B_{MSY}, and therefore is not overfished, and that overfishing is not occurring. In this situation, the default control rule dictates that ABC be based on fishing at 75%F_{MSY}, although the control rule also dictates that ABC can be adjusted based upon additional scientific information.

The PDT proposed candidate ABCs for 2015-2017 based upon 75%F_{MSY} applied to projected exploitable biomass. However, for many groundfish stocks in recent years, projections have proven in hindsight to be overly optimistic, which increases the probability of overfishing. Therefore, in response to this concern for several stocks with projected increases in biomass and catch, the SSC has recommended setting the ABC based upon 75%F_{MSY} applied to projected biomass for the first year, and then holding this ABC constant for the second and third years. Because OFL is intended to be a risk-neutral limit, it is allowed to change with projected biomass. Maintaining the ABC

constant when the OFL is projected to increase implies an increasing uncertainty buffer into the future as confidence in projections decreases, and is the approach we recommend for pollock.

The ABC resulting from applying 75%F_{MSY} to biomass projected for 2015 is 16,600mt. The SSC recommends that 16,600mt be the ABC for 2015, 2016 and 2017. Corresponding OFLs increase from 21,538mt in 2015, to 21,864mt in 2016, to 24,598mt in 2017. In offering this advice, the SSC notes that an operational assessment for pollock is planned in 2015, and the 2016 and 2017 ABCs and OFLs may be adjusted based upon updated information.

The SSC recognizes that the SAW50 assessment method is a substantial improvement over the previous index-based assessment method, but considerable uncertainties remain in the updated analytical assessment. Therefore, the SSC recommends that the uncertainties evaluated through sensitivity analyses (e.g., assumed form of selectivity, data weighting) and the potential causes of the retrospective pattern be investigated in future assessments.

Georges Bank winter flounder

The operational assessment concluded that biomass is above 50%B_{MSY} but still below B_{MSY}. Therefore, the stock is not overfished, but continued rebuilding toward the biomass target is required. The rebuilding objective is 75% probability of being rebuilt by 2017. Overfishing is not occurring. In this situation, the default control rule dictates that ABCs be based on $F_{rebuild}$. The SSC sees no reason to deviate from the default control rule, and therefore recommends that ABCs increase from 2,124mt in 2015, to 2,221mt in 2016, to 2,294mt in 2017. Corresponding OFLs increase from 3,242mt in 2015, to 3,383mt in 2016, to 3,511mt in 2017. In offering this advice, the SSC notes that an operational assessment for GB winter flounder is planned in 2015, and the 2016 and 2017 ABCs and OFLs may be adjusted based upon updated information.

Gulf of Maine winter flounder

The operational assessment concluded that overfishing is not occurring. However, as with previous assessments, biomass-based reference points could not be estimated, and it is therefore unknown whether the stock is overfished. The default control rule dictates setting ABC as 75%F_{MSY} applied to the most recent estimate of exploitable biomass. Projections are not possible for index-based stocks, and ABC therefore remains constant until new survey indices are available. Therefore, the SSC recommends that ABC be set at 510mt for 2015, 2016 and 2017, with a corresponding OFL of 688mt. In offering this advice, the SSC notes that an operational assessment for GOM winter flounder is planned in 2015, and the 2016 and 2017 ABCs and OFLs may be adjusted based upon updated information.

Given that the majority of catch of both GOM cod and GOM winter flounder come from the same statistical area, in setting catch advice the SSC recognizes that catches of GOM winter flounder may be particularly affected by Council decisions for GOM cod. These issues are more likely to affect management uncertainty rather than scientific uncertainty.

Gulf of Maine cod

<u>Utility of incidental catch information</u>

The SSC expresses gratitude to the PDT and the groundfish sector representatives for addressing the request for additional information on incidental, non-target catch, especially given the very limited time to do so. In response to the first TOR for GOM cod, the SSC reviewed the information provided and determined that it could be used to inform catch advice, as described below.

The PDT was unable to produce a single estimate of incidental, non-target catch with confidence given the information and time available. Information provided by three commercial fishing industry groups representing all but two groundfish sectors that have relatively little cod allocation, along with recreational discard estimates provided by the PDT, suggest an approximation of incidental catch on the order of 500-600mt, close to or slightly greater than the 2015-2017 OFL of 514mt. There are additional sources of fishing mortality not included within this estimate, notably bycatch from other fisheries, as well as other uncertainties, and the actual incidental catch is likely to be higher. However, the information provided helps scale the likely non-target catch.

Alternative reference points

In response to the second TOR for GOM cod, the SSC reviewed information provided by NEFSC on reference points, catch and biomass projections, and other estimates associated with a scenario in which natural mortality ramps up to 0.4 and then remains at this rate indefinitely. The SSC did not focus its discussion on the numerical outcomes associated with a scenario in which M ramps up to 0.4 and remains at the level, however. Instead, SSC discussion focused more generally on the plausibility of the scenario and its implications.

With respect to the plausibility of a persistent change in M, some SSC members deferred to the SARC55 conclusion that, if M has increased in recent years, it is unlikely to be a permanent change, and therefore will return to a level that is more consistent with the life history of a species like cod (e.g., M=0.2). On the other hand, some members felt that there have been multiple changes within the ecosystem that have likely increased mortality of cod, and that a sudden return to a lower mortality rate coincident the end of the assessment time series is unlikely. Other SSC members noted that SARC55 also concluded that no change in M from the assumed value of 0.2 was a comparably plausible scenario, and some felt that to be more likely.

The plausibility and persistence of a change in M notwithstanding, there was also disagreement within the SSC about the implications for reference points and catch advice if such a change is assumed to have occurred. Some members felt that expectations for rebuilding need to be consistent with the current productivity of the stock as determined, in part, by the current natural mortality rate. That would mean lowering the estimated B_{MSY} due to fewer fish reaching larger size classes, and increasing the estimated F_{MSY}, consistent with yield-per-recruit theory. Other members argued that theories of sustainable fishing assumed a certain set of co-evolved life history traits, and that a recent increase in M represents a substantial deviation and a highly stressed population. In such a situation, increasing F would be imprudent as it would further stress the stock as it adapts to its changed environment. The challenge of determining appropriate overfishing limits and rebuilding targets for the increasing M scenario is exacerbated because these reference points for cod are currently based on MSY proxies rather than direct estimates of MSY reference points. Revised estimates of $F_{40\%SPR}$ that assume M=0.4 and the associated rebuilding target may not represent F_{MSY} and B_{MSY} as intended, and a different SPR might be warranted.

Ultimately, the SSC was not able to reach consensus on the issues addressed, and reiterates previous recommendations that a dedicated scientific process is needed to develop a formal consensus about the nature of regime shifts or other more persistent ecological changes that might fundamentally alter expectations about stock productivity. Because this was an operational update, it is not appropriate for the SSC to deviate significantly from the view of this stock represented by the previous benchmark assessment (i.e., reference points based on M=0.2) in developing catch advice.

Finally, despite the lively debate on these issues among its members, the SSC did reach consensus that the GOM cod stock is in poor shape under any of the scenarios considered, and that substantial reductions in catch are needed to allow for rebuilding.

ABC advice

The SSC recommends an ABC for 2015-2017 that is 75% of the OFL of 514mt, or 386mt. The SSC recommends this approach for the following reasons:

- ABC advice is still well below the OFL to account for uncertainty in the OFL.
- ABC advice is substantially reduced from the status quo ABC (1,550mt) as required given the poor state of the stock. Specifically, the SSC is recommending a 75% reduction in the ABC.
- ABC advice is below the average of the three alternatives based upon 75%F_{MSY} provided by the PDT (405mt for 2015), but above the values based on $F_{rebuild}$ (180 mt and 207 mt for 2015) from the two projections which suggest rebuilding in ten years is possible.
- The control rule includes a provision for the ABC to be set based on an estimate of incidental non-target bycatch, with a reduction, when projections suggest that rebuilding is not possible within 10 years. Given the information at hand and the need to balance this provision with other components of the control rule associated with alternative scenarios put forward by the assessment, this recommendation is the best option the SSC can offer to achieve this policy objective.
- Based on the assessment and the PDT's analysis, it is clear that the prospects for rebuilding Gulf of Maine cod in a 10 year time frame are limited at best. Projections assuming M=0.4 (but using M=0.2 reference points) suggest that rebuilding is impossible. Under M=0.2, rebuilding may be possible, but as the PDT's analysis highlights, this would require favorable environmental conditions and sustained growth of 37-40% per year. Furthermore, the low population size raises the possibility of depensatory processes that may cause projections to be overly optimistic. Based on this analysis, the SSC concluded that rebuilding this stock in 10 years is unlikely under current conditions.
- There remains disagreement within the SSC about the implications for reference points and catch advice when M is assumed to have increased within an assessment.
- SSB would still be projected to increase, so an ABC of 386m would not compromise the ability of the stock to rebuild. However, catch projections to provide for rebuilding by 2024 would need to be re-estimated.
- The ABC and OFL values are held constant for years 2015-2017 in recognition of the difficulties making projections at low population sizes and the update assessment scheduled for 2015.

Summary of recommendations

1. **ABCs and OFLs are as follows (all values are in metric tons, mt):**

Stock	2015		2016[1]		2017[1]	
	ABC	OFL	ABC	OFL	ABC	OFL
Pollock	16,600	21,538	16,600	21,864	16,600	24,598
GB winter flounder	2,124	3,242	2,221	3,383	2,294	3,511
GOM winter flounder	510	688	510	688	510	688
GOM cod	386	514	386	514	386	514

[1]ABCs and OFLs for 2016 and 2017 are expected to be adjusted following the operational assessment planned in 2015.

2. **Uncertainties in the pollock stock assessment evaluated by sensitivity analyses (e.g., assumed form of selectivity, data weighting) and the retrospective pattern should be considered in future assessments.**

3. **A scientific process is needed to develop a formal consensus on the impact of recent ecosystem changes, including the possibility that we have experienced an abrupt and possibly persistent regime shift, especially as those affect natural mortality and other key drivers of productivity of GOM cod and other stocks.**

Framework Adjustment 53

To the

Northeast Multispecies FMP

Appendix II: Analytic Techniques:

Gulf of Maine Cod and Other Groundfish Analysis

Identifying location and times of spawning for Gulf of Maine cod

Micah Dean and Steven J. Correia, Massachusetts Division of Marine Fisheries
October 31, 2014

Introduction:

At its September/October meeting, the Council tasked the Groundfish Plan Development Team (PDT) with evaluating the biological impacts of spawning closure options for GOM cod in draft Framework Adjustment 53 (FW 53) to the Multispecies (Groundfish) fishery management plan. Two options were identified at the Council meeting, and the PDT requested that it work with the Committee after the September/October Council meeting to further evaluate the efficacy of those time/areas for protecting spawning GOM cod. The options in FW 53 include 30 minute blocks that would be closed for specific months to protect spawning cod. Several independent data sources and methods were used to examine the time-area blocks with high concentrations of spawning cod.

Cod spawning biology:

The GOM stock of Atlantic cod is comprised of two genetically distinct groups whose spawning activity overlaps in space, but not in time (i.e., "winter" and "spring" spawners) (Kovach et al., 2010; Zemeckis et al., 2014). Within these broad groups are several smaller sub-components that form spawning aggregations at predictable times and locations. At one time, numerous aggregations of spawning cod could be found all along the GOM coast (Ames 2004). Unfortunately, most of these spawning grounds are now vacant, and current cod spawning activity appears restricted to a narrow range of coastline from NH to MA. Cod exhibit high fidelity to their spawning sites, and recent studies on spring spawning GOM cod have shown that tagged females are capable of returning to the same precise spawning location (within <10m) over multiple years (Dean et al., 2014; Zemeckis et al., 2014). This spatial and temporal predictability makes individual spawning groups particularly vulnerable to depletion, and there is little indication that once a site-specific spawning component is lost that the area can be recolonized.

Some of the remaining GOM cod spawning aggregations are well documented and small seasonal fishery closures have been implemented in an attempt to protect them from disruption and depletion (Armstrong et al., 2013). However, these examples as well as similar experiences in other cod stocks have pointed to a need for broader-scale measures (i.e., at the scale of 30-min blocks) to prevent further loss of population structure and enhance the potential for recruitment success in the future (Zemeckis et al., 2014).

Trawl surveys:

We examined the spatial distribution of spawning cod from 5 trawl surveys in the Gulf of Maine: NEFSC spring, NEFSC fall, MADMF spring, MADMF fall, and the Industry-based cod survey (IBS). The NEFSC and MADMF surveys have narrow seasonal coverage, limiting their applicability to spawning cod (Figure 1). Additionally, because these surveys were designed to

provide information on a wide variety of species, they have relatively low catches of cod and even smaller sample sizes of sex and maturity data.

The IBS cod survey was specifically designed to study stock distribution and demographics of cod in inshore Gulf of Maine waters (< 75 fathoms) from Cape Cod to the Bay of Fundy. The IBS survey gathered detailed information on the spawning condition of captured animals (see section *Spawner CPUE*). The IBS was a cooperative research effort that employed 4 industry vessels to simultaneously survey the entire study area with high intensity over five back-to-back cruises starting in mid-November and continuing through May:

Cruise	Dates	Season
1	Nov 14 - Dec 31	Winter
2	Jan 1 - Feb 12	Winter
3	Feb13 - Mar 17	Winter
4	Mar 18 - Apr 19	Spring
5	Apr 20 - May 31	Spring

Each vessel used an identical net equipped with a mensuration system to ensure equivalent net geometry and fishing power among vessels. The survey used a systematic fixed station design (standardized grid) as well as a random stratified sampling design for areas that fishermen designated as "hot spots" with traditionally high catch rates. Due to its singular focus on Atlantic cod, the IBS provided an order of magnitude more biological samples (i.e., sex, maturity) from this species than the other surveys (NEFSC, MADMF). The broad seasonal overlap with cod spawning, high spatial resolution and large sample sizes make the IBS an invaluable source for describing the spawning activity of cod in the GOM.

The August 2008 peer-review of the Cod IBS acknowledged its utility for this purpose:

> *"The Cod IBS provides valuable information on cod in the Gulf of Maine when no other sources of data are available. The Cod IBS is a good example of a cooperative project."*
>
> *"The survey provides high resolution information on the spatial and temporal distribution, size composition, maturity and potentially age of cod and augments existing surveys."*
>
> *"Survey data are useful in determining the location and timing of cod in spawning condition as well as the coincidence of spawning cod with rolling closures."*
>
> *"The utility of the Cod IBS data relative to the fishery closure areas (rolling closures) lies mostly in the identification of the areas containing spawning fish during specific times of the year. Generally, the monthly closed areas matched well with the areas where the highest catches of spawning fish could be found. In that respect, the survey data are useful to determine the location and timing of cod in spawning condition."*

Trawl survey data were used in two separate ways to identify areas of cod spawning activity:

1) CPUE of cod in spawning conditions, and;
2) Presence of significantly skewed sex ratios

Spawner CPUE:

Cod were considered "spawning" if they were classified as ripe, running, or spent using standard macroscopic maturity criteria. While it is possible to find cod in spawning condition some distance from the specific spawning sites, a high abundance of spawning cod is typically seen as a reliable indicator of spawning location. In particular, females in spawning condition are likely to be near the spawning area as hydrated eggs (i.e., "ripe") are typically released within 36 hours and ovulated eggs (i.e., "running") within 5 hours (Kjesbu et al., 1990).The CPUE (kg/tow) of cod in spawning condition was calculated for each survey tow (Figure 2) and summarized by 30-min square ("block") and season, using the arithmetic mean (Figure 3). For the purpose of identifying blocks with spawning activity, the mean's sensitivity to outliers is a useful property that can help indicate the presence of cod spawning aggregations. Each 30-min block was classified into low (<1 kg/tow), medium (1-8 kg/tow) or high (>8 kg per tow) categories.

For the winter cruises, only Massachusetts Bay (Block 125) was assigned to the "high" category, with the neighboring blocks of 124, 132, 133, as well as 123 and 139 falling into the "medium" category. A very low level of spawning fish was detected in nearly all other sampled blocks, but these areas were dominated by zero catches.

In the spring (see above table), blocks covering Massachusetts Bay (Block 125), Ipswich Bay (Block 133) and Jefferies Ledge (Block 132) were identified as having "high" CPUE of spawning cod. Stellwagen Bank (Block 124), Bigelow Bight (Block 139), and the offshore ledges of Platts (Block 138), Fippennies (Block 130) and Cashes (Block 129) all fell into the "medium" category. Notably, the backside of Cape Cod was identified as having either "high" (Block 123) or "medium" (Block 114) CPUE of spawning cod; however, these areas are technically part of the Georges Bank stock area.

Despite the intensive sampling and broad seasonal footprint of the IBS, this survey did not completely encompass the entire spawning periods of GOM cod. In particular, the beginning of the winter spawning season (before November 15) and the end of the spring spawning season (after May 31) were not sampled. Furthermore, the short time series (2004-2007) provides a recent "snapshot" of spawning activity, and some areas that formerly may have been quite important to the reproductive capacity of the stock may have been depleted when these data were collected. As such, the areas identified by the IBS should be seen as a subset of where cod spawning occurs.

For the draft FW 53 GOM cod spawning area closure alternatives (in section 4.2.1), Sub-Option A appears to have good overlap with the areas identified as having high CPUE of spawning cod from the IBS for the months of November - May. However, as there are no IBS data for June and July, and adequacy of proposed closures for these months should be evaluated using other data sets (see sections *ichthyoplankton surveys* and *acoustic telemetry*). Also, several blocks with "medium" abundance of spawning cod would be vulnerable under this option. Sub-Option B appears to provide only partial protection of spawning cod, particularly in the spring.

Skewed sex ratios:

During spawning, males and females segregate themselves on the spawning ground, with males exhibiting higher activity over a larger area. This causes males to become more vulnerable to capture, leading to predominantly male-skewed sex ratios in survey or fishery catches (Dean et al., 2014). This phenomenon can be utilized to identify specific locations where spawning behavior occurs. When not spawning, the ratio of females to males[1] is expected to be 1:1. Therefore, identifying survey tows with a sex ratio (SR) that is significantly different from 1:1 indicates spawning activity. All bottom trawl survey tows with a sufficient sample size (n>=5 sex observations) were evaluated for the presence of a significant SR skew using a two-tailed exact binomial test (α=0.05). The resulting probabilities were further adjusted for multiple comparisons by controlling the false discovery rate.

The IBS was the most relevant dataset for this approach, given the broad temporal overlap with spawning and generally high sample sizes. Of the IBS tows conducted in winter, significantly skewed sex ratios were detected in blocks 124, 125 and 139 (Figure 5). For the spring cruises, blocks 124,125,132,133 were found to contain significantly skewed SRs. Only a handful of tows from the NEFSC surveys were found to have a significant SR skew (Blocks 124 and 125 in both spring and fall), but this survey is not well suited for this method given the low number of sex observations and limited coverage of inshore areas (Figure 6). Because the MADMF fall survey does not occur at a time of year when cod are typically spawning, it is not surprising that none of the 3,200+ tows were found to have a significant SR skew. However, within the limited survey area of the MADMF spring survey, the same precise locations of spawning activity were identified as in the IBS dataset (Figure 7 - near Cape Ann, in blocks 124 and 133).

Ichthyoplankton surveys:

The MARMAP ichthyoplankton survey (1977-1987) provides a unique picture of GOM cod spawning, because it is the only data source that offers a measure of spawning activity in every month of the year.

Once released, cod eggs are generally pelagic and their distribution is largely influenced by oceanographic currents. The duration of this incubation period is strongly temperature dependent (Marteinsdottir et al., 2000) and given the average water temperature in the GOM over the course of a spawning season, the expected time to hatch is 15 days in winter and 9 days in spring. A study of the dispersal of cod eggs and larvae in the GOM using a highly-resolved hydrodynamic model found that the maximum dispersal over 15 days was approximately 100 km (Churchill et al., 2011). Assuming an egg mortality rate of 10% per day estimated from MARMAP data (Mountain et al., 2003), the median age of eggs at peak spawning would be

[1] Cod hatch in equal numbers of males and females as evidenced by the equal sex ratio of juveniles in survey data. As they mature, the higher activity level and space use of spawning males causes a male-skewed sex ratio in catches made on a spawning ground. This sexually-dimorphic behavior also causes mature males to be removed from the population at a faster rate (by the fishery), leading to female dominated older ages. However, due to the relative abundance of juveniles, the overall sex ratio of the population is likely very close to 1:1. The sex ratio of cod catches from surveys that occur in non-spawning times (MADMF Fall; NEFSC Shrimp), there are essentially no tows that are significantly different from 1:1 (Dean et al., in prep).

approximately 6 days in winter and 4 days in spring. Therefore, we conclude that the maximum dispersal (distance from the spawning location) of the typical egg would be ~40 km in winter and ~25 km in spring. Therefore, it is reasonable to assume that quarter-degree blocks (~40 km x 55 km) with elevated egg densities correspond to spawning locations.

Maps of cod egg density from MARMAP surveys (1977-1987) were examined from Berrien and Sibunka (1999) and used to assign a maximum observed egg density to each 30-min block for each month (Figures 9-11). These data both corroborate and complete the seasonal profile of spawning activity provided by the IBS (Figure 12). Specifically, the winter spawning season spans the months of November-February, whereas the spring season encompasses the months of April-July. It appears that very limited spawning occurs in the months of August, October and March, with a complete absence of spawning in September.

The MARMAP data represent spawning areas during the 1970's and 1980s and may capture spawning aggregations that have since been depleted or extirpated. Regardless, the areas of spawning activity indicated by this method are similar to those described by sex ratio and spawner CPUE data from trawl surveys. For the winter months, elevated egg densities were found most consistently in blocks 124, 125, 132, 133 and 139, with the highest levels observed in Massachusetts Bay (block 125). As with the IBS dataset, the backside of Cape Cod (blocks 123, 114) was also identified as a spawning area; however, it should be noted that these blocks are technically part of the Georges Bank cod stock. For the spring spawning season, blocks 124, 125, 132, 133, 139, and 140 all achieved the highest level of observed egg density. These data provide some indication of a latitudinal progression of spawning activity, with peak egg density occurring earlier in Massachusetts Bay than in Ipswich Bay. However, it should be noted that the timing of the shift in closure areas under the FW53 Sub-options do not align well with the available data.

Acoustic telemetry:

Several acoustic telemetry experiments have been conducted recently on groups of spring spawning cod in the GOM (Dean et al., 2012, 2014; Zemeckis et al., 2014; Siceloff and Howell, 2013 – all occurring in blocks 125 and 133). While narrow in scope, each study provides direct empirical evidence from individual spawning aggregations. Given the high resolution and the multi-year observational capabilities of this technology, tagged fish were documented returning to the same precise spawning location year after year. A spring spawning aggregation was observed to be intact for over 100 days, corroborating other sources of data on the temporal span of the spawning season. Significant spawning activity was observed from acoustically tagged cod in June and July, which is in agreement with the MARMAP surveys of cod egg density.

Of note, a similar acoustic telemetry study is currently underway to describe the activity of winter spawning cod in Massachusetts Bay (blocks 125 and 124). The finding of this project will be subject to a peer review upon completion and in the interim early information is being provided for informational purposes only. Preliminary data from this project are only relevant for the end of the winter spawning season (surviving tagged fish will return to the spawning ground this winter), but the departure of spawning fish from the study area by mid-February corroborates the IBS and MARMAP datasets.

Passive acoustic monitoring
The mating system of cod involves vocalizations (i.e., "grunts"), primarily arising from agonistic interactions between males competing over mating territories. Cod spawning grunts are sufficiently distinct that they can be discerned from other fish and marine mammal sounds, and the frequency of their occurrence has been used as a proxy for the intensity of spawning activity (Hernandez et al., 2013). Arrays of moored underwater hydrophones have successfully recorded cod spawning grunts from both the winter (blocks 124, 125, 133) and spring (blocks 125, 133) spawning groups. While use of this technology is limited by a relatively narrow detection range and a labor intensive analytical process, the peaks in vocal activity correspond well with the other measures of the seasonal distribution of cod spawning activity: Winter = late November to early December; Spring = late May to early June. It should be noted that while the passive acoustic observations of spring pawning GOM cod have been published in a peer-reviewed journal (Hernandez et al., 2013), the data from winter spawning cod are preliminary observations from an ongoing project and should be considered accordingly.

Conclusions:

Alternatives in FW 53[2]:
<u>Sub-Option A</u>
All commercial and recreational groundfish fishing would be prohibited:
Year-round in the WGOM Closed Area and;
Seasonally in the following 30-minute blocks during these months:
- May: 124, 125, 132, 133, 139, 140
- June: 132, 133, 139, 140, 147
- November – January: 124-125
- March-April: 124, 125, 132, 133

<u>Sub-Option B</u>
All commercial and recreational groundfish fishing would be prohibited in the following 30-minute blocks:
- May: 125, 133
- June: 133
- November – January: 124 with an eastern boundary defined at 70-15, 125
- March-April: 125, 133

Multiple independent data sources and analytical approaches were used to identify the areas important to spawning cod in the GOM, at the scale of the 30-min month-block. Notable discrepancies exist between these analyses and the FW53 spawning closure sub-options (Sub-Option A and Sub-Option B), including:
1) Significant spawning occurs in February and July, both of which are absent from sub-options A and B

[2] Sub-Option A and Sub-Option B documented here were the versions developed by the Council at their September 2014 meeting. The final versions of the sub-options in this action from the November Council meeting reflected the use of Appendix II to further refine the sub-options, notably, to remove March and the WGOM from consideration as spawning closures.

2) March appears to be a time with limited spawning, yet is included in both sub-option A and B
3) The northward shift in closure areas (from May to June) under both sub-option A and B does not match existing data on the latitudinal progression of spawning. Blocks 124 and 125 continue to be important in June.
4) Sub-option B would protect a small fraction of the area that is import to spring spawning cod

An alternative Sub-option C should be considered that will more fully protect spawning cod, while at the same time allow access to areas that do not support aggregations of spawning cod. Based on these analyses, we recommend the closure of blocks 124, 125, 132, 133 for the months of November through February, and blocks 124, 125, 132, 133, 139, 140 for the months of April through July.

References:

Armstrong, M. P., M. J. Dean, W. S. Hoffman, D. R. Zemeckis, T. A. Nies, D. E. Pierce, P. J. Diodati, and D. J. Mckiernan. 2013. The application of small scale fishery closures to protect Atlantic cod spawning aggregations in the inshore Gulf of Maine. Fisheries Research 141:62-69

Berrien, P., and Sibunka, J. 1999. Distribution Patterns of Fish Eggs in the U.S. Northeast Continental Shelf Ecosystem, 1977-1987. NOAA Technical Memorandum 145:1-310

Clapp, A. R., T. R. Smith, A. I. Kovach, and D. L. Berlinsky. 2012. No differences in egg buoyancy and anti-freeze protein production in genetically divergent subpopulations of Gulf of Maine Atlantic Cod (Gadus morhua). Fisheries Research :

Dean, M. J., W. S. Hoffman, and M. P. Armstrong. 2012. Disruption of an Atlantic Cod Spawning Aggregation Resulting from the Opening of a Directed Gill-Net Fishery. North American Journal of Fisheries Management 32:124-134

Dean, M. J., W. S. Hoffman, D. R. Zemeckis, and M. P. Armstrong. 2014. Fine-scale diel and gender-based patterns in behaviour of Atlantic cod (*Gadus morhua*) on a spawning ground in the Western Gulf of Maine. ICES Journal of Marine Science. 71:1474-1489

Churchill, J. H., J. Runge, and C. Chen. 2011. Processes controlling retention of spring-spawned Atlantic cod (Gadus morhua) in the western Gulf of Maine and their relationship to an index of recruitment success. Fisheries Oceanography 20:32-46

Hernandez, K. M., D. Risch, D. M. Cholewiak, M. J. Dean, L. T. Hatch, W. S. Hoffman, A. N. Rice, D. Zemeckis, and S. M. Van Parijs. 2013. Acoustic monitoring of Atlantic cod (Gadus morhua) in Massachusetts Bay: implications for management and conservation. ICES Journal of Marine Science 70:628-635

Kjesbu, O. S., Witthames, P. R., Solemdal, P., and Greer Walker, M. 1990. Ovulatory Rhythm and a Method to Determine the Stage of Spawning in Atlantic Cod (Gadus morhua). Canadian Journal of Fisheries and Aquatic Sciences 47:1185-1193

Kovach, Adrienne I, Timothy S. Breton, David L. Berlinsky, Lorraine Maceda, Isaac Wirgin. 2010. Fine-scale spatial and temporal genetic structure of Atlantic cod off the Atlantic coast of the USA. Marine Ecology Progress Series 410:177-195

Marteinsdottir, G., A. Gudmundsdottir, and I. M. Suthers. 2000. Spatial variation in hatch date distributions and origin of pelagic juvenile cod in Icelandic waters. ICES Journal of Marine Science 57:1182-1195

Mountain, D., P. Berrien, and J. Sibunka. 2003. Distribution, abundance and mortality of cod and haddock eggs and larvae on Georges Bank in 1995 and 1996. Marine Ecology Progress Series 263:247-260

Siceloff, L., and W. H. Howell. 2013. Fine-scale temporal and spatial distributions of Atlantic cod (Gadus morhua) on a western Gulf of Maine spawning ground. Fisheries Research 141:31-43

Zemeckis, D., Dean, M., Cadrin, S. 2014. Spawning dynamics and associated management implications for Atlantic cod (Gadus morhua). North American Journal of Fisheries Management. 34:424-442

Zemeckis, D., Hoffman, W., Dean, M., Armstrong, M. 2014. Spawning site fidelity by Atlantic cod (Gadus morhua) in the Gulf of Maine: implications for population structure and rebuilding. ICES Journal of Marine Science. 71: 1356-1365

Zemeckis, D. R., Martins, D., Kerr, L. A., and Cadrin, S. X. 2014. Stock identification of Atlantic cod (Gadus morhua) in US waters: an interdisciplinary approach. ICES Journal of Marine Science. 71:1490-1506

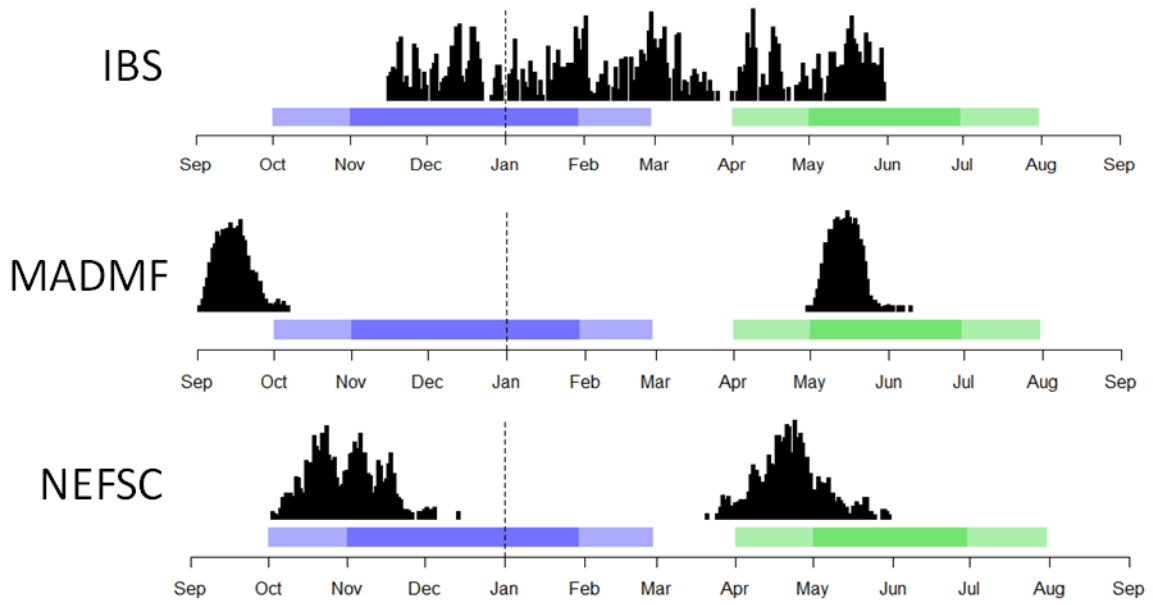


Figure 1- Histogram of tow dates for the IBS, MADMF and NEFSC bottom trawl surveys, in relation to cod spawning seasons in the GOM (blue = “winter”; green = “spring”).

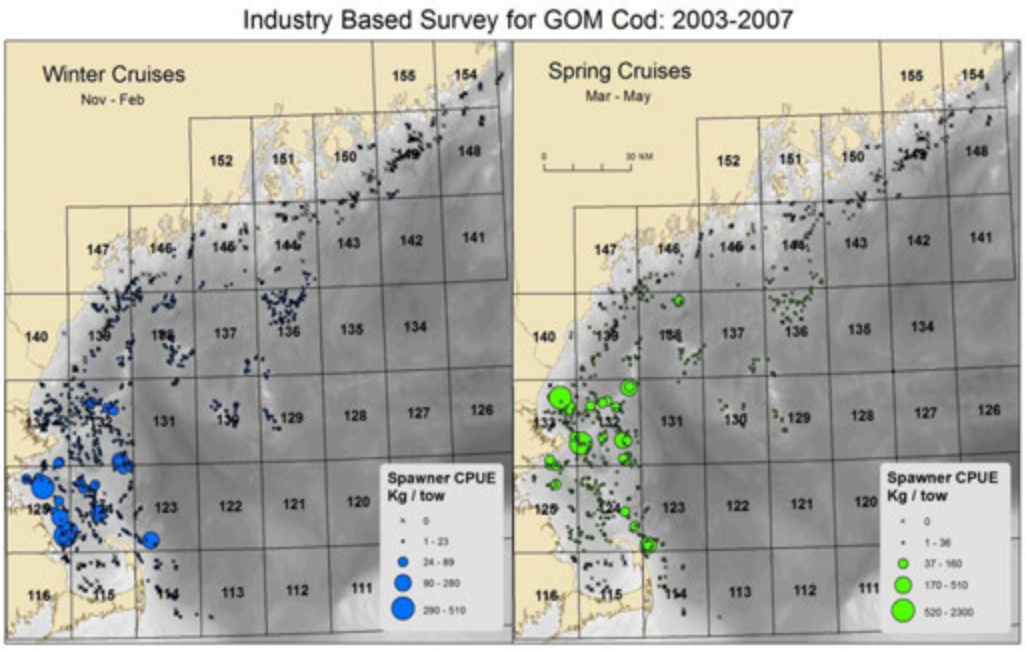


Figure 2- Distribution of weights of ripe, ripe and running and spent cod (kg) for winter and spring period in the IBS survey (2003-2007).

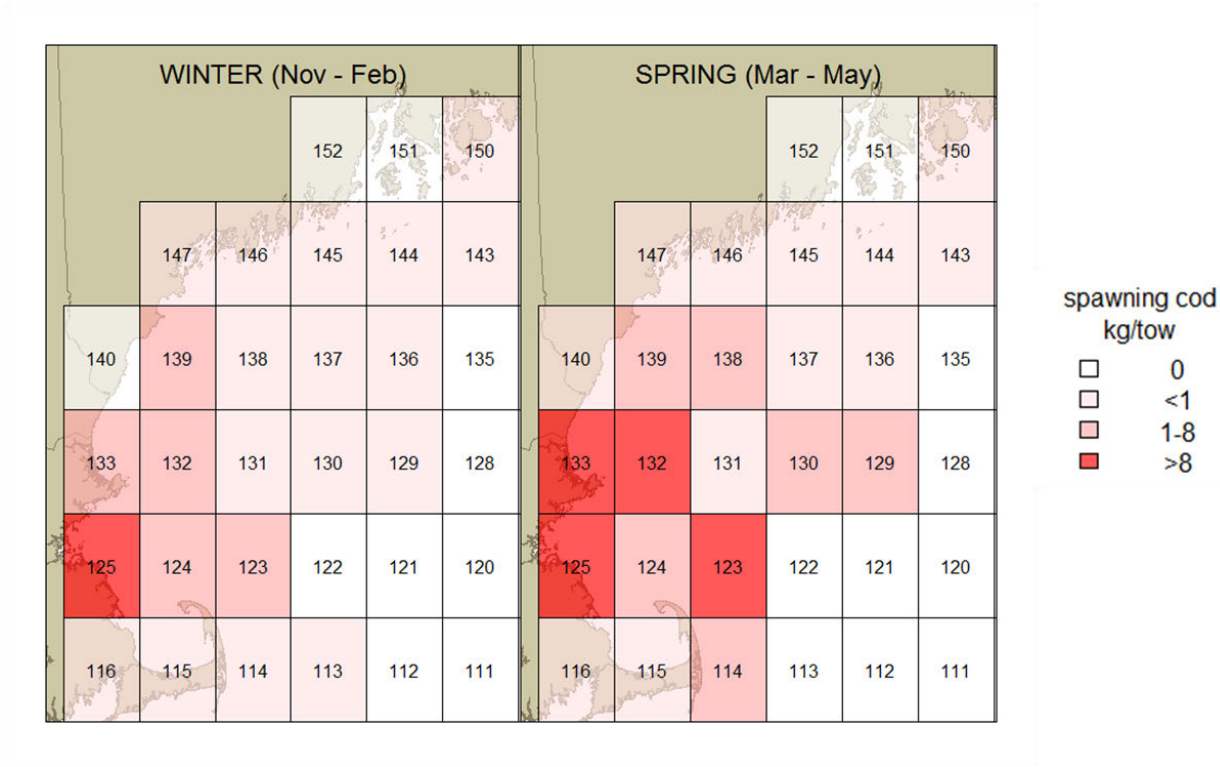


Figure 3- Mean CPUE of spawning cod from the IBS by block and season.

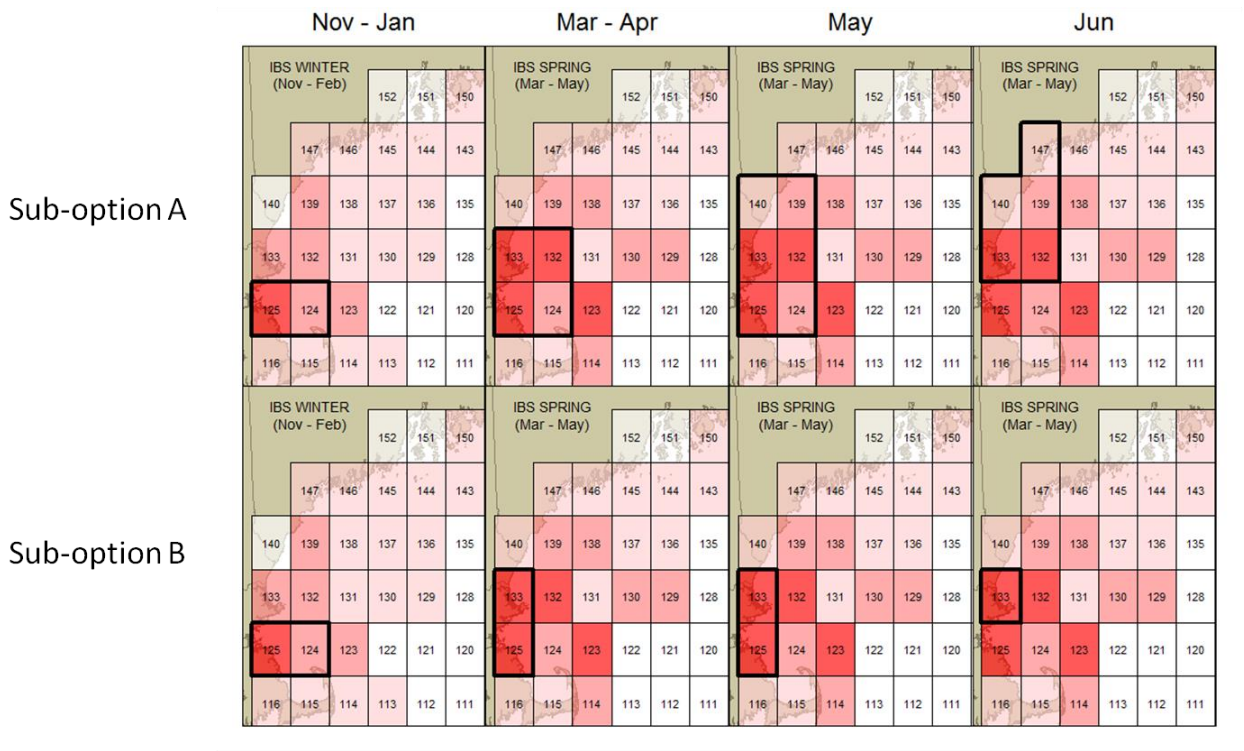


Figure 4- Mean CPUE of spawning cod by season from the IBS, as compared to the two sub-options identified in FW 53. Blocks under consideration for closure are outlined in bold. It should be noted that IBS did not operate in June, and data from all spring cruises (March-May) are shown for comparison.

GOM Cod IBS Survey (2003-2007)

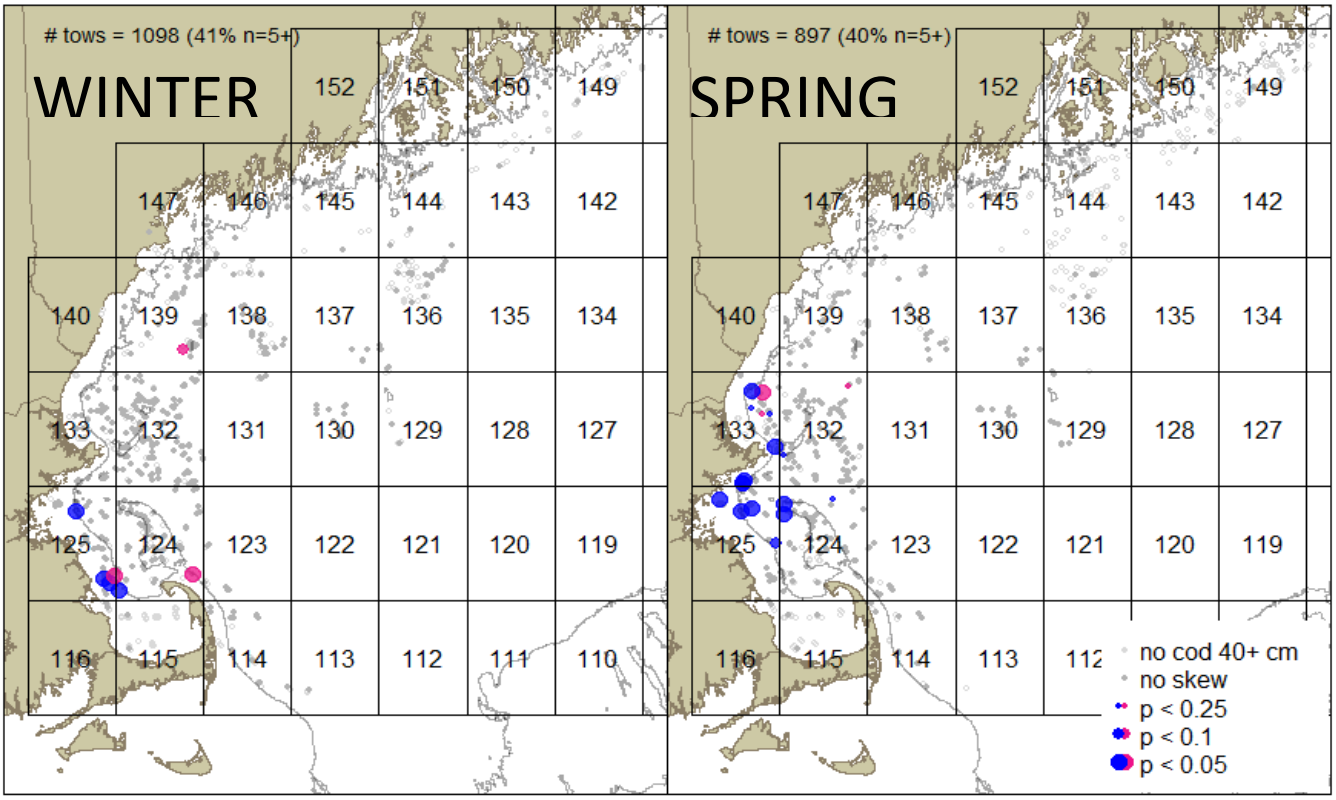


Figure 5- Location of tows with significantly skewed cod sex ratios in the IBS survey, indicating the presence of spawning behavior. Blue dots represent a significant male skew, whereas pink dots represent a significant female skew. The size of the dot is proportional to the *p*-value of the significance test (i.e., larger dots indicate a stronger sex ratio skew).

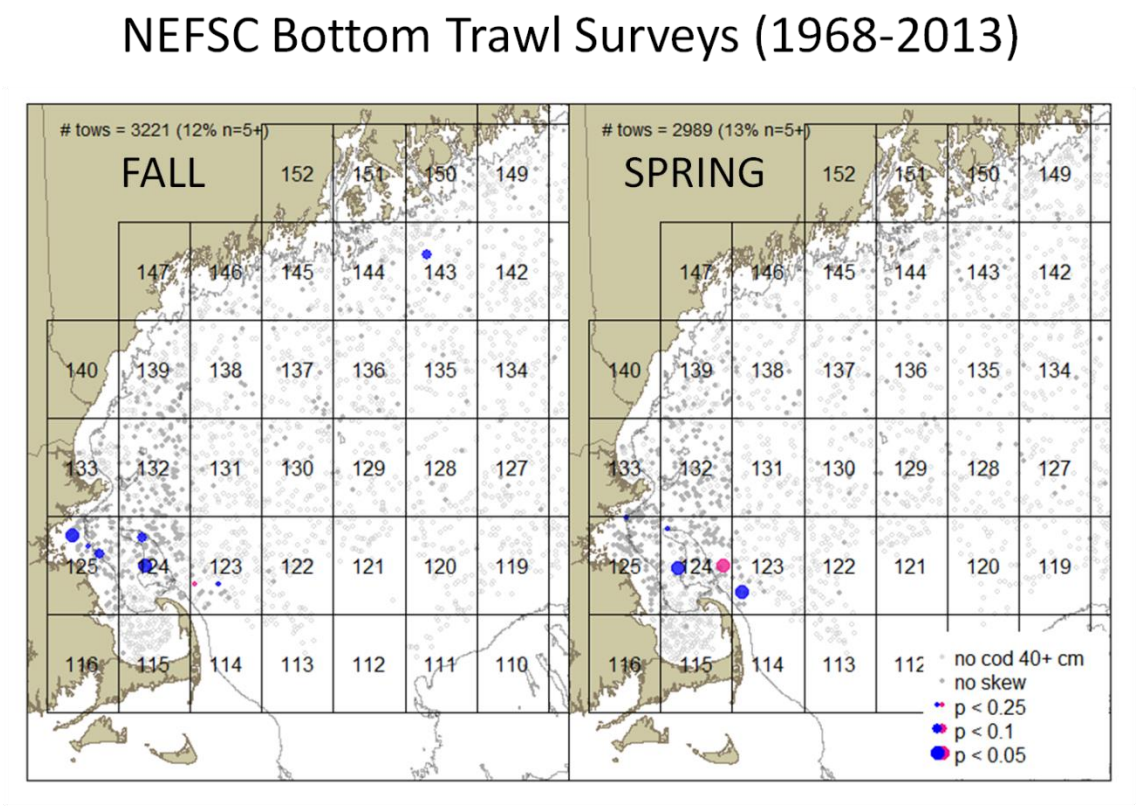


Figure 6- Location of tows with significantly skewed cod sex ratios in the NEFSC bottom trawl surveys, indicating the presence of spawning behavior. Blue dots represent a significant male skew, whereas pink dots represent a significant female skew. The size of the dot is proportional to the *p*-value of the significance test (i.e., larger dots indicate a stronger sex ratio skew).

MADMF Bottom Trawl Surveys (1978-2013)

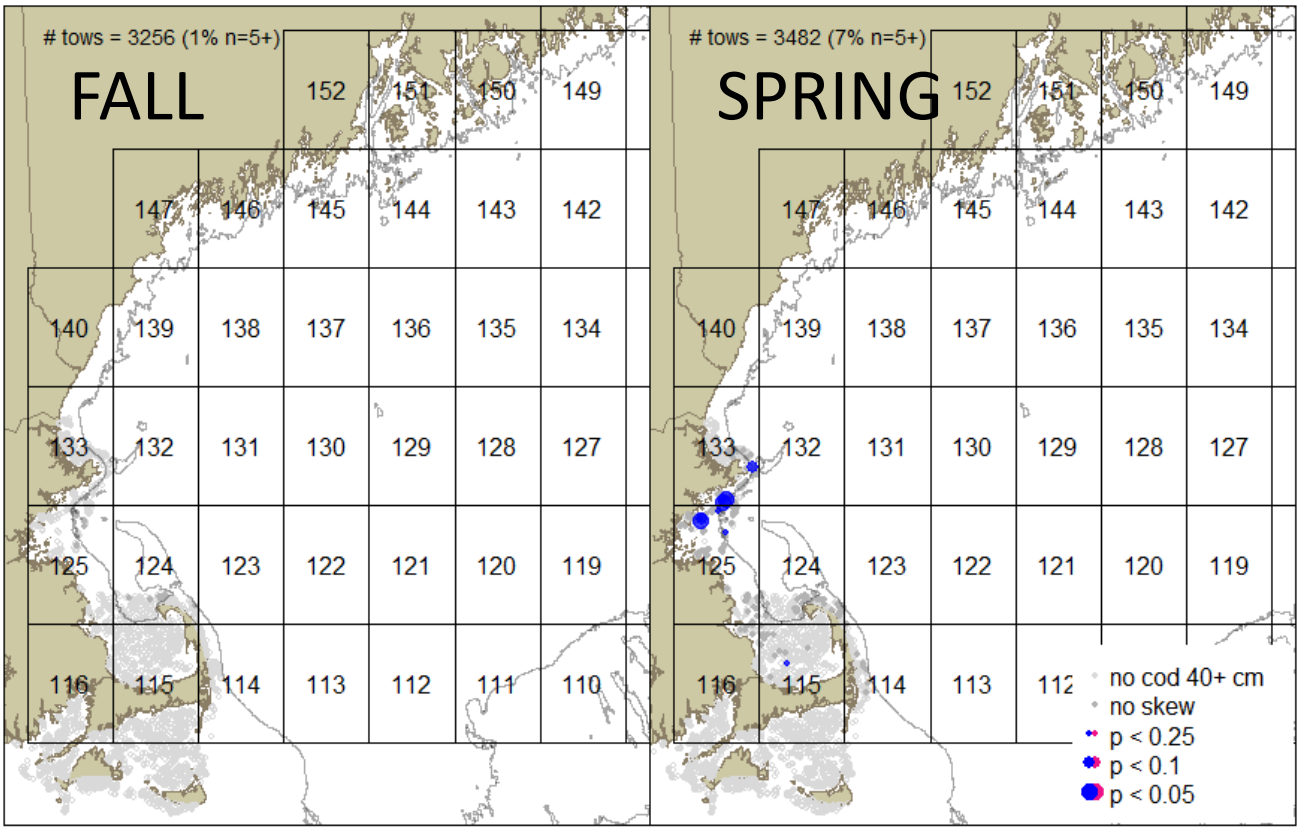


Figure 7- Location of tows with significantly skewed cod sex ratios in the MADMF bottom trawl surveys, indicating the presence of spawning behavior. Blue dots represent a significant male skew, whereas pink dots represent a significant female skew. The size of the dot is proportional to the *p*-value of the significance test (i.e., larger dots indicate a stronger sex ratio skew).

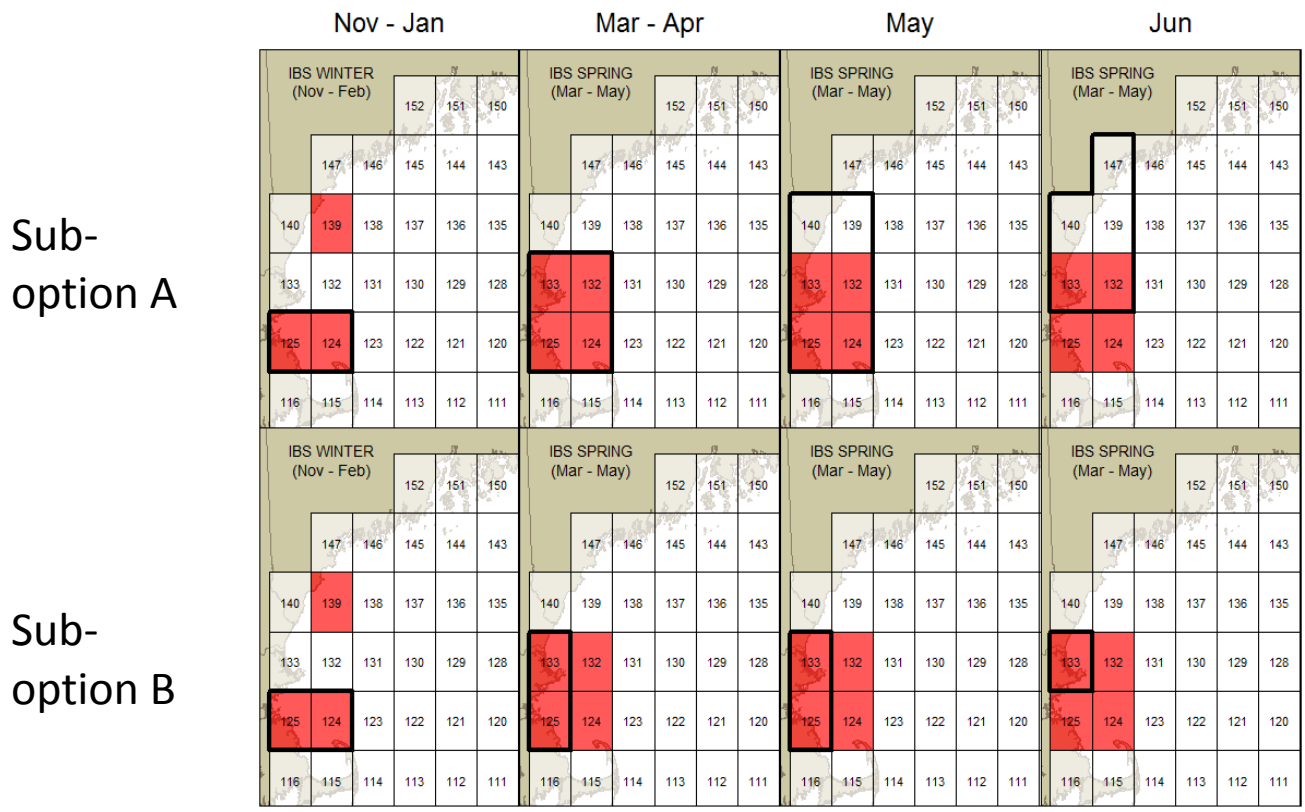
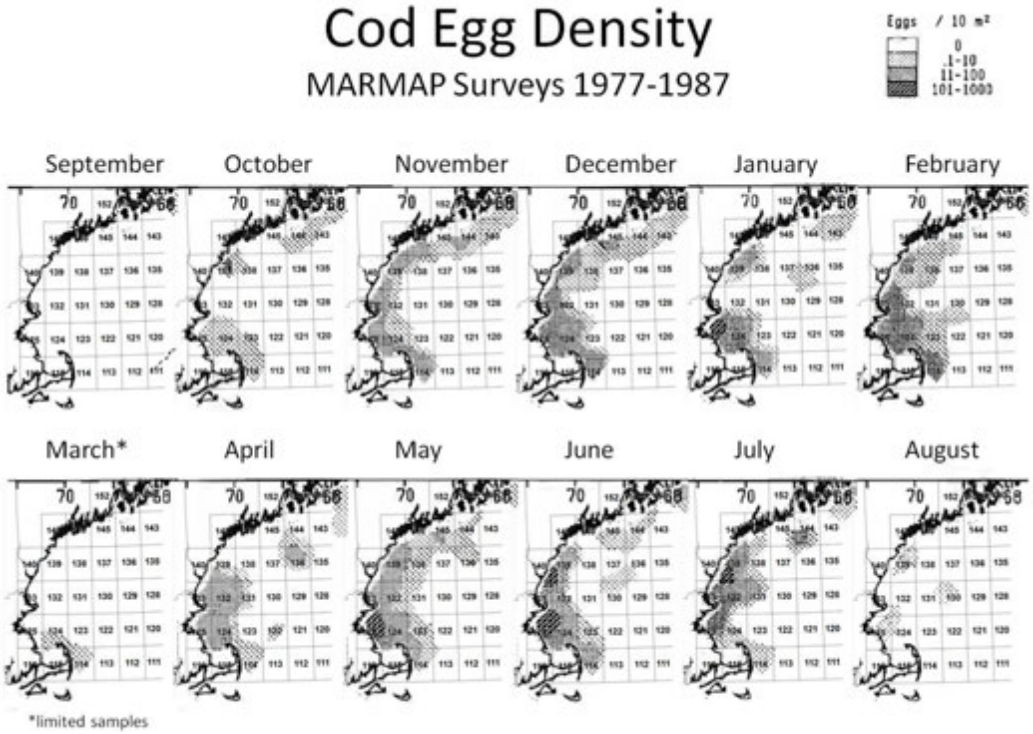


Figure 8- Blocks containing tows from the IBS with significantly skewed cod sex ratios, indicating spawning behavior. Blocks under consideration for closure under the FW 53 sub-options outlined in bold. It should be noted that IBS did not operate in June, and data from all spring cruises (March-May) are shown for comparison.



Reproduced from Berrien and Sibunka, 1999

Figure 9- MARMAP cod egg densities by Month in relation to 30-min blocks. Figures were reproduced from from Berrien and Sibunka (1999). Note that the scale of egg density bins represent increasing orders of magnitude.

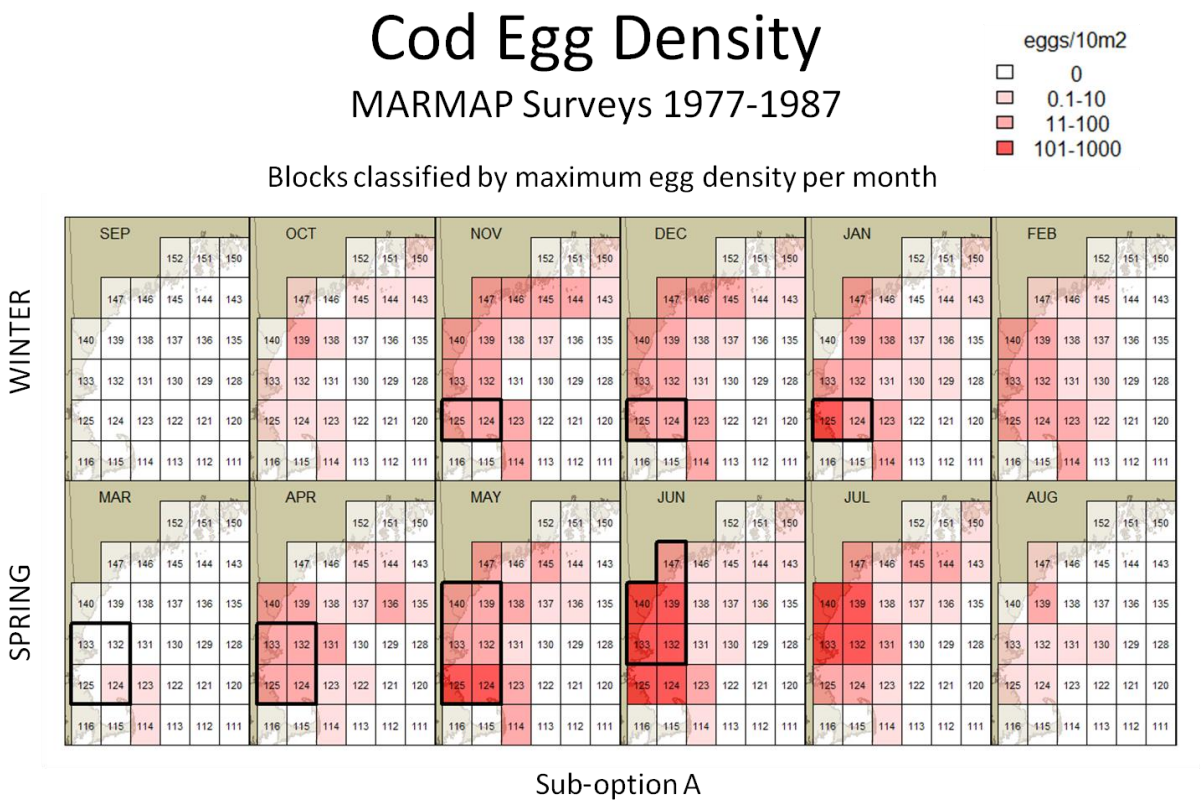


Figure 10- Maximum observed cod egg density per block from the MARMAP ichthyoplankton survey. Blocks under consideration for closure under the FW 53 sub-option A are outlined in bold. Note the presence of significant spawning activity in February and July.

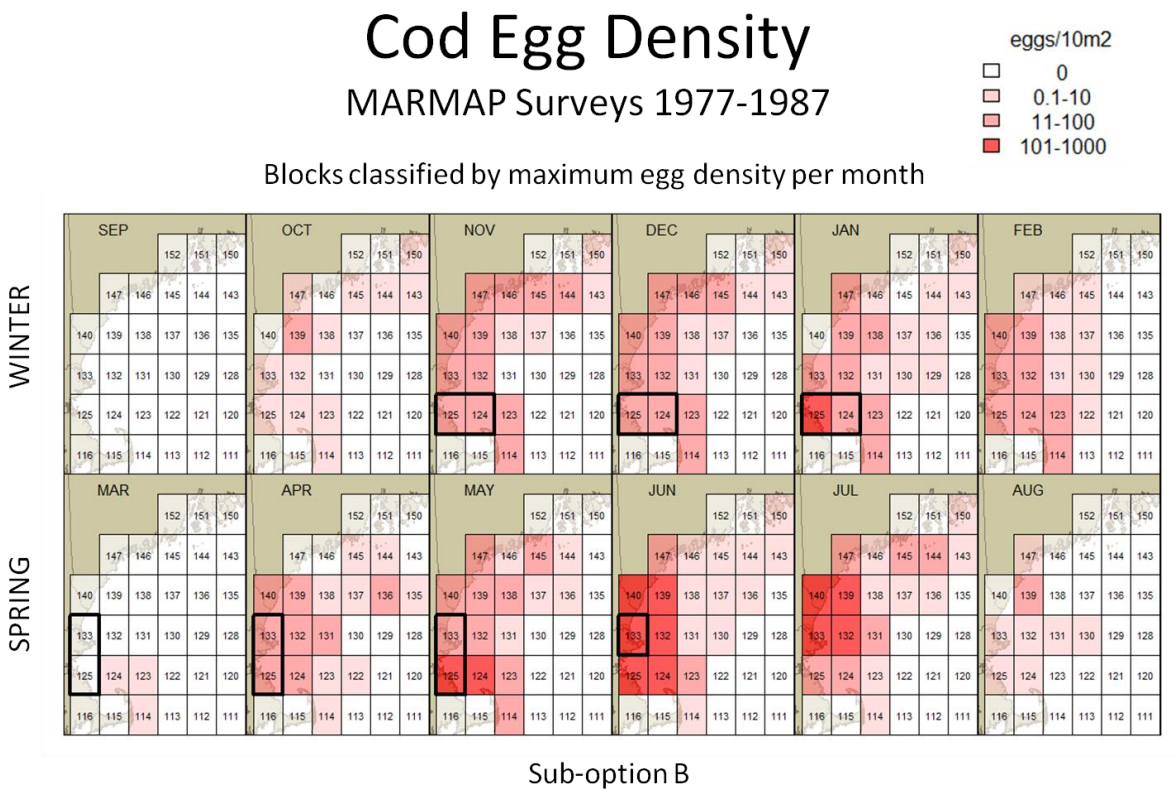


Figure 11- Maximum observed cod egg density per block from the MARMAP ichthyoplankton survey. Blocks under consideration for closure under the FW 53 sub-option B are outlined in bold. Note the presence of significant spawning activity in February and July.

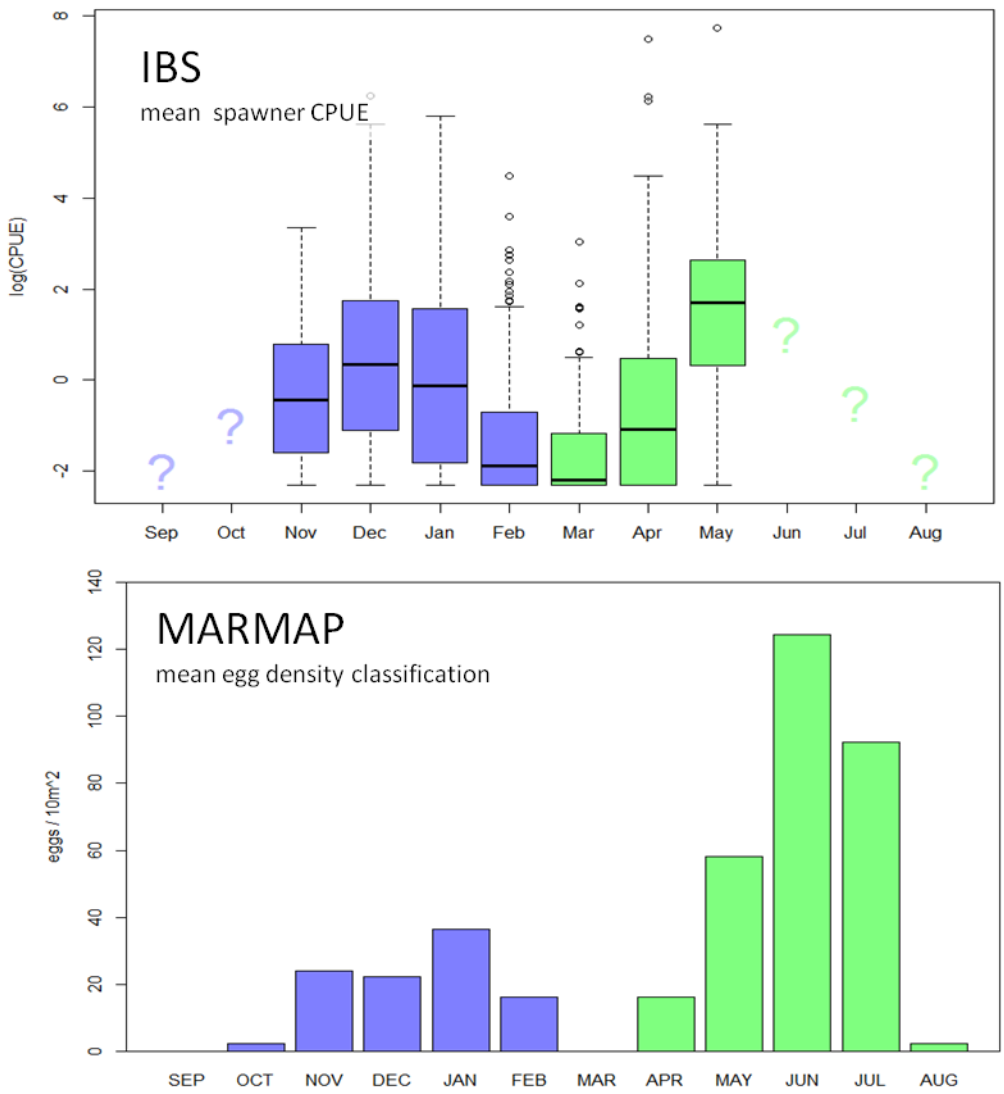


Figure 12- Seasonal distribution of cod spawning activity in the GOM, as evidenced by the IBS trawl survey (above), and the MARMAP ichthyoplankton survey (below). The IBS did not operate between the months of June and October, while MARMAP had very few samples from the GOM in March. "Winter" spawning months are shown in blue and "spring" spawning months are shown in green.

Estimating the Conservation Benefit of Gulf of Maine (GOM) Cod Protection Measures- Revised Commercial Groundfish Fishery Rolling Closures- to Spawning Cod

Micah Dean – December 15, 2014

Purpose: Framework Adjustment 53 (FW53) includes an option to modify the existing Gulf of Maine (GOM) sector and common pool rolling closures with *GOM Cod Protection Measures (Preferred Alternative).* These GOM Cod Protection Measures were evaluated with respect to the protection offered to spawning cod, relative to *No Action* (current GOM rolling closures).

The GOM cod stock is comprised of two genetically distinct spawning components: winter spawners and spring spawners (Kovach et al., 2010; Zemeckis et al., 2014). Spatial management measures may prevent the depletion and loss of individual stock components, thereby sustaining spawning diversity and increasing the chance of recruitment success. As such, the relative conservation benefit of the *Preferred Alternative* relative to the *No Action* was evaluated for each spawning component separately.

Methods: The only available dataset that provides a measure of the abundance and distribution of spawning cod for the months and areas under consideration comes from the Industry Based Survey for GOM Cod (IBS) (Figure 1). The IBS dataset was well-suited for evaluating the relative conservation benefit of FW53 alternatives due to the cod-focused design, intensive sampling effort, and the broad seasonal coverage. The cod IBS employed a two-stage survey design, allocating approximately two-thirds of its survey effort (145 tows per cruise) to a systematic grid encompassing all US waters of the GOM from 10 to 75 fathoms (~ 20 to 140 meters). The remaining one-third of survey effort (80 tows per cruise) was assigned to a stratified random sample of areas that were previously identified by fishermen as having a high abundance of cod. The purpose of this unique design was to ensure a "baseline" level of coverage for the whole survey area, yet achieve higher sampling intensity in the areas most important to cod. The 2006 peer review acknowledged that the cod IBS was particularly useful for evaluating the adequacy of rolling closure areas for protecting spawning cod. However, reviewers also pointed out that the IBS design presents difficulties in describing uncertainty, because it does not lend itself well to typical variance estimators. While uncertainty in biomass estimates was not addressed in this paper, it could be described through a geostatistical approach or post-stratification methods.

For the purpose of this analysis, the largest drawbacks to the IBS dataset are the short time series (2003-2007) and lack of data from June, a month known to be important to spring spawning cod in the GOM (Dean et al., 2014; Siceloff and Howell, 2013). However, despite only operating for four years, the entire study area was surveyed on five consecutive cruises per year (Nov-May), with the distribution of survey effort optimized for describing the spatial and temporal distribution of cod. Furthermore, emphasis was placed on collecting biological and demographic information from cod, and as a result the IBS dataset includes far more maturity observations (i.e., spawning condition) than other surveys that operate in the

GOM. For the purpose of this analysis, the abundance and distribution of spawning cod in June were assumed to be similar to that of May (i.e., June closures were compared to May IBS data).

A compilation of federal and state commercial groundfish fishery closures was assembled to represent the *No Action* in federal waters with respect to FW 53 and *Status Quo* in state waters (Table 1; Figure 2). Some of these closures overlapped in time and space because of differing management bodies or regulatory objectives; however, all current closures prohibit commercial groundfishing for all vessels. For the sake of simplicity, the rolling closures that apply to only common pool vessels were not considered because of the relatively small size of their cod harvest (~2% of the commercial ACL). Furthermore, only closures for the months of Nov-June were considered, because closures that occur at other times of year remain unaffected by the *Preferred Alternative*. As compared to the *No Action*, FW53 results in a decrease in total closure area in April and June, with an increase in total closure area in November, December, January, and May (Figure 3).

The IBS data were summarized by calculating the mean catch per unit effort (CPUE – kg per standard tow) of spawning cod (i.e., ripe, running or spent) per 30-minute block per month. The mean CPUE per block was then multiplied by the survey area within each block (depths from 20m to 140m) to provide an index of the biomass of spawning cod in each block. As with most fisheries data, the distribution of IBS catches has a long right tail. The influence of outliers is often listed as a reason for not using the mean as the measure of central tendency; however, in this case we don't want to disregard the outliers because they indicate spawning aggregations, exactly the phenomenon we are trying to capture the 'signal' of. These index values were then summed across all blocks to achieve an estimate of the entire spawning stock per month (Table 3). Note that the units here are arbitrary, as the area swept of a standard tow was not considered. The goal of this analysis was to determine the amount of protection afforded to spawning cod of the *Preferred Alternative* relative to the *No Action* closures. For this reason, it is only necessary to calculate the proportion of total spawners affected by area closures, not the absolute biomass.

The amount of spawning cod that occurred inside closed areas was estimated by multiplying the mean CPUE per month/block inside the closure by the closed survey area in that month/block (Tables 3 and 4). These values were then summed across all closed areas and compared to the estimate of the total to achieve a proportion of the spawning stock protected by area closures in each month (Table 5). To evaluate the net effect on each spawning component (i.e., winter vs. spring spawners), the estimates of protected spawners were summed across months for each season and compared to the equivalent measure from the entire IBS survey area.

Results: The results of this analysis indicate that the *Preferred Alternative* closures offer additional protection to winter spawners in all months November through January, with the largest increase in December. Across the entire season, the *Preferred Alternative* protects 35% more winter spawning biomass than the *No Action*. For the spring spawning component, the *Preferred Alternative* offers additional protection in May and June, but decreases protection in April. When aggregated across all three months, 8% less of the spring spawning biomass receives protection under the Preferred Alternative as compared to the *No Action*.

Interestingly, the IBS observed more spawning cod biomass in the spring than in winter, despite less coverage of the spring spawning season. If we assume that spawner biomass in June is roughly equal to that of May, the spring spawning component appears to be more than double the size of the winter pawning component.

References

Dean, M. J., Hoffman, W. S., Zemeckis, D. R., and Armstrong, M. P. 2014. Fine-scale diel and gender-based patterns in behaviour of Atlantic cod (Gadus morhua) on a spawning ground in the Western Gulf of Maine. ICES Journal of Marine Science 71:1474-1489

Kovach, Adrienne I, Timothy S. Breton, David L. Berlinsky, Lorraine Maceda, Isaac Wirgin. 2010. Fine-scale spatial and temporal genetic structure of Atlantic cod off the Atlantic coast of the USA. Marine Ecology Progress Series 410:177-195

Siceloff, L., and W. H. Howell. 2013. Fine-scale temporal and spatial distributions of Atlantic cod (Gadus morhua) on a western Gulf of Maine spawning ground. Fisheries Research 141:31-43

Zemeckis, D. R., Martins, D., Kerr, L. A., and Cadrin, S. X. 2014. Stock identification of Atlantic cod (Gadus morhua) in US waters: an interdisciplinary approach. ICES Journal of Marine Science 71:1490-1506

Table 1. Current closures that prohibit commercial groundfish fishing by all vessels in federal and state waters.

Closure	Type	Dates
GOM Cod Spawning Protection Area ("Whaleback")	Federal	June
WGOM Closed Area	Federal	All Year
Cashes Ledge Closed Area	Federal	All Year
Apr Sector Rolling Closure (blocks 125, 124, 132,133)	Federal	April
May Sector Rolling Closure (blocks 132, 133, 138, 139, 140)	Federal	May
Jun Sector Rolling Closure (blocks 139, 140, 146, 147)	Federal	June
Nov State Waters Rolling Closure (blocks 123, 124, 125)	Massachusetts	November
Apr State Waters Rolling Closure (blocks 123, 124, 125, 133)	Massachusetts	April
May State Waters Rolling Closure (block 133)	Massachusetts	May
Spring Cod Conservation Zone	Massachusetts	Apr 16 - Jul 21
Winter Cod Conservation Zone	Massachusetts	Nov 15 - Jan 31

Table 2. Calculation of the monthly spawner biomass index for the entire IBS survey area.

	Area	Number of Tows						Spawner CPUE (kg / tow)						Biomass Index (CPUE x Area)					
BLOCK	(km^2)	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*
154	567		8	6	3	6	6		0.5	0.0	0.2	0.0	0.0		292	0	139	0	0
151	214			1	1					0.0	0.0					0	0		
150	954		10	4	6	15	15		0.1	0.0	0.0	0.0	0.0		124	2	20	0	0
149	1439		14	15	11	39	39		0.2	0.0	0.1	0.0	0.0		233	63	107	0	0
148	671		5	4	6	9	9		0.0	0.0	0.1	0.0	0.0		15	0	75	0	0
147	303		6	3	3	3	3		0.1	0.0	0.4	0.0	0.0		32	4	114	13	13
146	1076		18	7	8	21	21		0.3	0.1	0.1	0.2	0.2		342	132	126	268	268
145	1643		7	8	4	19	19		0.9	0.1	0.0	0.2	0.2		1473	124	0	298	298
144	1787		17	2	17	40	40		0.5	0.1	0.0	0.1	0.1		959	141	85	113	113
143	497		7	3	2	14	14		0.1	0.0	0.0	0.0	0.0		68	0	0	7	7
140	285		1	1	1	1	1		0.0	0.0	0.0	0.1	0.1		0	0	0	26	26
139	1633	17	28	34	30	35	35	1.7	1.5	1.3	0.0	4.7	4.7	2698	2490	2133	77	7673	7673
138	771	2	49	14	17	32	32	10.7	0.6	0.6	0.1	4.4	4.4	8240	458	434	78	3424	3424
137	153		5	5	3	6	6		0.2	0.3	0.0	0.9	0.9		34	39	2	135	135
136	663		49	8	17	27	27		0.2	0.2	0.1	0.4	0.4		122	102	48	243	243
133	1012	44	10	29	44	26	26	0.6	1.2	2.3	12.0	112.9	112.9	619	1245	2331	12146	114265	114265
132	1959	53	55	78	66	60	60	3.0	5.0	7.8	38.4	23.3	23.3	5827	9705	15370	75205	45675	45675
131	28		2	2		1	1		0.6	1.4		0.6	0.6		16	40		16	16
130	271		10	9	7	8	8		1.5	1.0	1.0	6.2	6.2		397	265	260	1685	1685
129	270		8	7	5	5	5		0.9	0.4	0.7	2.0	2.0		248	109	186	533	533
125	1088	18	18	33	16	23	23	6.9	56.1	29.5	8.3	9.9	9.9	7556	61082	32145	9019	10756	10756
124	2087	41	51	46	45	55	55	1.8	12.2	6.2	4.9	8.2	8.2	3824	25390	12932	10257	17061	17061
123	277	3	9	4	8	11	11	0.7	1.9	3.7	34.2	6.7	6.7	186	530	1033	9481	1860	1860
116	38	4	1	4	3	4	4	0.3	0.6	0.1	0.0	1.5	1.5	13	22	3	0	58	58
115	626	12	12	12	21	11	11	0.0	0.1	0.0	0.0	0.1	0.1	5	32	5	4	39	39
114	1138	7	19	7	14	18	18	0.0	0.9	0.2	2.4	0.9	0.9	0	1048	196	2723	1005	1005
113	150	1	1		1			0.0	0.0		0.0			0	4		0		
Total =	21600	202	420	346	359	489	489							28967	106361	67603	120154	205152	205152

** IBS did not operate in June; data from May tows were used to represent June.*

Table 3. Calculation of the spawner biomass index for IBS tows that occurred inside current closures.

	Closure Area (km2)						Number of Tows						Spawner CPUE (kg / tow)						Biomass Index (CPUE x Area)					
BLOCK	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*
147						306						3						0.0						13
146						1081						21						0.2						269
145						1704						19						0.2						309
140					285	285					1	1					0.1	0.1					26	26
139	324	324	324	324	1633	1634	10	8	8	6	35	35	2.7	4.5	2.9	0.2	4.7	4.7	878	1457	940	68	7673	7678
138	50	50	50	50	770	51	2	2	2	1	32	4	10.7	6.0	1.4	0.6	4.4	10.1	534	300	69	31	3419	515
137		71	71	71	71	71		2	2	1	3	3		0.4	0.2	0.0	1.2	1.2		27	15	1	85	85
136		23		23	23	23		1		1	2	2		0.0		0.0	0.8	0.8		0		0	19	19
133				1014	1014	453				44	26	14				12.0	112.9	199.2				12170	114490	90238
132	939	939	939	1971	1972	940	10	25	32	66	60	35	4.5	6.0	14.9	38.4	23.3	28.9	4272	5638	13954	75666	45978	27206
130		246	246	246	246	246		9	8	6	7	7		1.3	0.9	0.5	7.0	7.0		320	226	131	1714	1714
129		190	190	190	190	190		4	4	2	2	2		0.6	0.6	0.9	2.3	2.3		120	119	170	435	435
125	587	219	219	1092	587		10	4	9	16	12		10.5	28.1	72.0	8.3	13.0		6149	6151	15764	9052	7613	
124	936	512	512	2087	937	512	14	3	7	45	13	8	2.9	2.4	19.9	4.9	2.5	3.0	2690	1217	10203	10257	2310	1555
123			18	38	38	18			1	1	1	1			1.1	0.5	0.6	0.6			20	21	22	10
114					0						2						5.8						0	
Total =	2836	2574	2569	7106	7766	7514	46	58	73	189	196	155							14523	15229	41308	107566	183784	130072

** IBS did not operate in June; data from May tows were used to represent June.*

Table 4. Calculation of the spawner biomass index for IBS tows that occurred inside Framework 53 Preferred Alternative closures.

	Closure Area (km2)						Number of Tows						Spawner CPUE (kg / tow)						Biomass Index (CPUE x Area)					
BLOCK	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*	Nov	Dec	Jan	Apr	May	Jun*
147						306						3						0.0						13
146						1081						21						0.2						269
145						0						19						0.2						0
140					285	285					1	1					0.1	0.1					26	26
139	324	324	324	324	1633	1634	10	8	8	6	35	35	2.7	4.5	2.9	0.2	4.7	4.7	878	1457	940	68	7673	7678
138	50	50	50	50	770	51	2	2	2	1	32	4	10.7	6.0	1.4	0.6	4.4	10.1	534	300	69	31	3419	515
137		71	71	71	71	71		2	2	1	3	3		0.4	0.2	0.0	1.2	1.2		27	15	1	85	85
136		23		23	23	23		1		1	2	2		0.0		0.0	0.8	0.8		0		0	19	19
133				342	1014	453				11	26	14				0.8	112.9	199.2				280	114490	90238
132	939	939	939	940	1972	1972	10	25	32	22	60	60	4.5	6.0	14.9	28.4	23.3	23.3	4272	5638	13954	26662	45978	45978
130		246	246	246	246	246		9	8	6	7	7		1.3	0.9	0.5	7.0	7.0		320	226	131	1714	1714
129		190	190	190	190	190		4	4	2	2	2		0.6	0.6	0.9	2.3	2.3		120	119	170	435	435
125	1091	1091	1091	587	806	559	18	18	33	12	16	12	6.9	56.1	29.5	10.1	12.4	14.7	7577	61250	32234	5955	9979	8230
124	1048	742	742	936	937	513	21	12	17	15	13	8	2.4	1.9	10.4	1.6	2.5	3.0	2541	1401	7717	1453	2310	1558
123			18	38	38	18			1	1	1	1			1.1	0.5	0.6	0.6			20	21	22	10
114					0						2						5.8						0	
Total =	3452	3676	3671	3747	7985	7402	61	81	107	78	200	192							15802	70513	55292	34771	186150	156768

** IBS did not operate in June; data from May tows were used to represent June.*

Table 5. Index of spawner biomass observed by the IBS from inside closed areas (No Action- Federal andStatus Quo State vs. Framework 53 Preferred Alternative), as compared to the total observed by the survey.

Winter Spawners

Month	All IBS	No Action/ Status Quo Closures		FW53 Closures			Change
November	28967	14523	50%	15802	55%	1278	+4%
December	106361	15229	14%	70513	66%	55284	+52%
January	67603	41308	61%	55292	82%	13984	+21%
Total	202932	71061	35%	141607	70%	70546	+35%

Spring Spawners

Month	All IBS	No Action/ Status Quo Closures		FW53 Closures			Change
April	120154	107566	90%	34771	29%	-72795	-61%
May	205152	183784	90%	186150	91%	2366	+1%
June*	205152	130072	63%	156768	76%	26696	+13%
Total	530457	421113	79%	377689	71%	-43733	-8%

** IBS did not operate in June; June closures were compared to May IBS data*

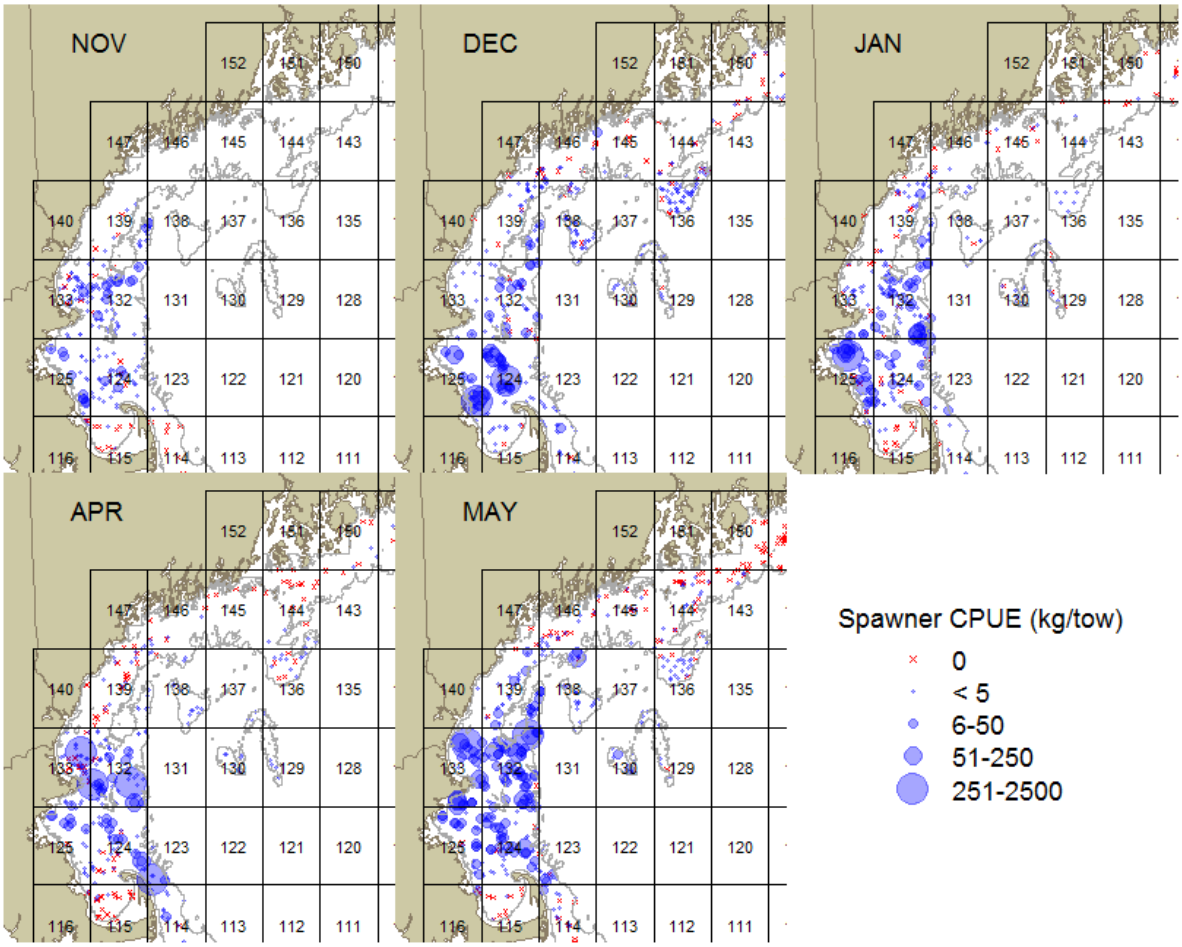


Figure 1. Catch per unit effort (CPUE) of cod in spawning condition (ripe, running or spent) by the Industry Based Survey (IBS) for Gulf of Maine Cod. The gray line indicates the limits of the IBS survey area (20-140m depths).

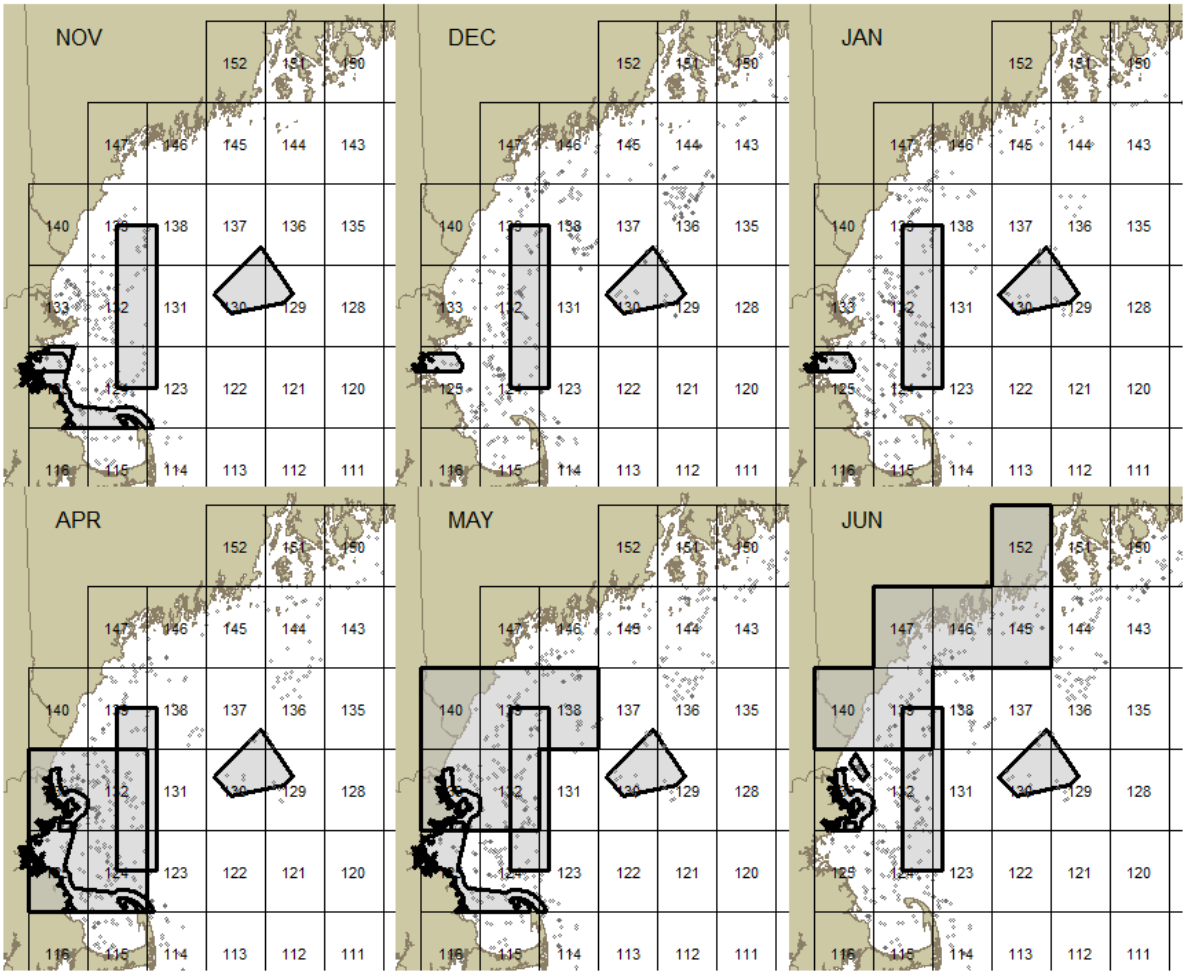


Figure 2. No Action (federal) and Status Quo (state) closures that prohibit commercial groundfishing are shown in gray. Gray points identify IBS tow locations in each month. Note that May tows are shown in comparison to June closures, due to a lack of survey coverage in June.

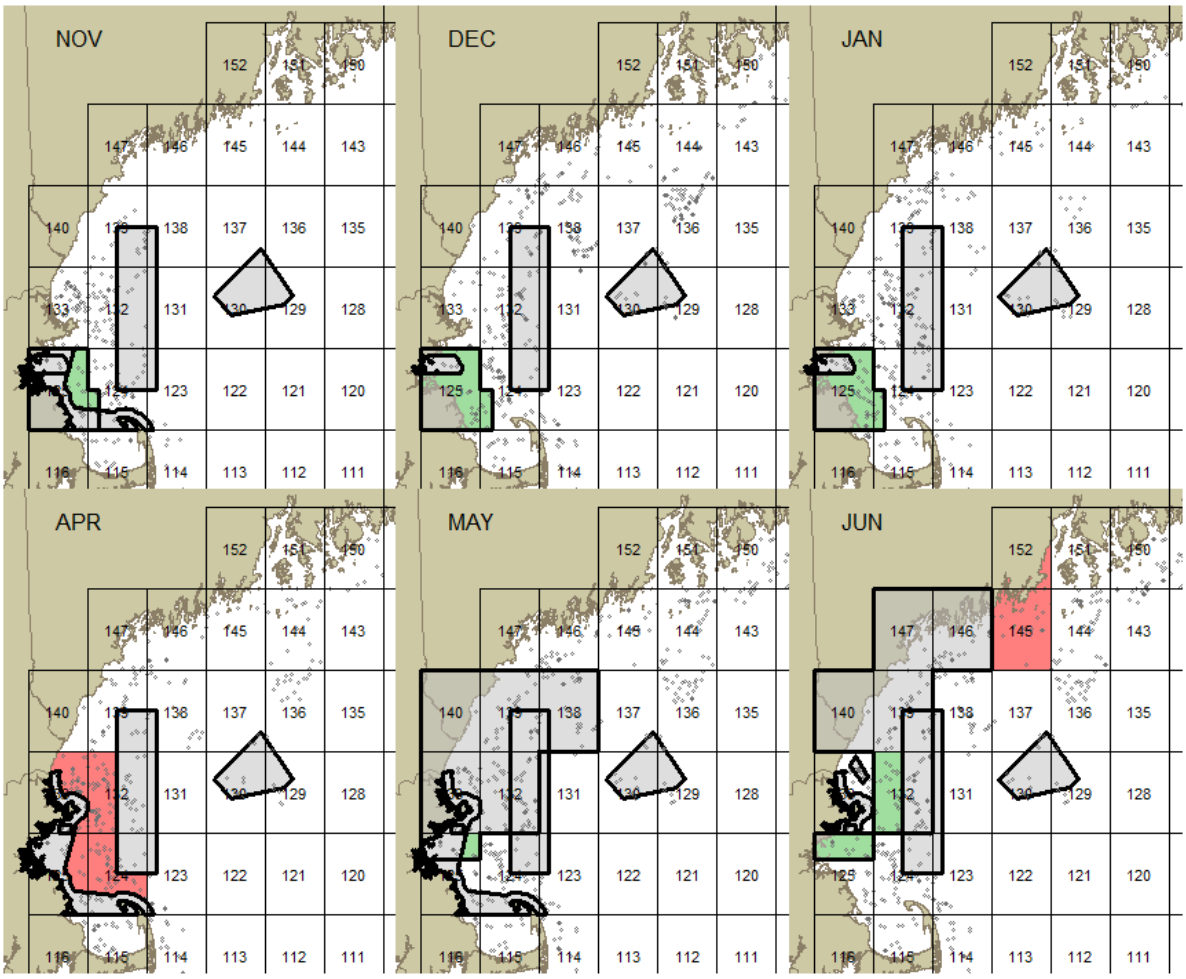


Figure 3. Changes to No Action closures under FW53 as the Preferred Alternative. Green areas are additional closures, whereas red areas would be open under the FW53 Preferred Alternative. Grey areas are No Action (federal) and Status Quo (state) closures that would remain unaffected by the measures in FW53. Gray points identify IBS tow locations in each month. Note that May tows are shown in comparison to June closures, due to a lack of survey coverage in June.

Examining Gulf of Maine (GOM) Cod Spawning Activity in the Coastal Waters of Maine and New Hampshire

Sally Sherman and Jamie Cournane– January 7, 2014

Background: Established in the fall of 2000, the Maine/New Hampshire (MENH) trawl survey covers the nearshore component of the Gulf of Maine waters along the coasts of Maine and New Hampshire. It operates on a random stratified sampling scheme and follows published standard protocols. A total of 20 strata are distributed over four depths: 5-20 fathoms, 21-35 fathoms, 36-55 fathoms, and >56 fathoms roughly bounded by the 12-mile limit, and contains five longitudinal regions. The current survey objective is to complete 120 stations. The number of random stations per stratum is proportional to the area of the stratum. Twenty minute standard bottom trawls are performed using a sample net specifically designed to sample bottom populations while not targeting any specific species. A survey consists of 25 sea days over a 5-week period conducted in the spring, typically from the first full week of May through the first week of June and in the fall from the last week of September through the month of October. The survey contracts a commercial fishing vessel, the Robert Michael, a 54' stern trawler, each year to accomplish the work. In order to evaluate management measures under consideration in Framework Adjustment 53, an examination of Atlantic cod data from the MENH survey is presented.

Data and Methods: An examination of biological information on spawning Atlantic cod begins with stratifying the survey data into two time periods (Spring: 2001-2007 and 2008-2014; Fall: 2000-2007 and 2008-2013) and by month (Spring-May and Fall-October). Figures illustrate survey locations with Atlantic cod present and absent (number/tow) based on this stratification (Figures 1 and 4). Next, maps display survey locations with the number of Atlantic cod per tow equal to or greater than 31 cm, which is the L50 (i.e., length in which 50% of the females are considered mature) for cod in the MENH survey (Figures 2 and 5). For mature cod examined, maps display the locations of individual cod collected at different maturity stages, using a standard classification scheme (as described in Burnett et al. 1989) (Figures 3 and 6). The MENH data was interpreted based on the presence/absence of cod in 30-minute blocks, and the relative number of cod within each classification and time period. An overlay of 30-minute blocks in each map provides a reference for comparing management measures under consideration in Framework Adjustment 53.

Results:

Summary of spatial (30-minute blocks) and temporal patterns in the cod data from the MENH surveys, based on visual inspection of Figures 1-6:

- Areas of relative cod abundance, based on the number of cod per tow in these surveys, regardless of time period (Figure 1 and Figure 4):
    - In the spring (May): waters off NH (132 and133), Southern ME (139), Midcoast ME (145,146,150,151) and Downeast ME (153 and 154), and
    - In the fall (October): waters off NH (132 and 133), Midcoast Maine (144,150, and 151), and Downeast Maine (153 and 154).

- Areas of cod caught in developing or ripe spawning condition,, regardless of time period (Figure 1 and Figure 4):
    - In the spring (May): waters off NH (132 and133), Southern ME (139, 147), Midcoast ME (145 and 146) and Downeast ME (153), and
    - In the fall (October): waters off Southern Maine (138 and 139).
- When comparing between the two time periods, in the more recent period:
    - Fewer locations with relatively high fish per tow for the spring and fall surveys observed (Figure 1 and Figure 4), and
    - More frequently observed fish greater than 31 cm in spring but less frequently in the fall surveys (Figure 2 and Figure 5). Of note, the percent of larger fish by year and in Southern ME and NH has remained stable, but in recent years has declined in Downeast ME.

Conclusions:

The GOM Cod protections closures being considered in FW 53 for the commercial fishery modify existing rolling closures in May for all vessels, closing blocks 132, 133, 138, 139, 140 and 125 north of 42° 20'. This configuration expands the overall closure area for sector vessels by adding the northern half of block 125, and contracts the number of blocks closed to the common pool, primarily in the central GOM. October closures apply only to common pool vessels and remain unchanged in both the GOM cod protection closures and the No Action alternatives, with blocks 124 and 125 closed during that month. Under the No Action for May, sector rolling closures include blocks 132,133,138,139, and 140, and common pool rolling closures in blocks 124, 125, 129, 130, 131, 132, 133, 135, 136, 137, 138, 139, 140. The MENH surveys do not cover blocks 124, 125, 129, 130, 131, 136, and 137, so this information cannot be used to examine the potential impact of modifying the time/area closures for those blocks in May and October.

Based on the survey coverage, the proposed GOM cod protection closures in May and October would continue to provide the same protection for aggregating and spawning cod that is currently afforded by the sector rolling closures provided these animals continue to exhibit behavior observed in the recent period. The impact of opening common-pool rolling closures in areas that would not be closed under the alternative cannot be discerned from the MENH data as the survey does not cover these blocks. In addition, waters down in Downeast Maine (blocks 153 and 154) do not have federal spatial management measures in place, but appear to be important areas for cod. In the fall (October), impacts are expected to be neutral. Overall in May and October, the No Action and the GOM cod protection closure alternative would continue to provide positive benefits for cod. However, this information cannot be used to examine the impact of April being open under Option 2 compared with closed under Option 1/No Action.

Figures:

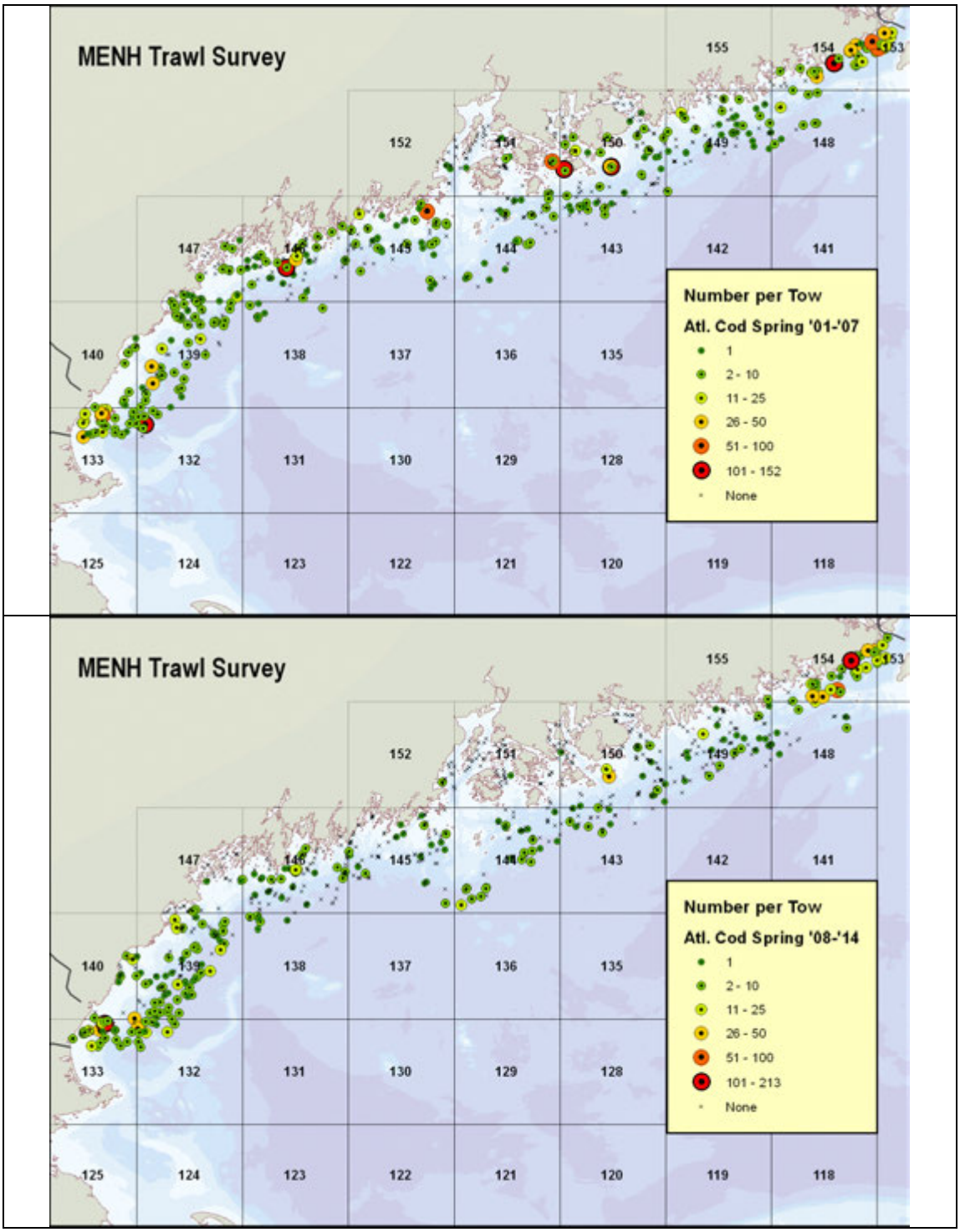


Figure 1 - Spring survey locations identified with the number of Atlantic cod per tow (circles of increasing size) and presence (circles) or absence (x's) indicated, for 2001-2007 (top) and 2008-2014 (bottom). Data source: ME/NH trawl survey, May 2001-2014, ME DMR.

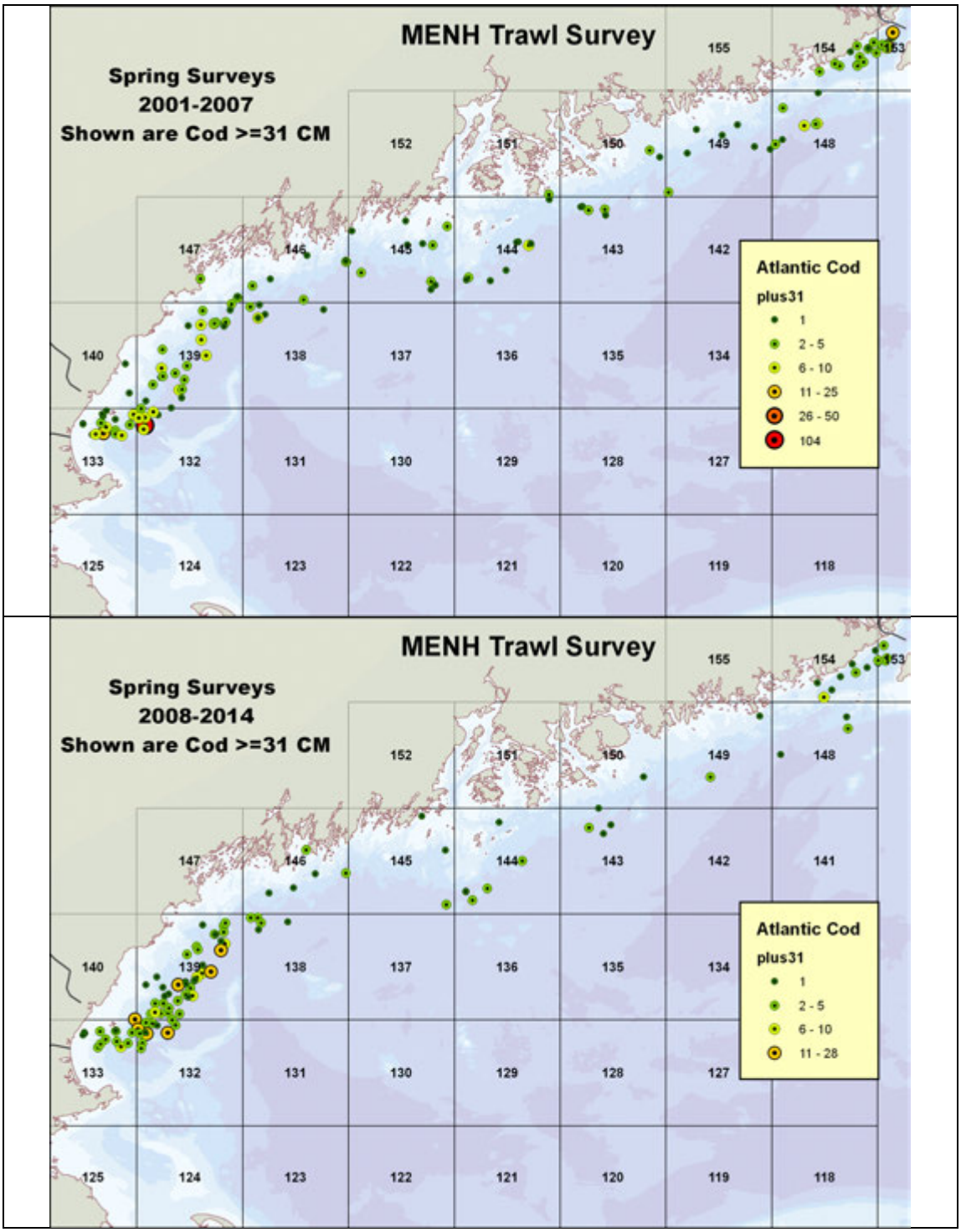


Figure 2- Spring survey locations identified with the number of Atlantic cod per tow (circles of increasing size) present equal or greater than 31 cm, for 2001-2007 (top) and 2008-2014 (bottom). Data source: ME/NH trawl survey, May 2001-2014, ME DMR. Total fish are 475 and 523 respectively.

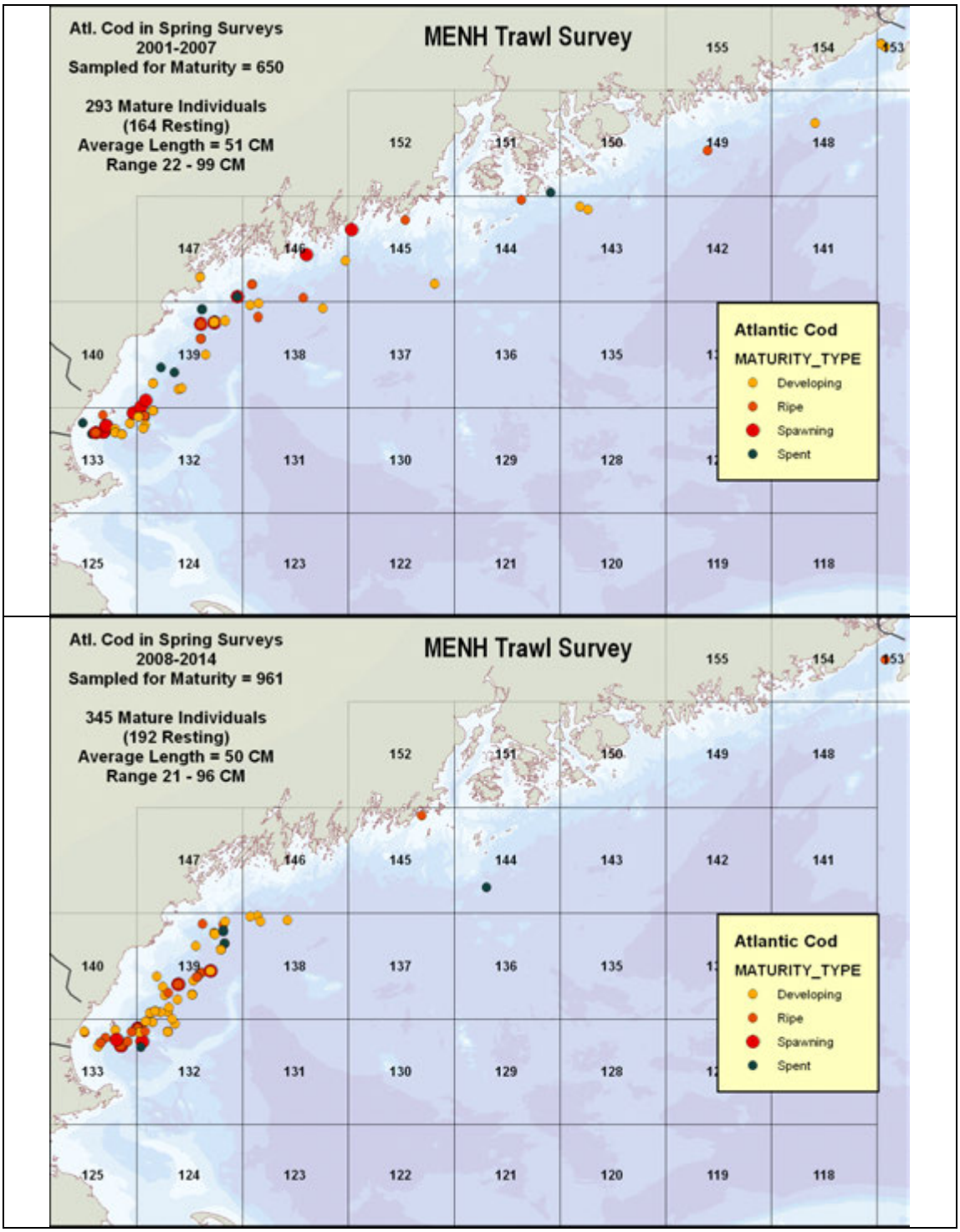


Figure 3- Spring survey locations identified with Atlantic cod for mature individuals and their spawning condition, for 2001-2007 (top) and 2008-2014 (bottom). Data source: ME/NH trawl survey, May 2001-2014, ME DMR.

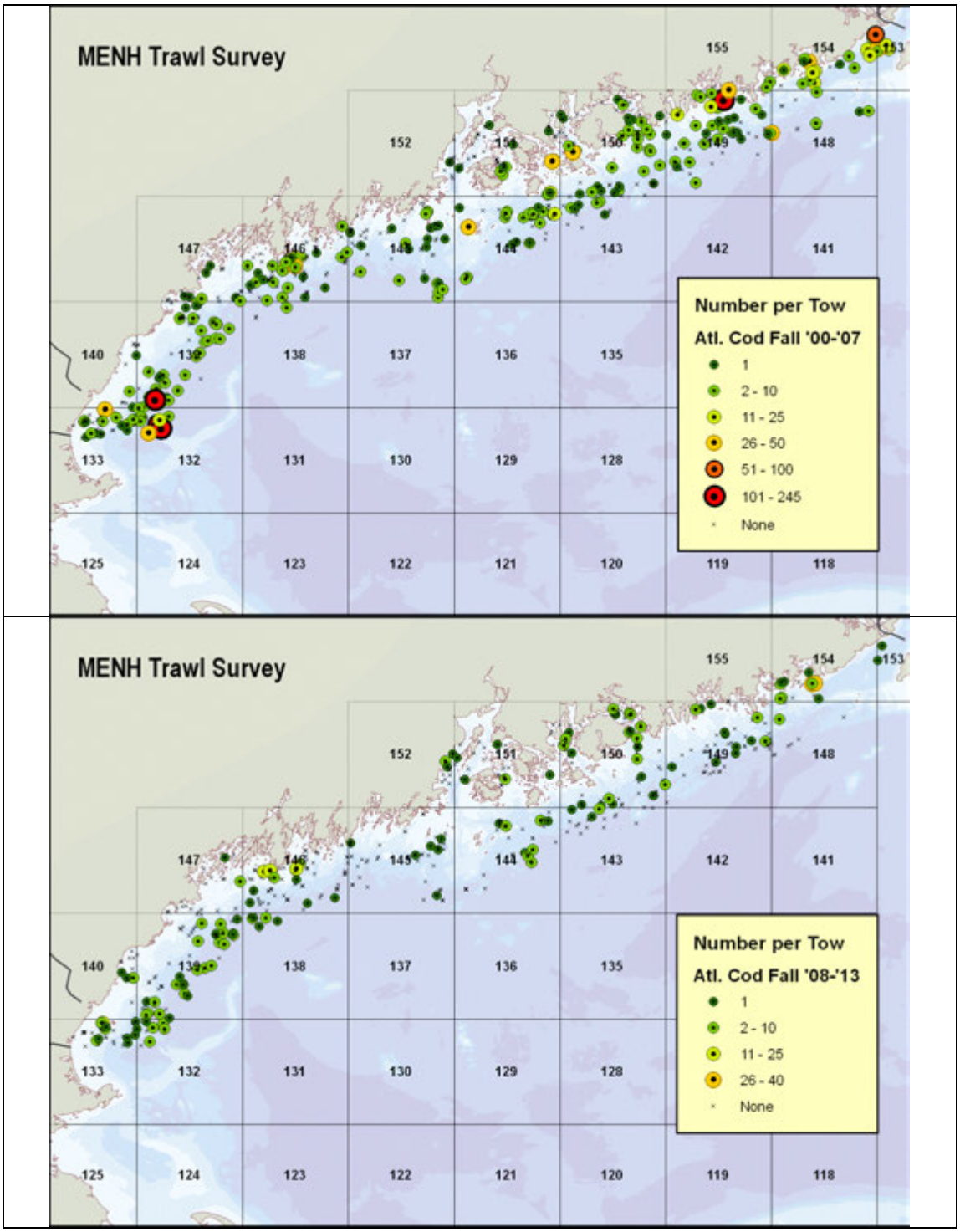


Figure 4 - Fall survey locations identified with the number of Atlantic cod per tow (circles of increasing size) and presence (circles) or absence (x's) indicated, for 2000-2007 (top) and 2008-2013 (bottom). Data source: ME/NH trawl survey, October 2000-2013, ME DMR.

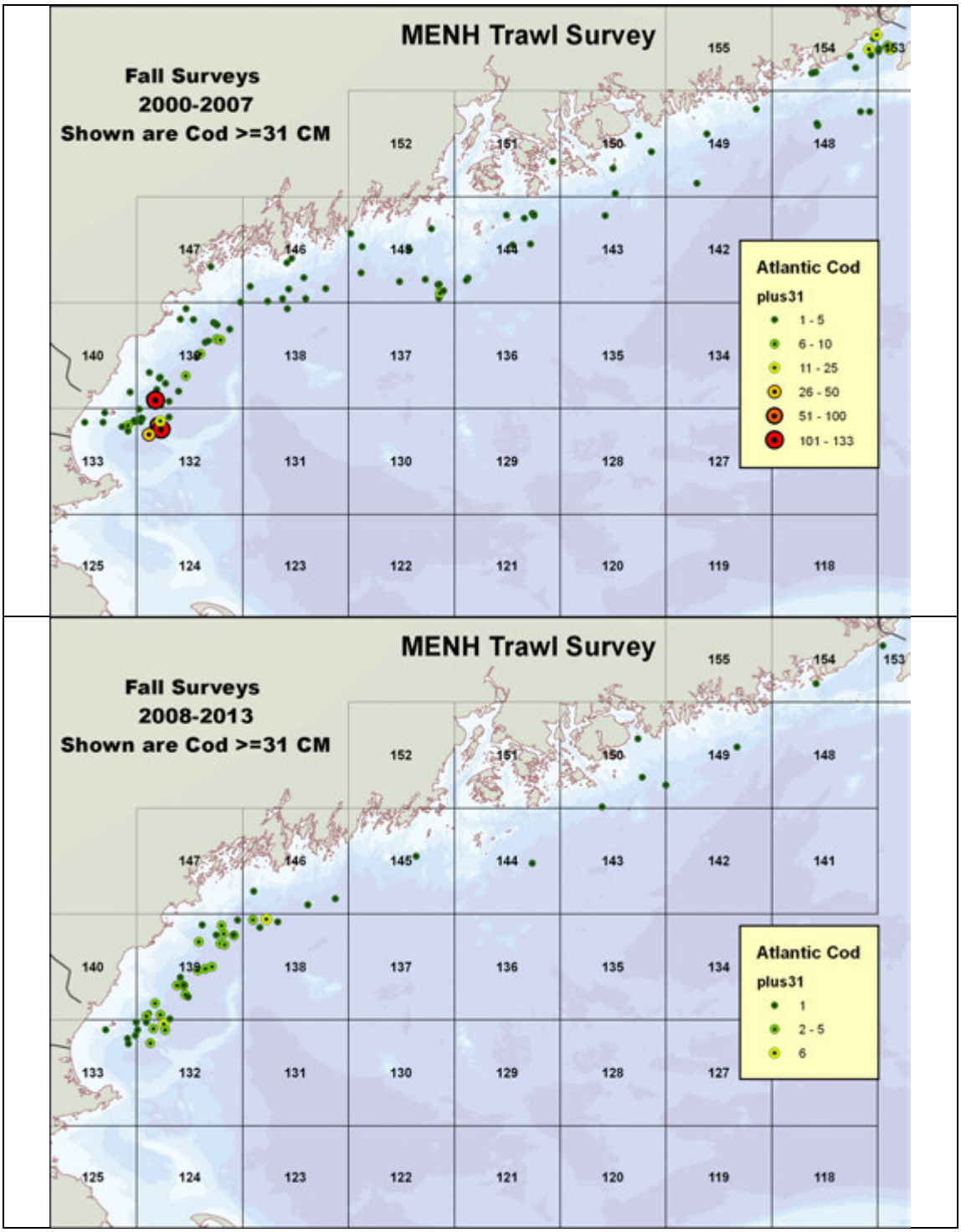


Figure 5- Fall survey locations identified with the number of Atlantic cod per tow (circles of increasing size) present equal or greater than 31 cm, for 2000-2007 (top) and 2008-2013 (bottom). Data source: ME/NH trawl survey, October 2000-2013, ME DMR. Total fish are 838 and 427 respectively.

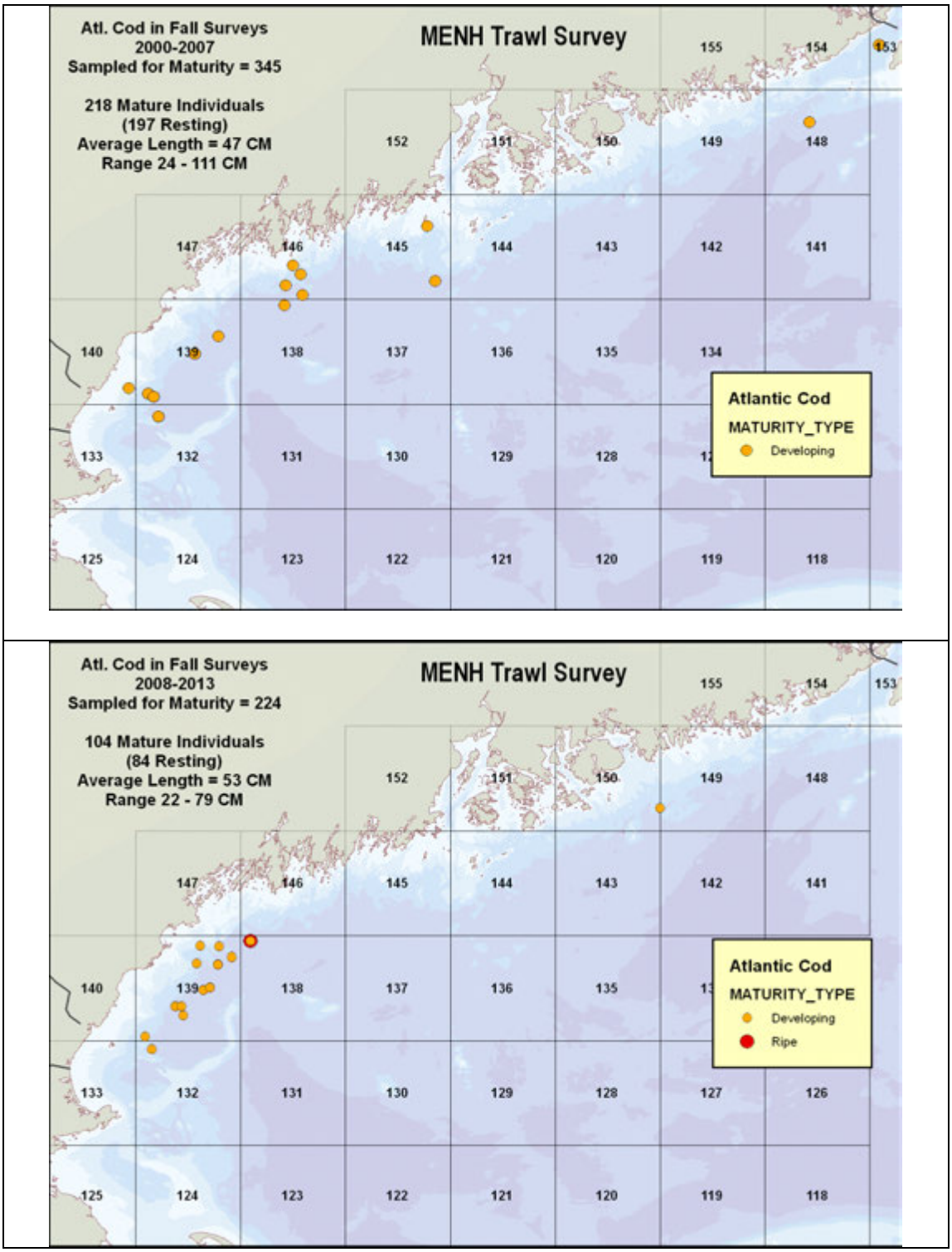


Figure 6- Fall survey locations identified with Atlantic cod for mature individuals and their spawning condition, for 2000-2007 (top) and 2008-2013 (bottom). Data source: ME/NH trawl survey, October 2000-2013, ME DMR.

Examination of seven spring spawning groundfish stocks in the NEFSC bottom trawl survey for comparison to spatial management measures under consideration in Framework Adjustment 53

Paul Nitschke and Jamie Cournane – January 7, 2015

Overview:

The Northeast Fisheries Science Center (NEFSC) spring bottom trawl survey was examined for evidence of spawning activity for seven groundfish stocks that spawn in the spring (cod, winter flounder, yellowtail flounder, American plaice, witch flounder, windowpane flounder and haddock) for comparison to the proposed changes in mortality/spawning closures for Gulf of Maine (GOM) cod in Framework Adjustment 53. This is not a full quantitative analysis of the survey data, but rather a visual inspection of the spatial/temporal patterns for mature and spawning condition fish observed in the NEFSC spring bottom trawl survey.

The suite of GOM cod protection closures (*Preferred Alternative*) includes the removal of time/area closures during the month of April, and modifies the existing rolling closures in the month of May.

Dataset and Data Selection:

The NEFSC spring survey has covered GOM survey strata during April and May since 2009, when the FSV Bigelow was used to conduct the bottom trawl survey (i.e, sampling coverage for inshore GOM improved with the transition from the Albatross to the Bigelow). The majority of tows in the western Gulf of Maine are completed in the last two weeks of April and the first two weeks of May. Therefore, the combination of data collected throughout April and May was considered a single temporal block for this analysis. An examination for each month separately was not possible due to low sample size.

To obtain adequate spatial coverage, 2009 and 2011 through 2014 surveys were combined in the analysis. The 2010 survey was omitted because inshore Massachusetts strata, which can be important for detecting spawning, were not completed for this survey year and therefore inconsistent with other years sampled. Only sampling locations (starting latitude and starting longitude) intersecting Broad Stock Area 1 - which is identical to the GOM cod stock area - were used in the analysis, for a total of 364 survey tows.

Mature and Spawning Fish Indicators:

Survey tows were examined for fish abundance greater than L50 (i.e., length in which 50% of the females are considered mature) and for abundance of fish in spawning condition. Evidence of spawning was defined as maturity stages ripe, ripe and running and spent following a similar approach to what was done for the GOM cod industry-based survey (IBS) analysis (see Dean and Correia in this Appendix). Fish abundance greater than L50 was calculated as the "Mature Fish Index" for each stock. Then, an estimate of spawning abundance was calculated for each tow as the proportion of fish in spawning condition multiplied by the numbers of fish greater than L50 since only a subsample of fish caught on each tow is staged for maturation. This assumes the likelihood of spawning does not change

considerably with sizes greater than L50, since maturation subsampling protocols are done at length. This is referred to as the "Spawning Fish Index."

The L50's used in this analysis were based on female fish (and was applied equally to males and females) using information from either the most recent stock assessment (Palmer, 2014) or from O'Brien et al. (1993) (Table 1). Peak spawning was compiled from Omnibus Habitat Amendment 2, Appendix B (Table 2). Note that previous PDT work on spawning cod in the GOM suggests a peak spawning period slightly later (May-June) (see Dean and Correia in this Appendix). The PDT analysis also found little evidence of cod spawning in March. Windowpane flounder has a peak spawning period in the summer but this species is known to have a very protracted spawning season from May to November, which is why it was included in this analysis.

Table 1- Summary of stocks examined in the analysis including length (cm) when 50% of females would be mature fish (L50s).

Stock	L50s
Cod	43 cm
Winter flounder	30 cm
Yellowtail flounder	31 cm
American plaice	27 cm
Witch flounder	30 cm
Windowpane flounder	23 cm
Haddock	38 cm

Plots for the combination of each species and index were developed using ArcGIS (Figures 1-7).

Results:

Comparison of abundance of fish greater than L50 (Mature Fish Index) with abundance of fish in spawning condition (Spawning Fish Index) for each stock is shown in Figures 1 through 7. Circles of increasing size indicate the magnitude of the value at the center of the sampled location. Break points were determined by using examining the distribution of the data for each species and each index, parsing it into quintiles (i.e., break points at 20%, 40%, 60%, and 80% of the data) using ArcGIS. Note that that scale changes when comparing maturity abundance plots with spawning condition plots.

Table 2 - Spawning periods for regulated groundfish stocks in the Gulf of Maine (Source: Omnibus Essential Fish Habitat Amendment 2; Appendix B).

spawning months

peak spawning months

Species	*January*	*February*	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*October*	*November*	*December*	*Notes*
American Plaice													
GOM Atlantic Cod													
Atlantic Halibut													Atlantic Canada waters
GOM Haddock													
Ocean Pout													
Pollock													
Redfish													copulation from Oct-Jan; fertilization from Feb-April; no peak times evident
GB-GOM White Hake													no evidence of spawning in the GOM
Windowpane													
GOM Winter Flounder													*peak spawning is from Press et al. 2014
Witch Flounder													
CC-GOM Yellowtail Flounder													

* Press, Y. K., M. J. Wuenschel, and R. S. McBride. 2014. Time course of oocyte development in winter flounder (Pseudopleuronectes americanus) and spawning seasonality for the Gulf of Maine, Georges Bank, and Southern New England stocks. J. Fish Biol. 85:421-445.

Table 3- Summary of the average mature and spawning fish indices (in numbers of fish). The percentage of the spawning index relative to the mature index is also shown. May and April are lumped into a single time block for this analysis. Spatial patterns are shown in the figures and are not summarized in this table.

Stock	Mature Fish Index	Spawning Fish Index	Spawning Index percentage of Mature
Cod	5.99	0.647	11%
Winter flounder	3.23	1.69	52%
Yellowtail flounder	15.08	10.88	72%
American plaice	12.62	6.43	51%
Witch flounder	3.03	0.53	18%
Windowpane flounder	0.29	0.05	16%
Haddock	3.01	0.99	33%

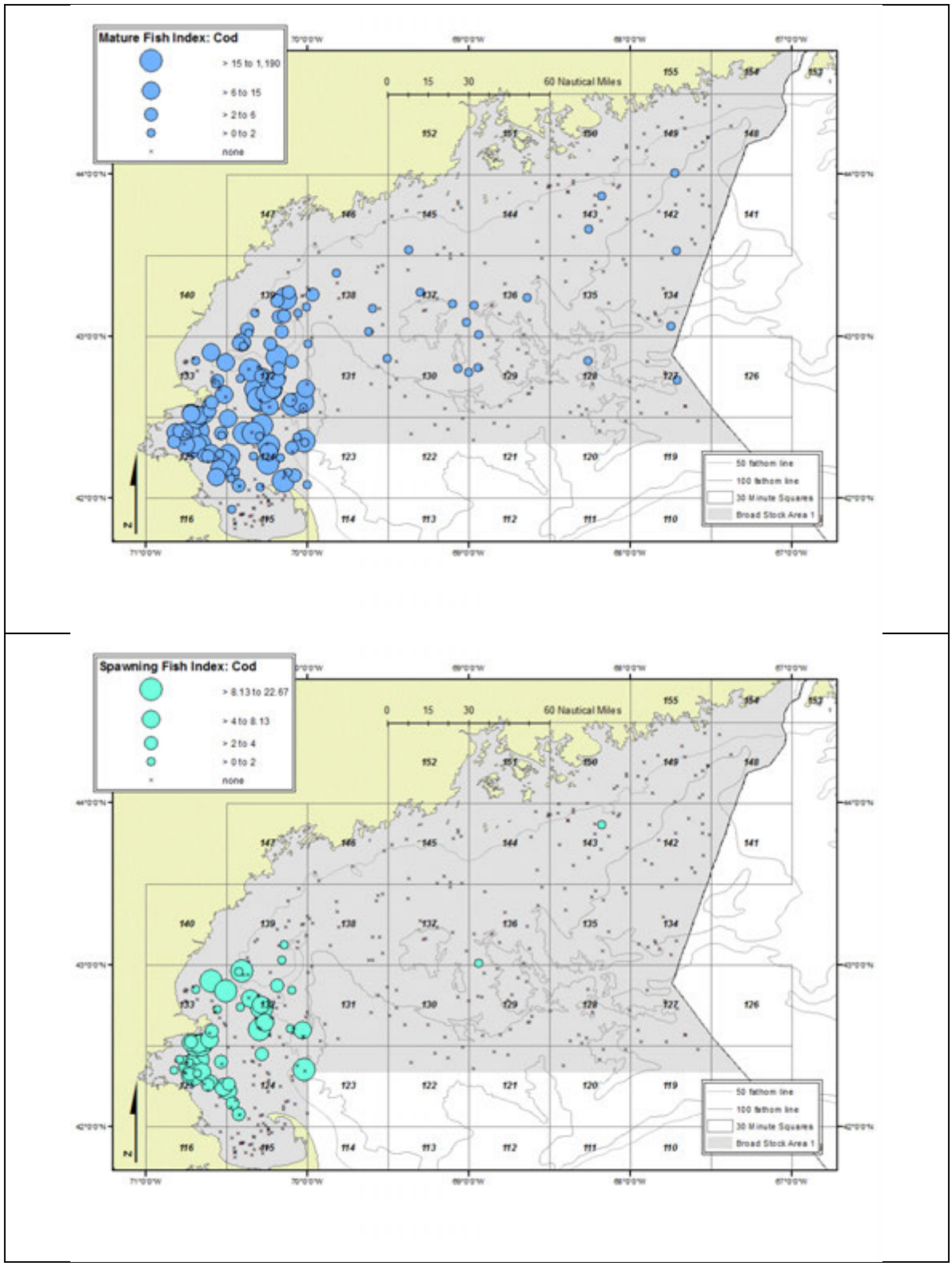


Figure 1- Mature Fish Index (above) and Spawning Fish Index (below) for Atlantic cod.

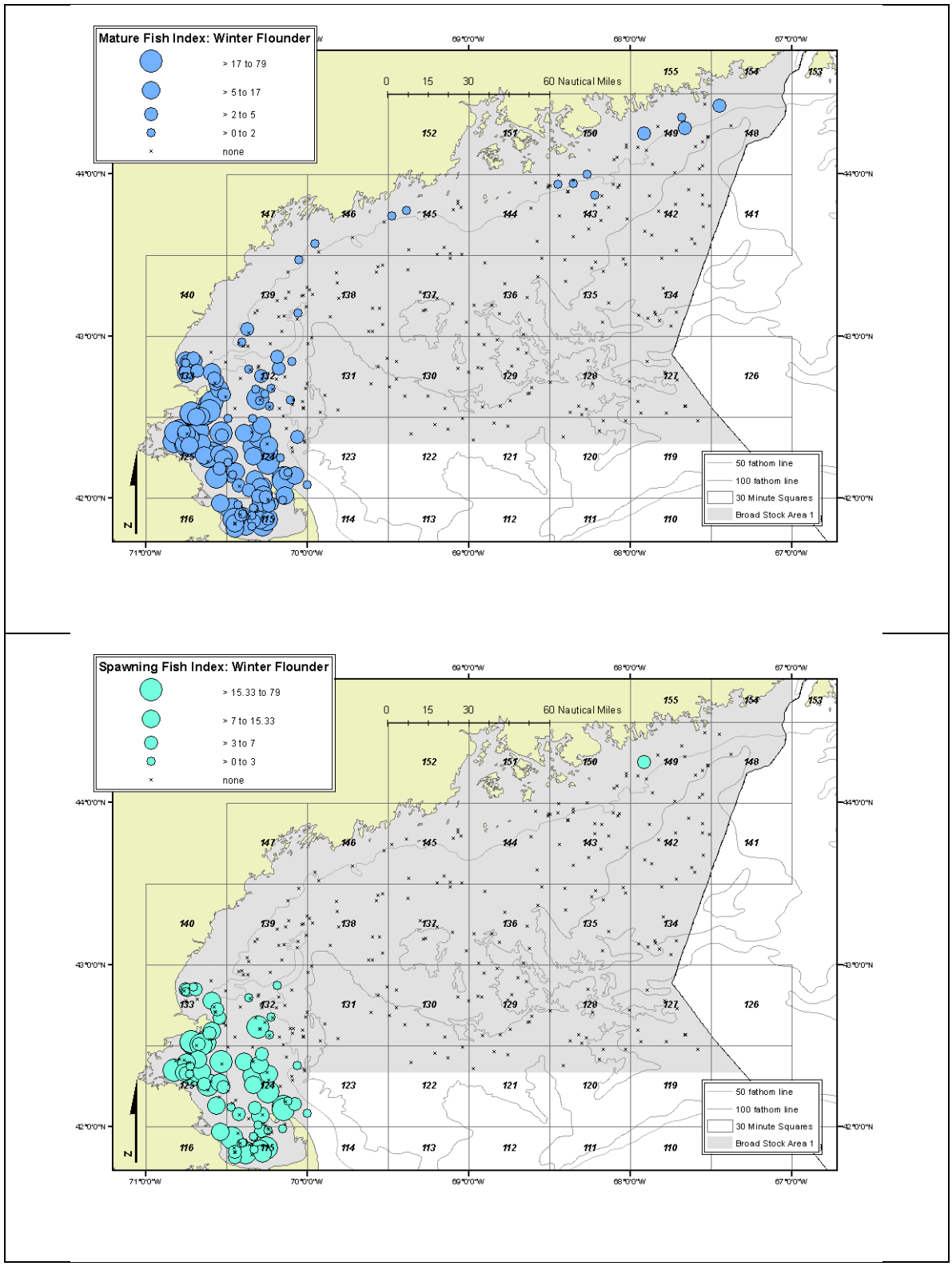


Figure 2- Mature Fish Index (above) and Spawning Fish Index (below) for winter flounder.

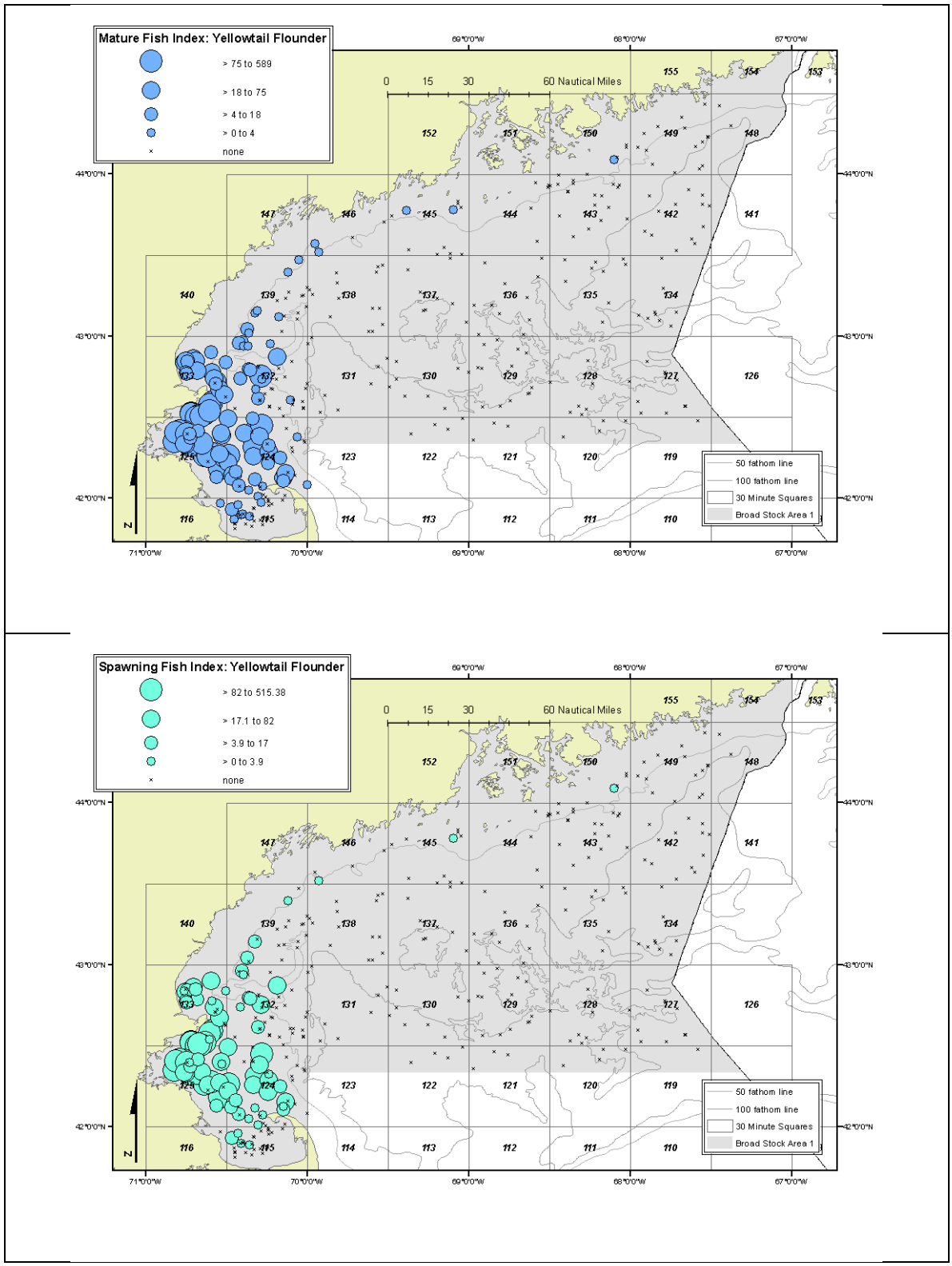


Figure 3- Mature Fish Index (above) and Spawning Fish Index (below) for yellowtail flounder.

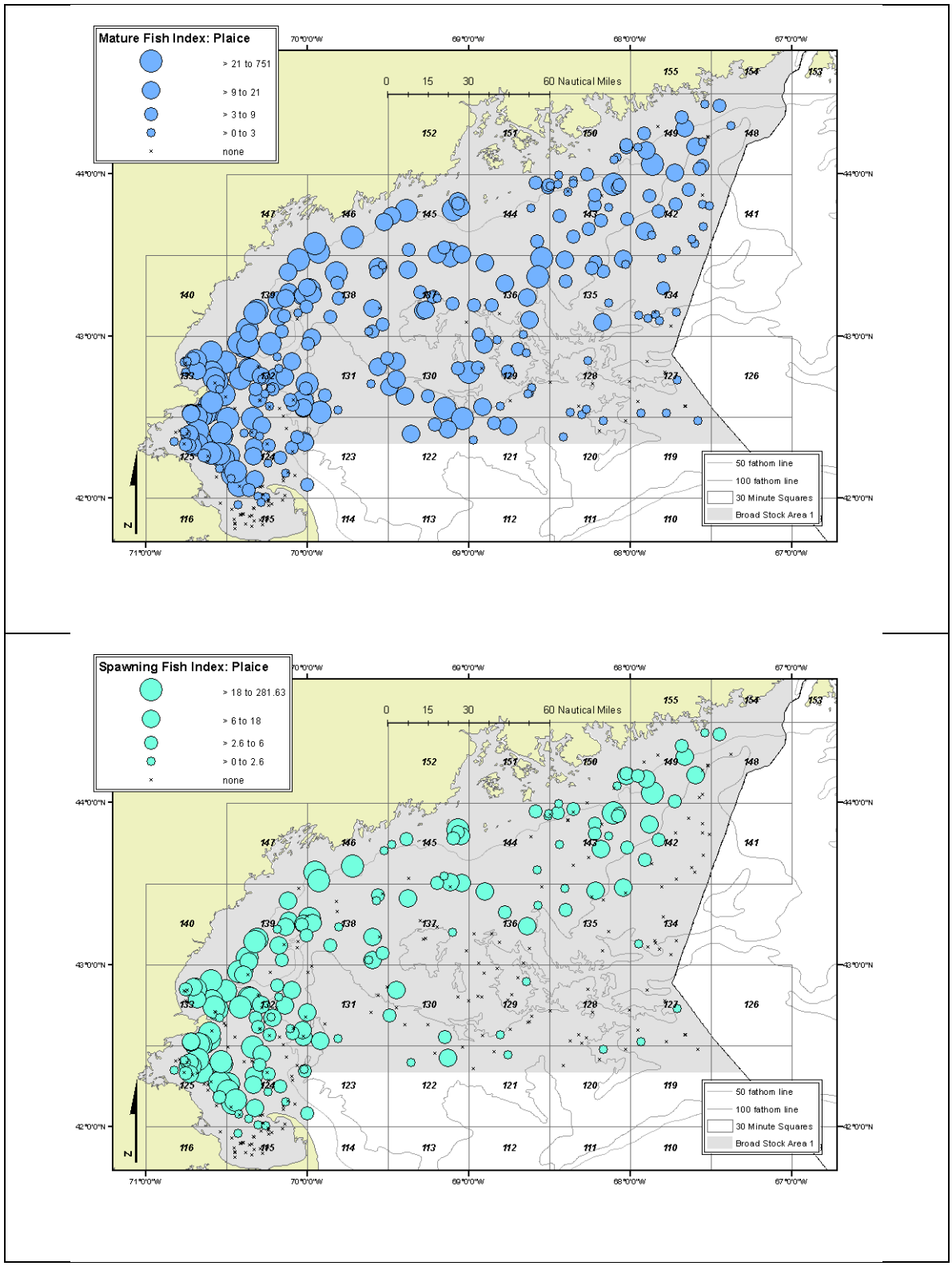


Figure 4- Mature Fish Index (above) and Spawning Fish Index (below) American plaice.

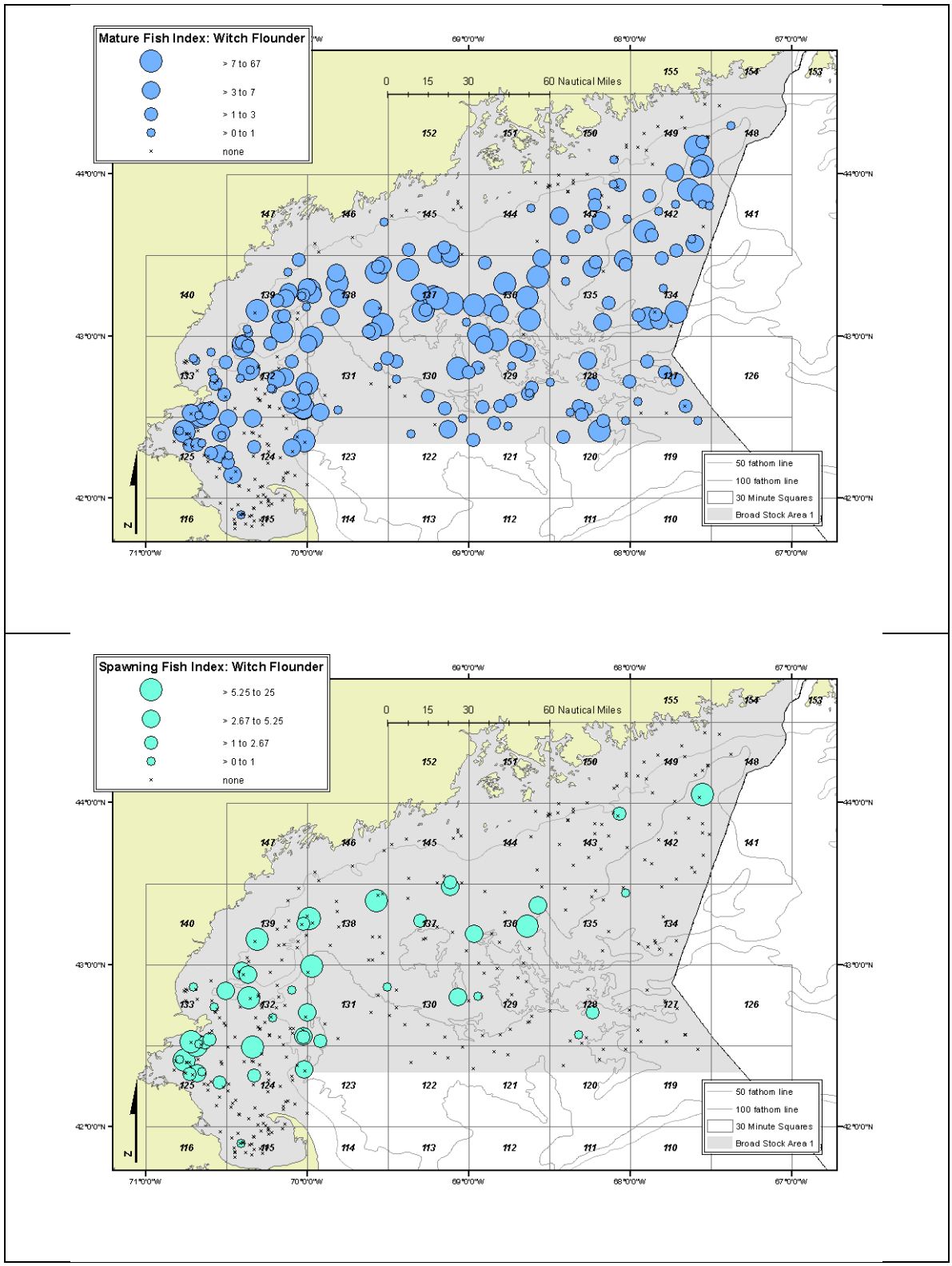


Figure 5- Mature Fish Index (above) and Spawning Fish Index (below) for witch flounder.

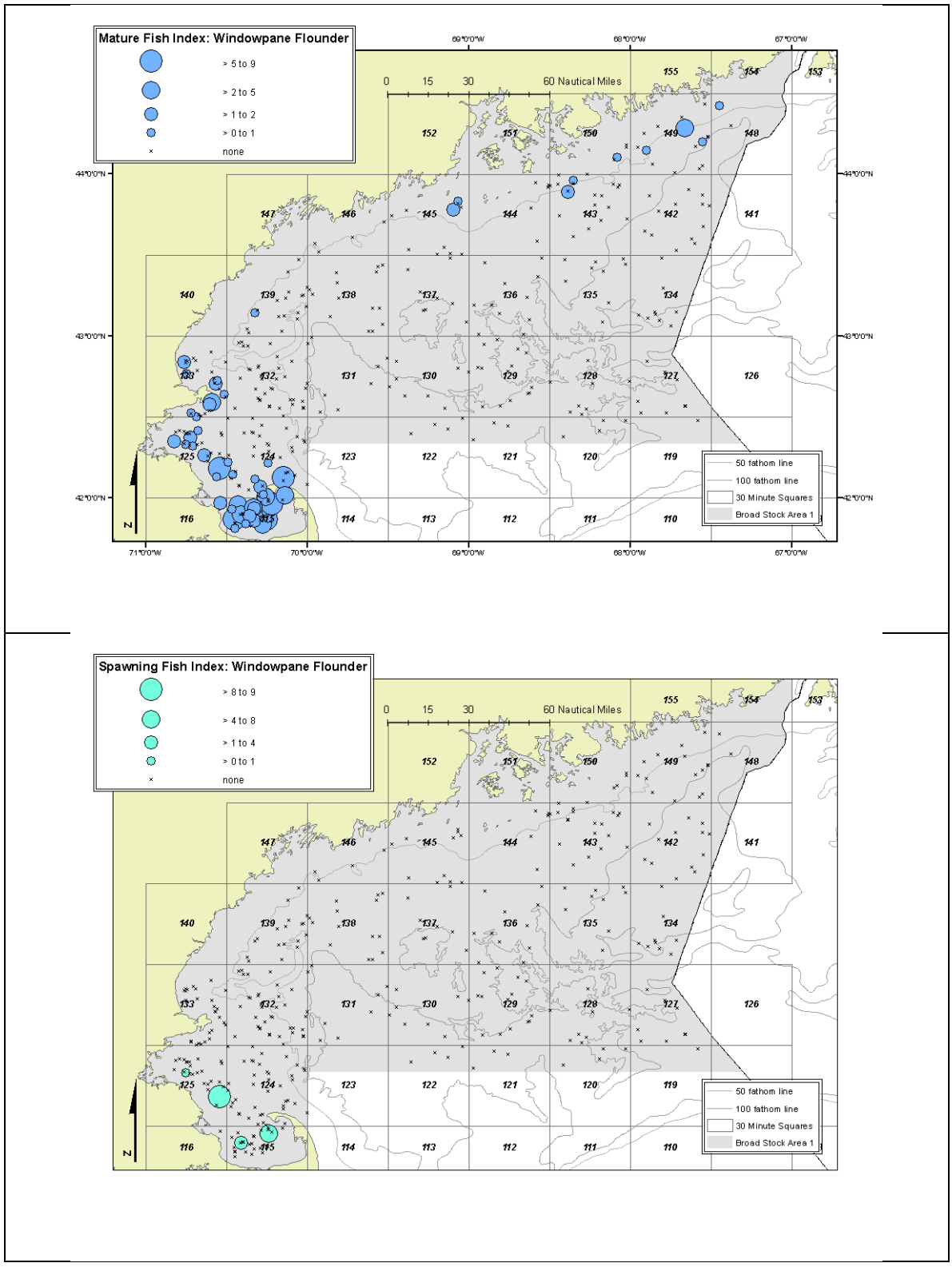


Figure 6- Mature Fish Index (above) and Spawning Fish Index (below) for windowpane flounder.

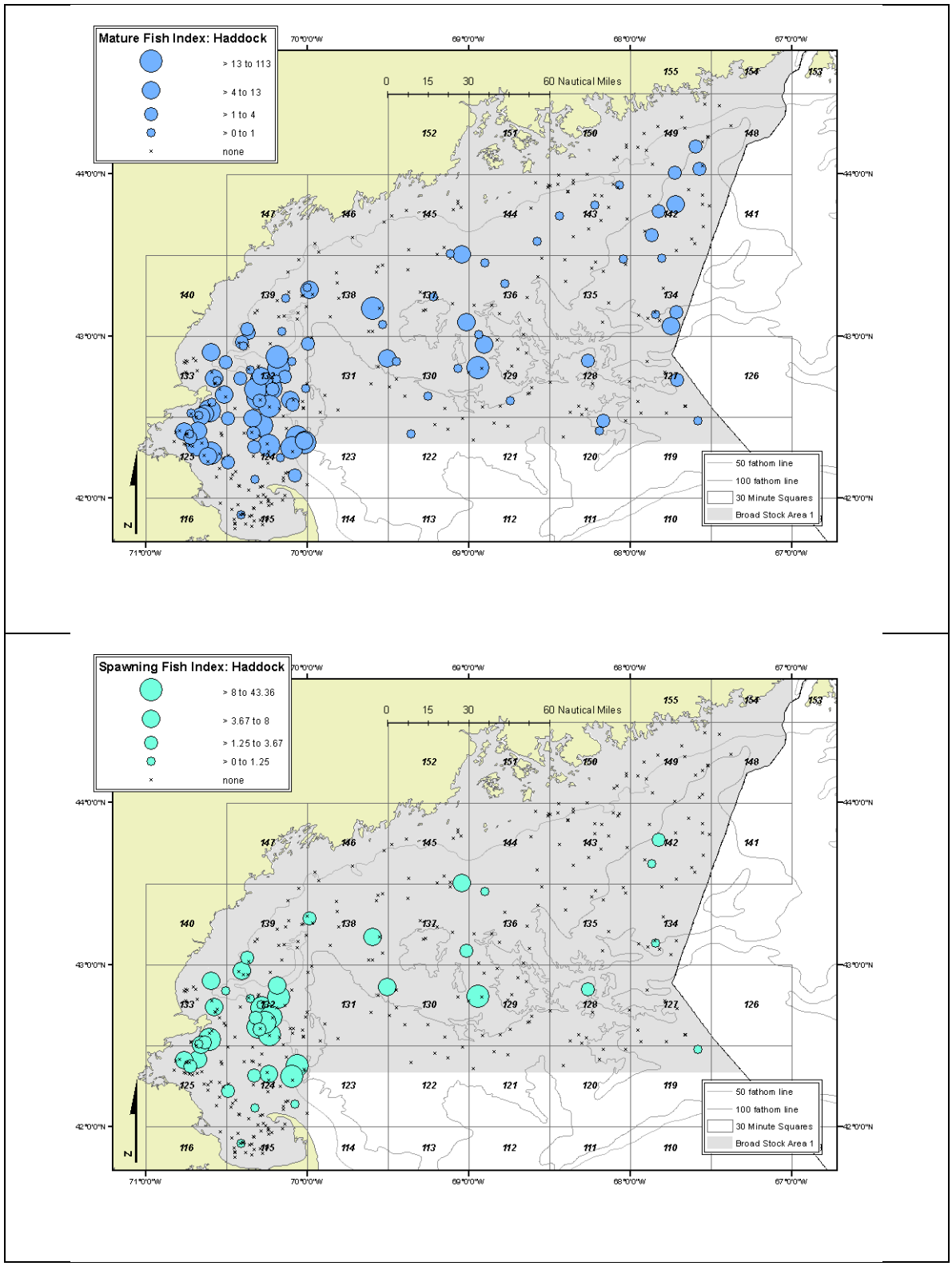


Figure 7- Mature Fish Index (above) and Spawning Fish Index (below) for haddock.

Conclusions:

The raw index (average numbers of fish/tow) for cod was relatively low in comparison to the maturity index (Table 3). This could be due to tows being conducted at the beginning of the spring spawning season. However the cod that were observed in spawning condition were within blocks 124, 125, 132, 133. The proportion of the index in spawning condition was relatively high for groundfish stocks of winter flounder, yellowtail flounder, American plaice, and haddock. Higher concentrations of spawning condition fish can be seen in blocks 124, 125, and 133 for winter flounder, and yellowtail flounder. For haddock, it appears all four blocks (124, 125, 132, and 133) are important for spawning. These blocks also appear to be important spawning blocks for American plaice. However, American plaice in spawning condition appear to be more widely distributed across the Gulf of Maine. Witch flounder and windowpane flounder showed relatively few fish in spawning condition. Additionally, witch and windowpane flounder that were observed in spawning condition did not appear to be as highly concentrated in blocks 124, 125, 132, and 133.

Comparison to the Alternatives in FW 53:

No Action

Under the No Action, the Sector Rolling Closures in April include 124, 125, 132, 133 and in May include 132, 133, 138, 139, 140. The Common Pool Rolling Closures include these additional areas in April 121, 122, 123, 129, 130, and 131 and in May 124, 125, 129, 130, 131, 136, and 137. In April and May, the No Action alternative in blocks 124,125,132, and 133 provides spawning protection for cod, winter flounder, yellowtail flounder, American plaice, and haddock and to a lesser extent witch flounder and windowpane flounder.

Preferred Alternative

Under the Preferred Alternative, there would be no Sector or Common Pool rolling closure in April. In May, the closures for both Sector and Common Pool would be May: 132, 133, 138, 139, 140, and 125 north of 42° 20'. Compared to the No Action alternative, the Preferred Alternative would negatively impact spawning fish in April with the opening of blocks 124,125,132, and 133, and in May in blocks 124 and 125 south of 42° 20' for cod, winter flounder, yellowtail flounder, American plaice, and haddock and to a lesser extent witch flounder and windowpane flounder.

References:

O'Brien, L., J. Burnett, and R. K. Mayo. 1993. Maturation of Nineteen Species of Finfish off the Northeast Coast of the United States, 1985-1990. NOAA Tech. Report. NMFS 113, 66 p.

Palmer M. C. 2014. 2014 Assessment update report of the Gulf of Maine Atlantic cod stock. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-14; p. 84 Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/. Accessed on December 18th, 2014.

Examining the mortality objective of the Gulf of Maine cod protection measures using fishery-dependent data

Paul Nitschke, Michael Palmer, and Jamie Cournane

January 8, 2015

Overview:

The *Preferred Alternative* in Framework Adjustment (FW 53) for the Gulf of Maine (GOM) cod protection measures would modify the existing groundfish rolling closures for the commercial groundfish fishery, and prohibit possession of GOM cod by the recreational fishery. These GOM cod protection measures have three objectives: 1) to protect spawning GOM cod, 2) reduce mortality of GOM cod in the identified times and areas, and 3) minimizing impacts to fishing fleets by allowing for opportunities to fish for healthy groundfish stocks. The mortality objective (2) of the GOM cod protection measures was examined using vessel trip reports (VTRs) submitted between January 2010 and August 2014 for commercial and recreational landings.

Alternatives in FW 53:

Figure 1 depicts 30 minute squares in the GOM. The following blocks apply No Action/status quo:

Sector Rolling Closures (30-Minute Blocks):

- May: 132, 133, 138, 139, 140
- June: 139, 140, 145, 146, 147, 152
- April: 124, 125, 132, 133

Common Pool Rolling Closures (30-Minute Blocks):

- May: 124, 125, 129, 130, 131, 132, 133, 136, 137, 138, 139, 140
- June: 132, 133, 139, 140, 142, 143, 144, 145, 146, 147, 152
- October – November: 124, 125
- March: 121, 122, 123
- April: 121, 122, 123, 124, 125, 129, 130, 131, 132, 133

The GOM cod protection measures would modify the rolling closures for sector and common pool vessels (shown above) to the following time/area configuration:

GOM Cod Protection Closures for all vessels:

- May: 132, 133, 138, 139, 140, and 125 north of 42° 20’
- June: 132, 139, 140, 146, 147, and 125 north of 42° 20’

- November – January: 125, and an area of 124 defined by the following coordinates:
  - 42° 00’ N…70° 30’ W
  - 42° 00’ N…70° 24’ W
  - 42° 15’ N…70° 24’ W
  - 42° 15’ N…70° 30° W, and

Rolling closures would continue to apply to common pool vessels in the following 30-Minute Blocks:

- October: 124 and 125
- March: 121, 122, 123

<u>Results:</u>

No Action:

The No Action alternative maintains the existing rolling closures for sector and common pool vessels. The impact of these management measures on landings is evident in the proportion and total monthly landings plots for Gulf of Maine (GOM) cod from 2010-2014 (Figure 2 and 3). The VTR data indicates that most of the GOM cod landings were taken from blocks 124 and 132 across the year except for the months when these blocks are closed due to the rolling closures (124 in April and 132 in April and May for all vessels; 124 is closed to the common pool in April). The April rolling closures appear to have shifted fishing effort further offshore with relative increases in cod catch from the other category and block 138. Additionally, block 125 has higher relative cod catch during the winter spawning season from November to January and block 133 has higher relative catch during the spring spawn in June and July (Figure 3). These results are analogous to what was determined in the PDT spring and winter spawning area analysis (see Dean and Correia in this Appendix). Most of the recreational catch is also taken from blocks 124 and 132 (Figure 4 and 5). In addition, the recreational catch also suggests that block 133 becomes more important during the spring spawning season.

Preferred Alternative:

The removal of closure 30 minute blocks 132,133,124 and 125 in April would allow fishing effort to shift into these blocks, where cod catch has been concentrated. This additional fishing opportunity in these productive areas will likely produce an increased incentive for observer bias, and unaccounted for cod mortality under the low cod ACL if GOM cod are caught as bycatch when targeting other groundfish stocks such as winter flounder, yellowtail flounder, American plaice, and haddock in these blocks. It appears that the core of the GOM cod population is within blocks 124 and 132 throughout the year even though commercial landing information cannot be used to definitively make this conclusion since there are existing rolling closures in these areas. However, the spring survey’s positive cod tows conducted in April and May suggest

that the highest cod abundance is within stratum 26 which roughly covers blocks 124 and 132 (2014 GOM cod operational assessment; Figure 1.26). Spring Gini indices and survey distribution plots from the assessment also suggest GOM cod distributions are concentrated in the western Gulf of Maine. In June, there may be some increased protection of cod from the 132 closure if this closure does not result in a shift in effort into blocks with high cod concentrations (i.e., block 124). The closure of block 125 north of 42 would likely afford minimal mortality protection since small amounts of catch come from 125 in May and June. There could be some increased protection from November to January if the displaced effort does not shift to other areas with high cod concentrations such as Stellwagen Bank or block 132 (Figure 3). Mortality reductions of the closures may not be realized with a potential shift in effort when blocks with high cod concentrations remain open (124 and 132). Mortality changes may be a tradeoff with the closure of one area and the opening of another or protection of cod from a closure may result in a shift in effort into other blocks that have relatively high cod concentrations. Therefore it is uncertain whether this action will result in a reduction in GOM cod mortality. Conversely, the opening of block 145 in June may also have minimal impact on cod since few cod were taken from this block in the past.

Summary:

This analysis suggests that should the GOM cod stock remain concentrated in the core 30 minute block areas of 124 and 132 the preferred closure areas provide little additional protection relative to the No Action. Some protection may be provided in June with the closure of 132 but in April protection of cod in the core area of 124 and 132 is lost. It is unlikely that reductions in fishing mortality will be met since displaced effort will probably shift into areas with relatively high cod concentrations (132 and 124) on unobserved trips.

Figures:

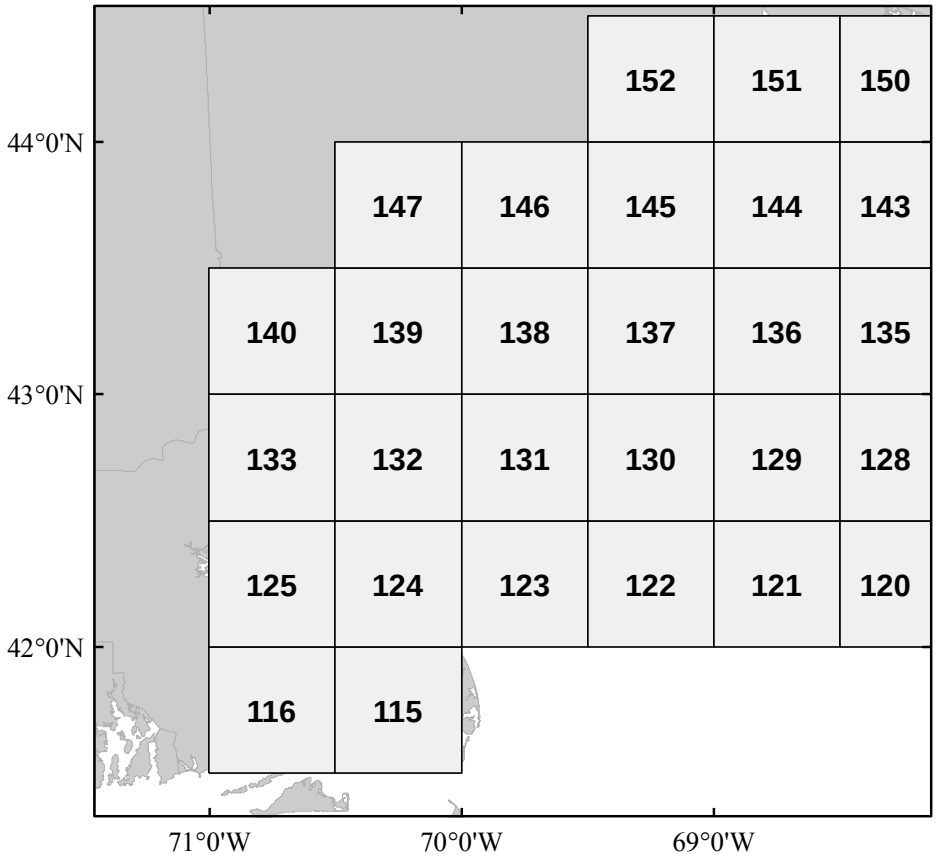


Figure 1. Map of 30 minute squares in the Gulf of Maine.

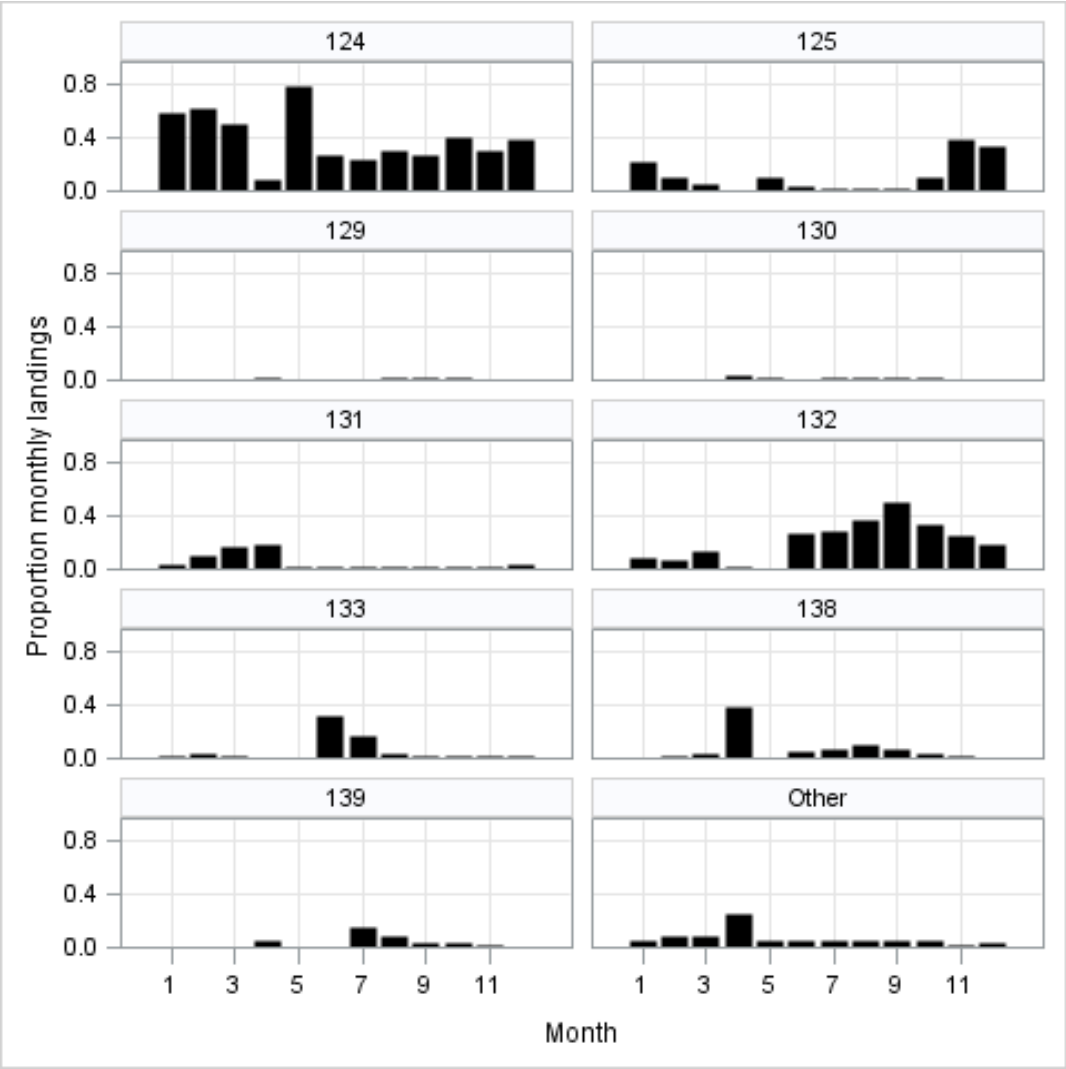


Figure 2. Proportion of commercial Gulf of Maine Cod landings by 30 minute block from 2010-2014.

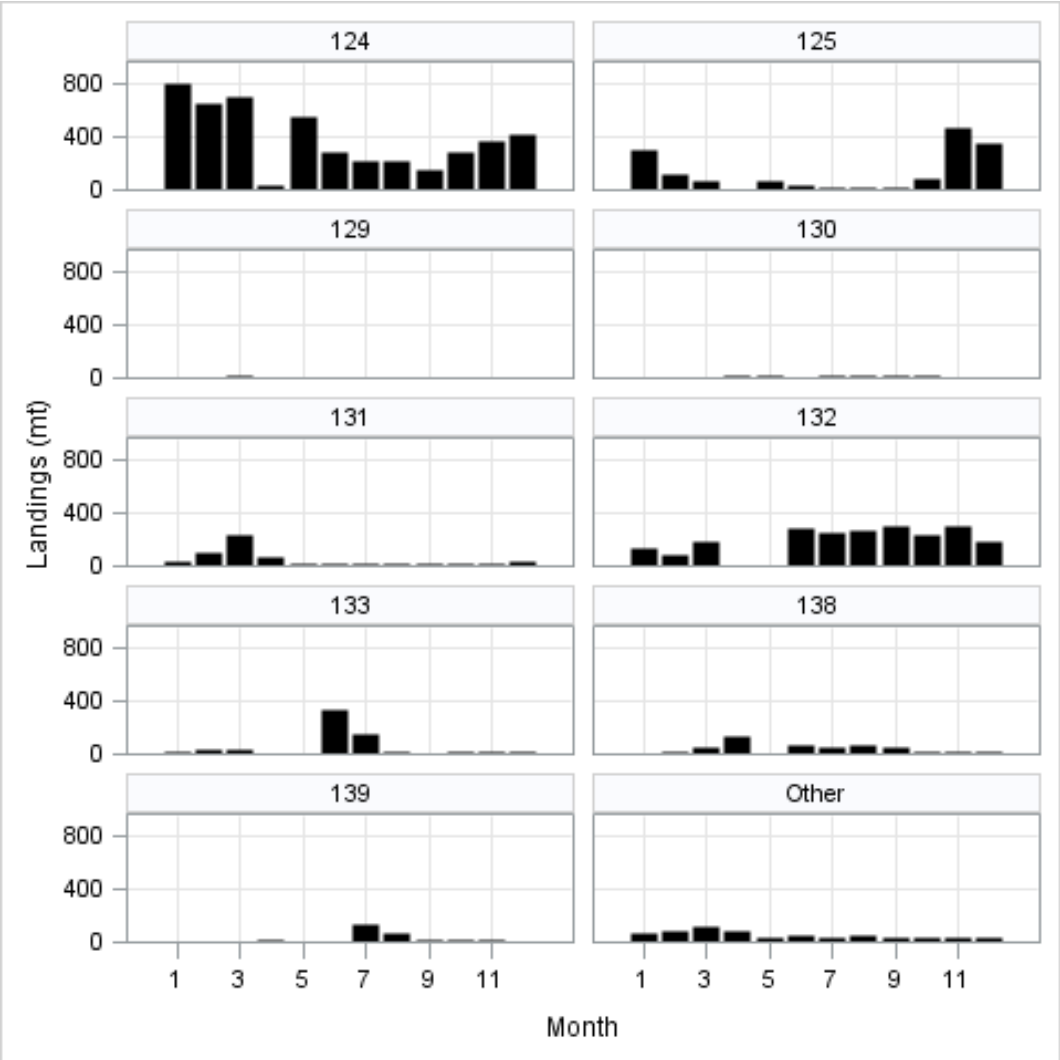


Figure 3. Total commercial Gulf of Maine Cod landings by 30 minute block from 2010-2014.

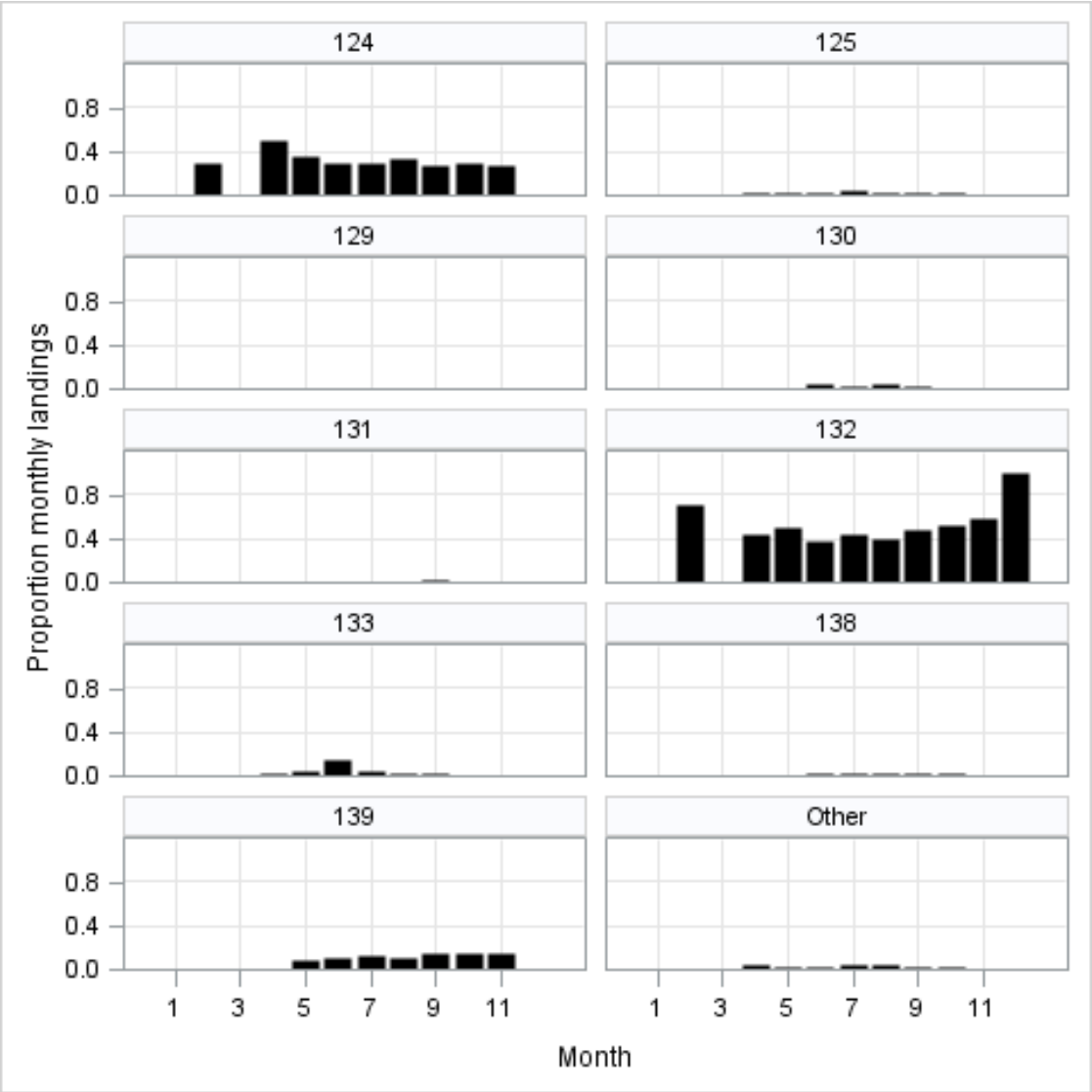


Figure 4. Proportion of VTR recreational Gulf of Maine Cod landings by 30 minute block from 2010-2014.

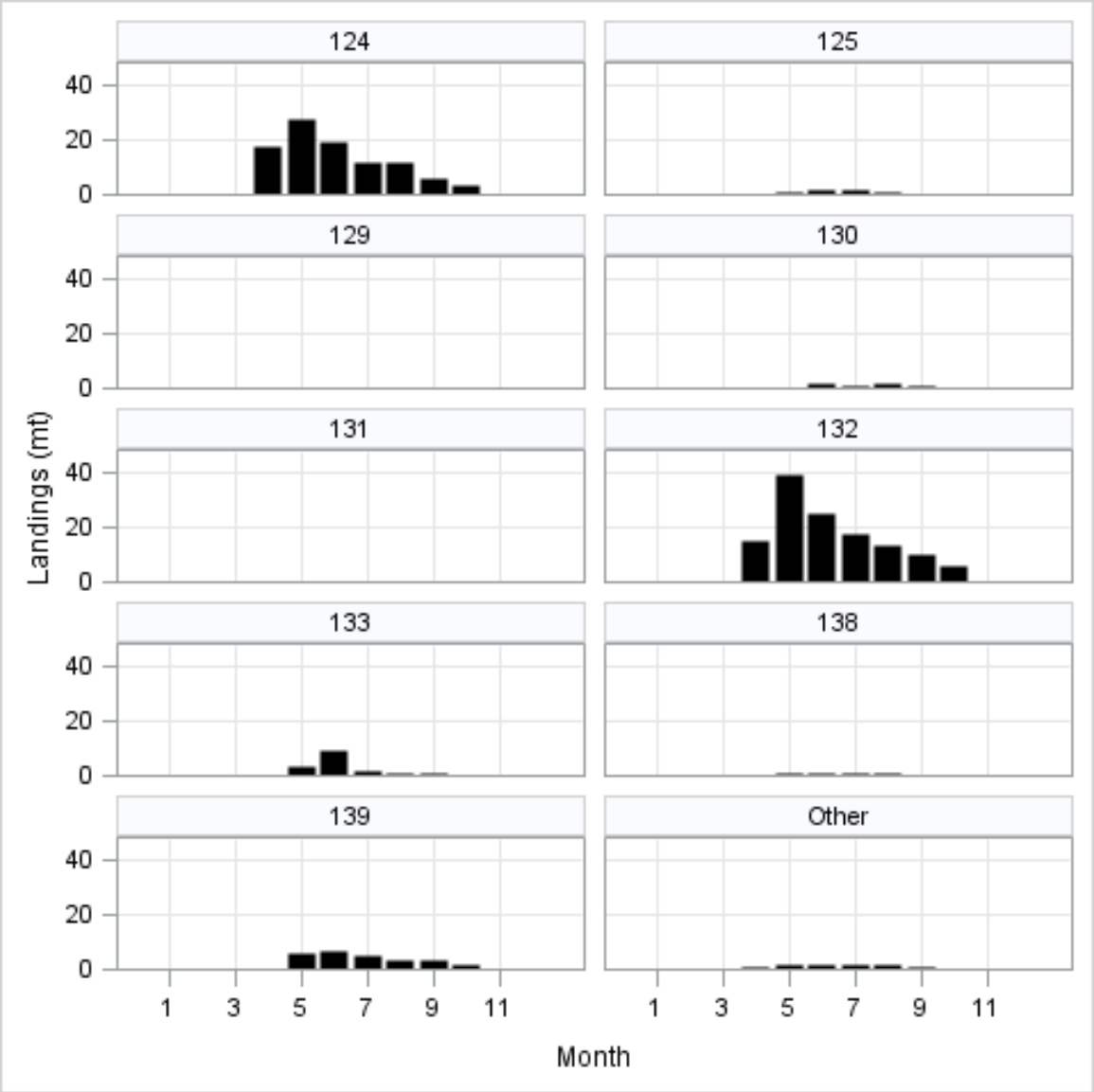


Figure 5. Total VTR recreational Gulf of Maine Cod landings by 30 minute block from 2010-2014.

Framework Adjustment 53

to the

Northeast Multispecies FMP

Appendix III

Calculation of Northeast Multispecies Annual Catch Limits, FY 2015 – FY 2017

This appendix documents the calculation of Northeast Multispecies Overfishing Levels (OFLs), Acceptable Biological Catches (ABCs), and Annual Catch Limits (ACLs) for FY 2015 - FY 2017. The general approach for all stocks is to first determine the OFL and then determine the ABC. The ABC in all cases is consistent with the recommendations of the SSC. The ABC is distributed to various components of the fishery, and then an adjustment is made to these "sub-ABCs" to determine the ACLs, sub-ACLs, or other sub-components. The descriptions in this Appendix reflect the Council's *Preferred Alternative* for specifications.

For this action, the *Preferred Alternative* lists specifications for all Northeast Multispecies stocks for FY 2015, and for white hake to FY 2016. For most stocks, the FY 2015 & FY 2016 values were established by FW 50 and FW 51 and the calculation of OFLs and ABCs are described in Appendix III to those documents. That information is not repeated here; it is available at www.nefmc.org. For the remaining stocks, specifications are proposed for FY 2015 – FY 2017 and the calculations are described in detail. These stocks are:

GOM cod
GOM haddock
GB yellowtail flounder (FY 2015- FY 2016 only)
GOM winter flounder
GB winter flounder
Pollock

This appendix also documents and clarifies how available catches are distributed to the sub-components of the fishery. These are listed for all stocks (even those where specifications are determined only for FY 2015) in order to keep a clear record of the distribution. Amendment 16 authorized changes to be made in a framework action and this summary documents several changes.

Determining OFL and ABC

Stocks with Age-Based Assessments and Projections

Catch levels (including OFLs, ABCs, and ACLs) for the following stocks are based on age-based projections. For these stocks the projections were performed using the Northeast Fisheries Science Center's (NEFSC) AGEPRO projection model. The projections are based on the most recent benchmark or operational assessment for each stock, as shown in the list:

GOM cod	(2014 Assessment Update)
GOM haddock	(SARC 59)
GB winter flounder	(2014 Assessment Update)
Pollock	(2014 Assessment Update)

There are a number of assumptions that must be made to complete the projections. All of these assumptions are potential sources of error. The assumptions for recruitment, selectivity, and weights-at-age that were used were those recommended by the assessment review panels.

Since the first year for ACLs based on these projections is 2015, an additional assumption must be made in the projections for the years between the terminal year and 2015. An estimate of catch developed by the Plan Development Team (PDT) was input into the projection model. The values may differ from realized catches and introduce uncertainty into the results. The catch assumptions for these projections are provided in Table 1**Error! Reference source not found.**.

Table 1 – 2013 and 2014 catch assumption used in age-based projections for stocks with recent age-based analytic assessments.

Stock	2013 Catch	2014 Catch
GOM Cod	1,715	1,470
GOM Haddock	692	500
GB Winter Flounder	1,763	1,522
Pollock	8,304	6,817

When calculating the OFL in future years, F_{MSY} is used as the fishing mortality in the projection. When calculating the ABC, either 75% of F_{MSY} or $F_{rebuild}$ is used (whichever is lower) and in one base based on non-target bycatch. This is consistent with the ABC control rules recommended by the Science and Statistical Committee (SSC) and adopted in Amendment 16. Specific mortality targets used for the ABC projections are provided in Table 2.

Table 2 – Mortality targets used to calculate ABCs, FY 2015 – 2017. ABCs were set constant for FY 2015 – FY 2017 for two groundfish stocks (GOM cod and pollock), and for FY 2015 and FY 2016 for GB yellowtail flounder.

Species	Stock	Basis for Target Fishing Mortality	Targeted Fishing Mortality or Exploitation	F_{msy}
Cod	**GOM**	(see text)	0.135 (see text)	0.18
Haddock	**GOM**	75%FMSY	0.345	0.46
Yellowtail Flounder	**GB**	(see text)	N/A	NA
Winter Flounder	**GB**	$F_{rebuild}$	0.315	0.44
Winter Flounder	**GOM**	75% FMSY	0.2325	0.31
Pollock	**GB/GOM**	75%FMSY	0.27	0.42

Recent experience and analyses by the PDT have demonstrated that projections are often overly optimistic. This means that future stock growth is projected to be higher than what is realized, and as a result catches less than the ACLs have frequently led to overfishing. For this reason, in many cases the ABCs that were recommended by the SSC are lower than the projection output in order to take into account this additional uncertainty. In most (but not all) cases, the ABC in FY 2015 is based on the projection output at the target fishing mortality, and then this ABC is used for FY 2016 and FY 2017 as well. This means that the target fishing mortality is lower for FY

2016 and FY 2017. Specific deviations from the projection output are identified below. Projection output used for setting ABCs is in Appendix IV.

a. GOM cod: Using results from the two assessment models, the ABC was set based on an estimate of non-target bycatch, with a reduction, when projections suggest that rebuilding is not possible within 10 years. The ABC for 2015 – 2017 is 75% of the OFL, and was held constant for three years in recognition of the difficulties in making projections at low population sizes.

b. GOM haddock: ABCs were set at 75% of F_{MSY} for FY 2015 –FY2017.

c. GB winter flounder: ABCs were set using $F_{rebuild}$, which would rebuild the stock by 2017 with a 75% probability of achieving the biomass target.

d. Pollock: The ABC of 16,600 mt is held constant for FY 2015 –FY 2017 due to the uncertainty in the projections. The ABC was set by applying 75% of F_{MSY} to the projected exploitable biomass.

Stocks with Index-Based Assessments

The GOM winter flounder 2014 update carried forward methods used at SARC 52. The stock continues to be assessed using a swept area assessment model. The OFL and ABC are based on applying the F_{MSY} proxy to an estimate of swept area biomass, while the ABC is based on 75% of the F_{MSY} proxy applied to the most recent estimate of swept area biomass.

In 2014, the Transboundary Resource Assessment Committee (TRAC) agreed to no longer use a VPA assessment model to evaluate stock status or to provide catch advice for GB yellowtail flounder assessment. The ABC for FY 2015 and FY 2016 is based on a constant exploitation rate of 16% applied to the most recent estimate of average survey-based biomass for GB yellowtail flounder.

Distribution of ABCs

Because the Council wants the ability to consider a different adjustment for management uncertainty for different components of the fishery, ABCs were first distributed to the components prior to applying this adjustment. A brief description of the components follows. Note that there are a few stock-specific instances (described in a later section) that may differ from this general overview.

<u>ABC</u>: Acceptable Biological Catch for the entire stock.

<u>Canadian Share/Allowance</u>: An amount from the stock that Canadian vessels are expected to harvest, as is the case for GB winter flounder and halibut (see details that follow in the next section). For GB cod, GB haddock, and GB yellowtail flounder, this is based on the Canadian allocation under the TMGC (but see the GB yellowtail flounder discussion below).

U.S. ABC: That portion of the ABC available to U.S. fishermen after accounting for Canadian harvests.

State waters: Portion of the U.S. ABC expected to be harvested from state waters, outside of the federal management plan. This is not an allocation.

Other sub-components: Portion of the U.S. ABC expected to be harvested by unidentified non-groundfish fishery components. These are not attributed to specific components because individual amounts are small. In cases where there is no specific recreational allocation, unless otherwise specified, recreational catches are counted against this sub-component. There are a few stocks where this may not be the case, such as when the majority of recreational catches are from state waters and the recreational catch is considered part of the state waters sub-component. These instances will be specifically identified.

Scallops: That portion of U.S. ABC allocated to the scallop fishery.

Groundfish: That portion of the U.S. ABC available to the groundfish fishery (including recreational and commercial vessels if there is a specific allocation). This ABC has several sub-components:

Commercial: The portion of the U.S. ABC available to commercial vessels; this is further sub-divided into sector and common-pool portions.

Recreational: The portion of the U.S. ABC available to recreational vessels, when a specific allocation is made.

MWT: Portion of the ABC available to herring mid-water trawl vessels. Currently only applies to the two haddock stocks.

Small-Mesh Fisheries: Portion of the U.S. ABC of GB yellowtail flounder for small-mesh fisheries.

Amendment 16 provides that the distribution to various sub-components can be modified in a framework or specification action. These adjustments are often made as more experience is gained with the ACL system adopted by Amendment 16. Changes can also be required if there are large changes in ABCs, particularly because the sub-components of the fishery are not subject to specific catch controls by the FMP and a specific percentage allocation has not been defined. This is the case for state waters and other sub-component catches. Unlike the case when a specific allocation has been specified, the PDT estimates the expected catch from these two components and then compares that amount to the ABC to determine the percentage that should be set aside to account for these catches. Table 6 summarizes the state waters and other sub-component distribution for recent years and the distribution that would result from the *Preferred Alternative*.

Groundfish ABCs and ACLs are distributed to various components of the fishery. First, expected catch by Canadian vessels is deducted from the total ABC, and the amount remaining is the portion of the ABC available to U.S. vessels (U.S. ABC). Expected catch from state waters and the other sub-component is then deducted from the U.S. ABC[1]. These sub-components are not subject to specific catch controls by the Groundfish FMP. As a result, the state waters and other sub-components are not allocations, and these components of the fishery are not subject to accountability measures if the catch limits are exceeded. Because the state waters and other sub-component values are based on expected catch, there is no downward adjustment for management uncertainty that applies to fisheries with specific allocations and accountability measures.

After the state and other sub-components are deducted, the remaining portion of the U.S. ABC is the amount available to the fishery components that receive an allocation (i.e., subject to accountability measures). Allocations are made first to non-groundfish fisheries (e.g., scallop, midwater trawl, small-mesh fisheries), and the remaining portion of the U.S. ABC is allocated to the commercial groundfish fishery.

Canadian Catch of Groundfish Stocks

Since fishing year 2010, expected Canadian catch has only been considered for Eastern GB cod and haddock and GB yellowtail, which are jointly managed with Canada. However, based on the results of recent assessments, some Canadian catch of GB winter flounder and halibut does occur. Although these stocks are not jointly managed, Canadian catch should be accounted for when distributing the ABC/ACLs to ensure that biological objectives are met and total catch does not exceed the overall ABC. During the 2014 operational assessment for GB winter flounder, the peer review panel also suggested that Canadian catches should be considered in determining the U.S. ABC.

Georges Bank Winter Flounder

For GB winter flounder, the PDT reviewed Canadian catch information that was included in the 2014 Operational Update. Only the most recent catches are presented here (Table 3). Canadian landings are primarily from the bottom trawl groundfish fishery, and have generally been low relative to the total landings of this stock, which are dominated by the U.S. landings. Discards from the Canadian bottom trawl fishery were not available for the assessment. Although discarding groundfish is prohibited in Canadian groundfish fisheries, some discards likely occur in this fishery. Discards from the Canadian scallop fleet fluctuated around 100 mt from 2010-2012, and decreased to 29 mt in 2013.

[1] For GOM cod and haddock, the state waters and other sub-component are deducted from the commercial portion of the U.S. ABC (after allocating to the recreational fishery).

Table 3- Canadian catches of Georges Bank winter flounder, metric tons, 2000-2013.

Year	Canadian Landings	Canadian Discards	**Total Canadian Catch**	**Total Canadian Catch as Percent of Total Catch**
2000	161	198	359	18%
2001	529	199	728	30%
2002	244	193	437	17%
2003	310	179	489	15%
2004	191	105	296	10%
2005	73	145	218	9%
2006	55	135	190	17%
2007	12	44	56	5%
2008	20	69	89	8%
2009	12	252	264	13%
2010	45	109	154	10%
2011	52	88	140	7%
2012	83	79	162	7%
2013	12	29	41	2%
2011-2013 Average	**49**	**65**	**114**	**6%**

Halibut

For halibut, the PDT reviewed recent Canadian catches from the most recent assessment (2012 Operational Assessment), as well as additional years of catch information that are available from the NAFO 21A Extraction Tool (Table 4). Canadian landings have typically been well below 30 mt with the exception of a few years. The 2012 Operational Assessment for halibut only included Canadian landings from NAFO Division 5ZC (Statistical Areas 551 and 552); however, the PDT noted that the assessment likely should have also included landings from NAFO Division 5Y (Statistical Area 511). Because the assessment did not include Division 5Y, the PDT did not include these catches in determining the expected Canadian catch that should be applied to the total ABC. In addition, duplicate catch data was included in the NAFO 21A Extraction Tool for 2012, and the PDT removed the duplicate data entry for this analysis.

Table 4- Canadian landings of halibut, metric tons, 2000-2012

Year	5Y	5ZC	Total Landings
2000		6	6
2001		11	11
2002		10	10
2003		14	14
2004		12	12
2005		9	9
2006		10	10
2007		32	32
2008		29	29
2009	7	15	22
2010	7	11	18
2011	6	19	25
2012	2	28	30
2010-2012 Average	**5**	**19**	**24**

PDT Recommendation for Accounting for Canadian Catch

For GB winter flounder and halibut, the PDT recommends using the average catch of the most recent three years available as the expected Canadian catch. This expected Canadian catch should be reduced from the total ABC for the respective stock before distributing the remaining portion of the ABC to U.S. vessels.

Stock	Expected Canadian Catch
GB winter flounder	114 mt
Atlantic halibut	19 mt

Review of State Waters and Other sub-Components

The PDT completed a comprehensive review of the sub-components for FW 50, and a number of adjustments were adopted beginning for the 2013 fishing year. The sub-components have not been reviewed since this action, which implemented substantial ACL reductions for many groundfish stocks. Two additional years of catch information (FY 2012 and 2013) are now available as well.

The PDT reviewed final fishing year 2013 catch information and sub-component performance to determine if adjustments made in FW 50 were effective. In general, there were only a few instances where fishing year 2013 sub-component catches exceeded the sub-component value. The PDT also highlighted a number of stocks where sub-component catch was either relatively high compared to the sub-component value (75% or greater), or relatively low compared to the other sub-component value (25% or less). Table 5 summarizes the major highlights from the

fishing year 2013 final catch report. The PDT also reviewed proposed FY 2015 specifications to determine if any adjustments to the sub-components are necessary in anticipation of any expected ACL changes.

Table 5- Summary of FY 2013 sub-Component Catches (as percent of sub-component caught).

	Stock	State sub-Component	Other sub-Component
Sub-component 'overages'	SNE/MA Yellowtail Flounder	206.5%	106.3%
	CC/GOM Yellowtail Flounder	130.2%	271.3%
	Witch Flounder	115.5%	–
	SNE/MA Winter Flounder	–	108.1%
	Pollock	104.9%	103.7%
	Wolffish	185.0%	
Sub-Components with High Utilization (≥ 75%)	Plaice	–	96%
	Northern Windowpane Flounder	–	95%
Sub-Components with Low Utilization (≤ 25%)	GOM Cod		6%
	GB Haddock	2%	5%
	GOM Haddock		25%
	GB Yellowtail Flounder		<1%
	Redfish	17%	2%
	White Hake	6%	10%

PDT Recommendations for Changes to sub-Components

The PDT developed recommendations for changes to the state waters and other sub-components based on recent catch information (FY 2010-FY 2013), expected ACL changes and management measures for 2015, stock abundance and availability, and other information. The PDT's recommendations for FW 53 are summarized in Table 6, and are described in more detail below. The PDT noted that final FY 2014 catch information will be available in time for setting specifications for FY 2016, and that the state waters and other sub-components should be reviewed again at that time in order to make any necessary adjustments. The Council approved the PDT recommendations for changes to sub-components at its November 2014 meeting in Newport, Rhode Island.

1. No changes are recommended for either the state waters or other sub-component values for GB cod, GOM cod, GB haddock, plaice, witch flounder, GB winter flounder, redfish, white hake, pollock, southern windowpane, or wolffish.

2. GOM haddock: Both the other sub-component and state waters catch have each been less than 10 mt since fishing year 2010. The PDT discussed that although this stock is abundant, there is no reason to expect other sub-component or state waters catch to increase dramatically from levels observed since FY 2010. As a result, the PDT recommended reducing the other sub-component from 3% to 2% of the ABC and the state sub-component from 2% to 1% of the ABC.

3. GB yellowtail flounder: The other sub-component catch declined to 0 mt in fishing year 2013. The small-mesh fisheries catch historically made up the majority of the other sub-component catch; however, with the adoption of the small-mesh fisheries sub-ACL beginning in FY 2013, these catches are no longer attributed to the other sub-component. As a result, the PDT recommended reducing the other sub-component from 2% to 1% of the ABC. The PDT does not recommend reducing the other sub-component beyond 1%.

4. SNE/MA yellowtail flounder:
    a. State waters catch remained relatively constant from FY 2012 to FY 2013 despite the large reduction to the ACL. In FY 2012 and 2013, the state sub-component catch exceeded the sub-component value, although only by a relatively small amount (2 and 8 mt, respectively). The PDT noted that it was not clear why state waters catch remained constant in fishing year 2013. Given the uncertainty around expected state waters catch, and the recent "overages" of the sub-component value, the PDT recommended increasing the state sub-component to 2% of the ABC (from 1%).
    b. Although the other sub-component catch exceeded the sub-component value in FY 2013, the PDT noted that the "overage" was only 2 mt, which is relatively minor compared to total catch of the stock. The PDT also noted that there was no reason to expect that FY 2015 catches should vary dramatically from FY 2013. As a result, the PDT is recommending no change to the other sub-component.

5. CC/GOM yellowtail flounder:
    a. State waters catch increased by approximately 10 mt in FY 2013 compared to FY 2012 despite the large reduction to the ACL. The PDT noted that there has been a general increase of state waters catch over time since FY 2013. The PDT discussed possible reasons for this increase, but could not pinpoint a clear reason, particularly for the increase from FY 2012 to FY 2013. As a result, it is difficult to predict expected state waters catch in FY 2015, although there does not seem to be any reason to expect dramatic changes in FY 2015 state waters catch compared to FY 2013. As a result, the PDT recommended increasing the state sub-component to 7% of the ABC (from 6%).
    b. The other sub-component catch increased by approximately 10 mt in FY 2013 compared to FY 2012, primarily due to a small increase in estimated discards from the scallop fishery. The other sub-component catch exceeded the sub-component value by approximately 20 mt. This increase in the other sub-component catch was anticipated because of an increase in scallop fishery effort, particularly in statistical area 521, compared to previous years. The PDT discussed likely scallop fishery measures for FY 2015, and noted that estimated

discards of this stock from the scallop fleet may be similar in FY 2015 compared to FY 2013. As a result, the PDT recommends increasing the state sub-component to 5% of the ABC (from 2%).

6. Witch flounder: State waters catch exceeded the sub-component value in FY 2013; however, the "overage" was small, 4 mt. As a result, the PDT recommends no change to the state waters sub-component.

7. GOM winter flounder:
    a. State waters catch has fluctuated around 60-70 mt since FY 2010, although FY 2011 catches were slightly above 100 mt. However, in general, recent catches are well below the current state sub-component value of 272 mt. During the development of FW 50, the PDT discussed reducing the state sub-component because catches had typically been well below the sub-component value. However, at the time, the PDT recommended that no changes be made until it was more clear what management measures the states would implement. Now that data is available for two additional fishing years, the PDT noted that there is no reason to expect that states would liberalize measures for this stock, and expects that state waters catch in FY 2015 will be similar to recent years. As a result, the PDT recommended reducing the state sub-component to 17% of the ABC (from 25%).
    b. Other sub-component catch has been less than 10 mt since FY 2012. The PDT noted that FY 2015 catch from this component is not expected to differ dramatically from recent years. The PDT also noted that if the other sub-component catch in FY 2015 was similar to recent years, it would be much less than the sub-component value, even when considering the expected reduction in the total ACL. As a result, the PDT recommended reducing the other sub-component to 2% of the ABC (from 5%).

8. SNE/MA winter flounder:
    a. State waters catch has been below 60 mt since FY 2011, which is well below the current state sub-component value of 235 mt. The PDT noted that based on initial ASMFC discussions, the state waters trip limit is not expected to change, and FY 2015 state waters catch is expected to be similar to recent years. As a result, the PDT recommended reducing the state sub-component to 7% of the ABC (from 14%).
    b. Other sub-component catch increased by approximately 30 mt in FY 2013 compared to FY 2012, primarily due to a slight increase in estimated discards from the scallop fishery. This increase is not surprising considering scallop management measures in FY 2013. The PDT noted that scallop effort could increase in the SNE/MA winter flounder stock area in FY 2015 due to an increase in access area trips compared to previous years. The other biggest contributor to the other sub-component catch in FY 2013 was landings that occurred on scientific research trips operating under a Letter of Acknowledgement (LOA). Research landings in FY 2013 were approximately 20 mt, which is a large increase from recent years. In FY 2013, there was an ongoing SNE/MA winter

flounder gear project that presumably contributed to most of these landings, but the PDT noted that it is difficult to predict landings that may occur under LOAs in future years. The PDT recommended increasing the other sub-component to 11% of the ABC (from 10%).

9. Pollock:
    a. The FY 2013 state waters catch exceeded the sub-component by approximately 45 mt. In addition, the PDT noted that FY 2013 state waters catch increased by approximately 400 mt compared to FY 2012, largely due to an increase in recreational discards. The PDT discussed whether state waters catch may increase in FY 2015 compared to FY 2013, but there was no clear indication that this would occur. The PDT recommends no change to the state sub-component.
    b. Other sub-component catch increased slightly in FY 2013 compared to FY 2012, and was approximately 40 mt over the sub-component value. Similar to the discussion on expected state waters catch, the PDT discussed whether the other sub-component catches would increase in FY 2015 compared to FY 2013. However, other sub-component catches have generally been below the sub-component value, and there is a slight increase in the ABC expected for FY 2015. As a result, the PDT recommends no change to the other sub-component.

10. Northern windowpane flounder: Other sub-component catches decreased by approximately 35 mt in FY 2013 compared to FY 2012, primarily due to a decrease in the estimated discards from the scallop fishery. Since FY 2010, the scallop fishery has made up over 90% of the total other sub-component catches. The PDT discussed potential FY 2015 scallop management measures, and noted that scallop fishery effort on GB would likely be similar in FY 2015 to FY 2013 and that discards from the scallop fishery are also expected to be similar. However, FW 53 considered an alternative that would allocate a sub-ACL to the scallop fishery. If the Council selected this alternative as preferred, the PDT recommended reducing the other sub-component to 1% of the ABC (from 29%). If the Council did not select the scallop fishery sub-ACL as the preferred alternative, the PDT recommended no changes to the other sub-component. The Council moved these measures in FW 53 to "Considered and Rejected" and therefore no changes were made to the other sub-component.

11. Ocean pout: Other sub-component catch exceeded the sub-component value in FY 2013, but only by 3 mt. However, the PDT noted that this small "overage" is approximately 3% of the total catch of ocean pout. Other sub-component catches have typically been greater than 25 mt, and the sub-component value has frequently been exceeded in recent years. As a result, the PDT recommended increasing the other sub-component to 10% of the ABC (from 9%).

12. Halibut:
    a. State waters catch has generally been well below the state sub-component value, which has fluctuated around 35-40 mt since FY 2010. Although there are reports that the stock is increasing, the PDT noted that there was no reason to expect state wasters catch to change dramatically in FY 2015 compared to recent years. As a

result, the PDT recommended decreasing the state sub-component to 30% of the ABC (from 40%).

b. Other sub-component catch has typically been below the sub-component value since FY 2010; however, the PDT noted that the sub-component is small (less than 5 mt). Although there are reports that the stock is increasing, the PDT could not point to any reason that FY 2015 catches would differ dramatically compared to recent years. As a result, the PDT recommended decreasing the other sub-component to 3% of the ABC (from 5%).

13. Wolffish: The other sub-component catches exceeded the sub-component value in FY 2013, but only by 0.3 mt. As a result, the PDT recommended no change to the other sub-component.

The distribution of ABC values by stock are shown in Table 7 and Table 8.

ACLs

Once the U.S. ABC is distributed to the various fishery components, sub-annual catch limits (sub-ACLs) are set by reducing the amount of the ABC distributed to each component to account for management uncertainty (i.e., the likelihood that management measures will result in a level of catch greater than the catch target). For each stock, management uncertainty is estimated using the following criteria: enforceability and precision of management measures, adequacy of catch monitoring, latent effort, and catch of groundfish in non-groundfish fisheries. The following default management uncertainty buffers are used for groundfish stocks:

- 3% for stocks with no state waters catch;
- 7% for zero possession stocks;
- 7% for recreational allocations; and
- 5% for all other stocks/components of the fishery.

Stock specific sub-ACL values are shown in Table 9.

Review of Management Uncertainty Buffer

The PDT last reviewed and recommended changes to the management uncertainty buffer for Framework Adjustment 50 (FW 50). The PDT briefly discussed the changes to the management uncertainty buffers implemented by FW 50, and considerations made for those adjustments. During the development of FW 50, the PDT discussed whether the buffer should be increased due to possible observer bias, but did not recommend any increase because no estimate of a bias is available to determine the appropriate changes.

The PDT reiterated that, at this time, it is not possible to quantify observer bias, and that the direction of any bias can change from year to year. The PDT also discussed that no changes to the buffer appears necessary as a result of any changes to the management measures since FW 50. The PDT concluded that no new information is available that would warrant any changes to

the default management uncertainty buffers for FW 53. The Council did not take action to adjust management uncertainty buffers in FW53.

Table 6- Summary of ABC Distribution to State and Other sub-Components (as percent of ABC)

Stock	State sub-Component					Other sub-Component				
	FW 44 (FY10-11)	FW 47 (FY 12)	FW 50 (FY13-14)	FW51 (FY14)	FW53 (FY15-17)	FW 44 (FY10-11)	FW 47 (FY 12)	FW 50 (FY13-14)	FW51 (FY14)	FW53 (FY15-17)
GB cod	1%	1%	1%	1%	1%	4%	4%	4%	4%	4%
GOM cod	10%	10%	10%	10%	10%	5%	5%	5%	5%	5%
GB Haddock	1%	1%	1%	1%	1%	4%	4%	4%	4%	4%
GOM Haddock	1%	2%	2%	2%	1%	4%	3%	3%	3%	2%
GB Yellowtail Flounder	0%	0%	0%	0%	0%	5%	4%	4%	2%	1%
SNE/MA Yellowtail Flounder	1%	1%	1%	1%	2%	4%	4%	4%	4%	4%
CC/GOM Yellowtail Flounder	1%	3%	6%	6%	7%	4%	2%	2%	2%	5%
Plaice	1%	1%	2%	2%	2%	4%	4%	2%	2%	2%
Witch Flounder	1%	3%	3%	3%	3%	4%	4%	15%	15%	15%
GB Winter Flounder	0%	0%	0%	0%	0%	5%	5%	3%	3%	3%
GOM Winter Flounder	25%	25%	25%	25%	17%	5%	5%	5%	5%	2%
SNE/MA Winter Flounder	8%	28%	14%	14%	7%	5%	20%	10%	10%	11%
Redfish	1%	1%	1%	1%	1%	4%	4%	2%	2%	2%
White Hake	1%	2%	1%	1%	1%	4%	3%	2%	2%	2%
Pollock	6%	5%	6%	6%	6%	6%	9%	7%	7%	7%
Northern Windowpane	1%	1%	1%	1%	1%	29%	19%	29%	29%	29%
Southern Windowpane	1%	10%	10%	10%	10%	29%	70%	34%	34%	34%
Ocean Pout	1%	1%	1%	1%	1%	4%	9%	9%	9%	10%
Halibut	50%	50%	40%	40%	30%	5%	5%	5%	5%	3%
Wolffish	1%	1%	1%	1%	1%	4%	4%	4%	4%	4%

Note: Highlighted cells indicate changes from the previous specifications (RED = increase to sub-component percentage; GREEN = decrease to sub-component percentage).

Incidental Catch TACs

Part of the commercial non-sector ACL is allocated to the incidental catch TACs that limit catches of stocks of concern in the Category B (regular) DAS program and certain SAPs.

An incidental catch TAC is specified for American plaice even though GARM III determined this stock was not overfished and overfishing was not occurring. This was done for several reasons. First, stock size barely exceeds the minimum biomass threshold and is at 51% of B_{MSY}, and has not completed stock rebuilding. Given uncertainty in the assessment it was considered prudent to continue to control catches until certain that rebuilding is on track. Second, plaice is often caught with witch flounder, an overfished stock, and allowing vessels to target plaice in these programs would likely lead to excessive catches of witch flounder.

Incidental catch TACs are no longer specified for pollock, GB winter flounder, and SNE/MA yellowtail flounder because these stocks are rebuilt

Table 7 – Distribution of ABC to fishery components. Sector PSCs are preliminary and may change based on final sector rosters.
(1) Includes commercial ABC in state waters and other subcomponents

Stock	Year	ABC	Canadian Share/ Allowance	US ABC	State Waters	Other Sub-Components	Scallops	Groundfish	Comm Groundfish	Rec Groundfish	Sector PSC	MWT/ Small-Mesh
GB Cod	2015	2,506	526	1,980	0.01	0.04		0.95	0.95		*0.98111645*	
	2016											
	2017											
GOM Cod	2015	386		386	0.10	0.05			0.663	0.337	*0.97665715*	
	2016	386		386	0.10	0.05			0.663	0.337	*0.97665715*	
	2017	386		386	0.10	0.05			0.663	0.337	*0.97665715*	
GB Haddock	2015	43,606	19,240	24,366	0.01	0.04		0.940	0.94		0.99308854	0.01
	2016											
	2017											
GOM Haddock	2015	1,454		1,454	0.01	0.02		0.96	0.725	0.275	0.99010702	0.01
	2016	1,772		1,772	0.01	0.02		0.96	0.725	0.275	0.99010702	0.01
	2017	2,125		2,125	0.01	0.02		0.96	0.725	0.275	0.99010702	0.01
GB Yellowtail Flounder	2015	354	106	248		0.01	0.16	0.81	0.81		0.98448248	0.02
	2016	354		354			0.16	0.81	0.81		0.98448248	0.02
	2017										0.98448248	0.02
SNE/MA Yellowtail Flounder	2015	700		700	0.02	0.04	0.102	0.838	0.838		0.81922893	
	2016											
	2017											
CC/GOM Yellowtail Flounder	2015	548		548	0.07	0.05		0.88	0.88		0.96606323	
	2016											
	2017											
Plaice	2015	1,544		1,544	0.02	0.02		0.96	0.96		0.98131847	
	2016											
	2017											
Witch Flounder	2015	783		783	0.03	0.15		0.82	0.82		0.97968299	
	2016											
	2017											

Stock	Year	ABC	Canadian Share/ Allowance	US ABC	State Waters	Other Sub-Components	Scallops	Ground-fish	Comm Groundfish	Rec Groundfish	Sector PSC	MWT
GB Winter Flounder	2015	2,124	114	2,010		0.03		0.97	0.97		0.99141044	
	2016	2,221		2,221		0.03		0.97	0.97		0.99141044	
	2017	2,294		2,294		0.03		0.97	0.97		0.99141044	
GOM Winter Flounder	2015	510		510	0.17	0.02		0.81	0.81		0.95538062	
	2016	510		510	0.17	0.02		0.81	0.81		0.95538062	
	2017	510		510	0.17	0.02		0.81	0.81		0.95538062	
SNE/MA Winter Flounder	2015	1,676		1,676	0.07	0.11		0.82	0.82		0.87821751	
	2016											
	2017											
Redfish	2015	11,974		11,974	0.01	0.02		0.97	0.97		0.99583521	
	2016											
	2017											
White Hake	2015	4,713		4,713	0.01	0.02		0.97	0.97		0.99301583	
	2016	4,645		4,645	0.01	0.02		0.97	0.97		0.99301583	
	2017											
Pollock	2015	16,600		16,600	0.06	0.07		0.87	0.87		0.99356326	
	2016	16,600		16,600	0.06	0.07		0.87	0.87		0.99356326	
	2017	16,600		16,600	0.06	0.07		0.87	0.87		0.99356326	
N. Window-pane Flounder	2015	151		151	0.01	0.29		0.70	0.70			
	2016							0.70	0.70			
	2017							0.70	0.70			
S. Window-pane Flounder	2015	548		548	0.10	0.34	0.36	0.20	0.20			
	2016											
	2017											
Ocean Pout	2015	235		235	0.01	0.04		0.89	0.89			
	2016											
	2017											

Stock	Year	ABC	Canadian Share/ Allowance	US ABC	State Waters	Other Sub-Components	Scallops	Groundfish	Comm Groundfish	Rec Groundfish	Sector PSC	MWT
Atlantic Halibut	2015	119		119	0.30	0.03		0.67	0.67			
	2016											
	2017											
Atlantic Wolffish	2015	70		70	0.01	0.04		0.95	0.95			
	2016											
	2017											

Table 8 – Distribution of ABC to fishery components
(1) Includes commercial ABC in state waters and other sub-components

Stock	Year	ABC	Canadian Share/ Allowance	US ABC	State Waters	Other Sub-Compo-nents	Scallops	Groundfish	Comm Groundfish	Rec Groundfish	Sector PSC	Non-Sector	MWT
GB Cod	2015	2,506	526	1,980	20	79		1,881	1,881		1,845	36	
	2016												
	2017												
GOM Cod	2015	386		386	26	13		386	256	130	212	5	
	2016	386		386	26	13		386	256	130	212	5	
	2017	386		386	26	13		386	256	130	212	5	
GB Haddock	2015	43,606	19,240	24,366	244	975		22,904	22,904		22,746	158	244
	2016												
	2017												
GOM Haddock	2015	1,454		1,454	11	21		1,454	1,054	400	998	10	15
	2016	1,772		1,772	13	26		1,772	1,285	487	1,216	12	18
	2017	2,125		2,125	15	31		2,125	1,541	584	1,459	15	21
GB Yellowtail Flounder	2015	354	106	354		2	40	201	201		198	3	5
	2016	354		354		4	57	287	287		282	4	7
	2017												
SNE/MA Yellowtail Flounder	2015	700		700	14	28	71	587	587		481	106	
	2016												
	2017												
CC/GOM Yellowtail Flounder	2015	688		688	38	27		482	482		466	16	
	2016												
	2017												
Plaice	2015	1,544		1,544	31	31		1,482	1,482		1,455	28	
	2016												
	2017												

Stock	Year	ABC	Canadian Share/ Allow-ance	US ABC	State Waters	Other Sub-Compo-nents	Scallops	Ground-fish	Comm Ground-fish	Rec Ground-fish	Sector PSC	Non-Sector	MWT
Witch Flounder	2015	783		783	23	117		642	642		629	13	
	2016												
	2017												
GB Winter Flounder	2015	2,124		2,124		60		1,950	1,950		1,933	17	
	2016	2,221		2,221		67		2,154	2,154		2,136	19	
	2017	2,294		2,294		69		2,225	2,225		2,206	19	
GOM Winter Flounder	2015	510		510	87	10		413	413		395	18	
	2016	510		510	87	10		413	413		395	18	
	2017	510		510	87	10		413	413		395	18	
SNE/MA Winter Flounder	2015	1,676		1,676	117	184		1,374	1,374		1,207	167	
	2016												
	2017												
Redfish	2015	11,974		11,974	120	239		11,615	11,615		11,566	48	
	2016												
	2017												
White Hake	2015	4,713		4,713	47	94		4,572	4,572		4,540	32	
	2016	4,645		4,645	46	93		4,506	4,506		4,474	31	
	2017												
Pollock	2015	16,600		16,600	996	1,162		14,442	14,442		14,349	93	
	2016	16,600		16,600	996	1,162		14,442	14,442		14,349	93	
	2017	16,600		16,600	996	1,162		14,442	14,442		14,349	93	
N. Window-pane Flounder	2015	151		151	2	44		106	106			106	
	2016												
	2017												
S. Window-pane Flounder	2015	548		548	55	186	197	110	110			110	
	2016												
	2017												

Stock	Year	ABC	Canadian Share/ Allow-ance	US ABC	State Waters	Other Sub-Compo-nents	Scallops	Ground-fish	Comm Ground-fish	Rec Ground-fish	Sector PSC	Non-Sector	MWT
Ocean Pout	2015	235		235	2	24		209	209			209	
	2016												
	2017												
Atlantic Halibut	2015	119		100	30	3		67	67			67	
	2016												
	2017												
Atlantic Wolffish	2015	70		70	1	3		67	67			67	
	2016												
	2017												

Table 9 – ACL adjustments

Stock	Year	State Waters	Other Sub-Components	Scallops	Groundfish	Comm/Non_ Sector Groundfish	Rec Groundfish	Sector PSC	MWT
GB Cod	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
GOM Cod	2015	1	1	1	0.95	0.95	0.93	0.95	1
	2016	1	1	1	0.95	0.95	0.93	0.95	1
	2017	1	1	1	0.95	0.95	0.93	0.95	1
GB Haddock	2015	1	1	1	0.95	0.95	0.95	0.95	0.93
	2016	1	1	1	0.95	0.95	0.95	0.95	0.93
	2017	1	1	1	0.95	0.95	0.95	0.95	0.93
GOM Haddock	2015	1	1	1	0.95	0.95	0.93	0.95	0.93
	2016	1	1	1	0.95	0.95	0.93	0.95	0.93
	2017	1	1	1	0.95	0.95	0.93	0.95	0.93
GB Yellowtail Flounder	2015	1	1	0.97	0.97	0.97	0.95	0.97	0.93
	2016	1	1	0.97	0.97	0.97	0.95	0.97	0.93
	2017	1	1	0.97	0.97	0.97	0.95	0.97	0.93
SNE/MA Yellowtail Flounder	2015	1	1	0.93	0.95	0.95	0.95	0.95	1
	2016	1	1	0.93	0.95	0.95	0.95	0.95	1
	2017	1	1	0.93	0.95	0.95	0.95	0.95	1
CC/GOM Yellowtail Flounder	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	0.97	0.95	0.95	0.95	0.95	1
	2017	1	1	0.97	0.95	0.95	0.95	0.95	1
Plaice	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
Witch Flounder	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1

Stock	Year	State Waters	Other Sub-Components	Scallops	Groundfish	Comm/Non-Sector Groundfish	Rec Groundfish	Sector PSC	MWT
GB Winter Flounder	2015	1	1	1	0.97	0.97	0.97	0.97	1
	2016	1	1	1	0.97	0.97	0.97	0.97	1
	2017	1	1	1	0.97	0.97	0.97	0.97	1
GOM Winter Flounder	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
SNE/MA Winter Flounder	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
Redfish	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
White Hake	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
Pollock	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
N. Windowpane Flounder	2015	1	1	1	0.93	0.93	0.95	0.93	1
	2016	1	1	1	0.93	0.93	0.95	0.93	1
	2017	1	1	1	0.93	0.93	0.95	0.93	1
S. Windowpane Flounder	2015	1	1	0.93	0.93	0.93	0.95	0.93	1
	2016	1	1	0.93	0.93	0.93	0.95	0.93	1
	2017	1	1	0.93	0.93	0.93	0.95	0.93	1
Ocean Pout	2015	1	1	1	0.93	0.93	0.95	0.93	1
	2016	1	1	1	0.93	0.93	0.95	0.93	1
	2017	1	1	1	0.93	0.93	0.95	0.93	1

Stock	Year	State Waters	Other Sub-Components	Scallops	Groundfish	Comm/Non-Sector Groundfish	Rec Groundfish	Sector PSC	MWT
Atlantic Halibut	2015	1	1	1	0.95	0.95	0.95	0.95	1
	2016	1	1	1	0.95	0.95	0.95	0.95	1
	2017	1	1	1	0.95	0.95	0.95	0.95	1
Atlantic Wolffish	2015	1	1	1	0.93	0.93	0.95	0.95	1
	2016	1	1	1	0.93	0.93	0.95	0.95	1
	2017	1	1	1	0.93	0.93	0.95	0.95	1

Table 10 – Proposed incidental catch TACs for major stocks of concern (mt). TACs are for the fishing year. TACs shown are metric tons, live weight. Note: GB cod and GB yellowtail flounder TAC is determined annually and cannot be estimated in advance. Values are dependent on ACLs, which have not yet been determined.

	Percentage of Common Pool ACL
GB cod	2%
GOM cod	1%
GB Yellowtail	2%
CC/GOM yellowtail	1%
Plaice	5%
Witch Flounder	5%
SNE/MA Winter Flounder	1%

Table 11 - Proposed allocation of incidental catch TACs for major stocks of concern to Category B DAS programs (shown as percentage of the incidental catch TAC)

	Category B (regular) DAS Program	CAI Hook Gear SAP	Eastern US/CA Haddock SAP	Southern CAII Haddock SAP
GOM cod	100%	NA	NA	
GB cod	50%	16%	34%	
CC/GOM yellowtail	100%	NA	NA	
Plaice	100%	NA	NA	
White Hake	100%	NA	NA	
SNE/MA Winter Flounder	100%	NA	NA	
Witch Flounder	100%	NA	NA	
GB Yellowtail	50%	NA	50%	

Framework Adjustment 53

To the

Northeast Multispecies FMP

Appendix IV

ABC and No Action Projection Output

Pollock ABC

AGEPRO VERSION 4.2

pollock new base with 2013 data; 75% of F40%

Date & Time of Run: 24 Oct 2014 09:50

Input File Name: C:\NIT2\GARM08\OP_UP2014\POLLOCK PROJECTIONS\POLLOCK PROJECTIONS\BASE\75F40\POLLOCK_RUN1_AGEPRO_75F40_ABC_CONSTANT.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 12
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 100

Bootstrap File Name: C:\NIT2\GARM08\OP_UP2014\POLLOCK PROJECTIONS\POLLOCK PROJECTIONS\BASE\75F40\RUN1_AGEPRO.BSN

Number of Feasible Solutions: 100000 of 100000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Landings	6817
2015	Landings	16600
2016	Landings	16600
2017	Landings	16600
2018	F-Mult	0.3150
2019	F-Mult	0.3150
2020	F-Mult	0.3150
2021	F-Mult	0.3150
2022	F-Mult	0.3150
2023	F-Mult	0.3150
2024	F-Mult	0.3150
2025	F-Mult	0.3150

Recruits 1 Fish

Year Class	Average	StdDev
2014	19254387.5160	9641319.5874
2015	19277269.4251	9633279.2387
2016	19297876.9497	9684546.4120
2017	19223306.3798	9596813.9069
2018	19260363.2682	9612965.4169
2019	19219135.5950	9619040.2103
2020	19290384.4282	9662317.9498
2021	19255628.6794	9662019.0263
2022	19299040.6505	9692201.1651
2023	19277788.0811	9612585.9065
2024	19251263.6712	9663007.5283
2025	19270603.9167	9636322.5926

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6781913	7801185	9227899	11497800	17617765	23396940	31932550	39906610	51924320
2015	6811976	7832178	9269176	11498750	17620870	23392540	32089890	39905150	51800030

2016	6792584	7828832	9244461	11497870	17625940	23437210	32065870	40291500	51913370
2017	6788916	7721736	9213943	11497860	17613320	23388130	31765990	39699680	51846130
2018	6806760	7851728	9227862	11498020	17634595	23430190	31925390	39723160	51819870
2019	6776290	7736926	9221708	11497750	17612640	23354460	31762250	39821830	51787370
2020	6788134	7810833	9260430	11496720	17631250	23455060	32138420	39951050	51824010
2021	6806266	7791673	9226535	11496700	17613785	23452270	32074880	39839760	51889430
2022	6766135	7779343	9217916	11498700	17627800	23409910	32107770	40301030	51942070
2023	6819309	7852585	9265529	11498310	17627820	23433160	32113690	39809800	51810970
2024	6802509	7804497	9216562	11496720	17627955	23382260	32032590	39982540	51945720
2025	6814249	7814611	9243821	11499480	17617625	23421510	31968020	39972900	51889110

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	123.7209	17.4965
2015	132.5386	18.6622
2016	132.4894	20.1898
2017	126.9378	20.9514
2018	120.7119	21.2689
2019	111.1684	18.0780
2020	107.9269	16.8184
2021	104.3113	16.0920
2022	101.6769	15.5575
2023	99.7614	15.2869
2024	98.3159	15.1299
2025	97.2407	15.0553

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	85.9120	95.9598	100.8630	110.9844	123.4073	135.1755	146.2797	153.2908	165.3885
2015	93.9272	102.6097	108.9874	119.2376	131.6334	144.4738	157.0382	163.7455	178.9773
2016	90.7773	101.0963	106.9467	117.8200	131.2193	145.1906	159.4580	167.2825	183.1528
2017	83.5131	94.2559	100.4080	112.1260	125.9944	140.0880	154.9433	162.5941	181.2476
2018	76.1095	87.6342	93.9749	105.9244	119.8546	134.0335	148.9676	157.1319	175.1755
2019	73.4199	83.0019	88.6922	98.6271	110.2795	122.7358	134.8974	142.4252	157.1135
2020	73.3225	82.2531	87.2519	96.1210	106.8258	118.5744	130.0472	137.3299	151.6745
2021	71.9673	80.1639	84.8358	92.9653	103.0295	114.3348	125.6222	132.8106	147.2688
2022	70.9842	78.4988	82.9135	90.6698	100.2929	111.3218	122.4138	129.5243	143.3109
2023	69.9569	77.1339	81.3495	88.9238	98.3121	109.2121	120.2060	127.1539	140.8671
2024	68.9926	76.0834	80.1309	87.5597	96.8155	107.6401	118.5531	125.4117	139.1769
2025	68.2567	75.1790	79.1764	86.5223	95.7134	106.5244	117.5643	124.3559	137.9273

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	150.1761	20.3099
2015	156.6681	21.2032
2016	152.3792	21.9997
2017	146.0501	22.3135
2018	140.3872	22.6652
2019	131.1342	19.7650
2020	127.9898	18.6705
2021	124.3851	18.0168
2022	121.7474	17.5384
2023	119.8409	17.2991
2024	118.4038	17.1586
2025	117.3309	17.0997

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%

2014	107.5429	117.6723	124.3501	135.6207	149.4389	163.3746	176.6456	184.3068	201.0196
2015	112.5631	123.1617	129.9545	141.4873	155.4079	170.1124	184.9699	192.5603	210.1770
2016	106.7257	117.9168	124.6184	136.8966	151.2896	166.1716	181.6043	189.9741	208.3664
2017	99.4248	111.2039	118.0208	130.5071	145.1616	160.1472	175.5214	184.2754	202.8643
2018	92.7823	105.0326	112.1155	124.6183	139.3927	154.8492	170.1390	179.3877	197.9610
2019	89.7218	100.5460	106.5804	117.3129	130.0761	143.8099	157.0459	165.4031	181.8855
2020	89.6475	99.5235	105.0860	114.8350	126.7373	139.8438	152.6004	160.6884	176.7418
2021	88.1710	97.2588	102.5289	111.6592	122.9521	135.7181	148.2550	156.3018	171.9222
2022	86.9108	95.4921	100.4932	109.3146	120.2267	132.7224	145.1453	153.0135	168.1303
2023	85.8459	94.1291	98.9174	107.5885	118.2753	130.6025	142.8777	150.7490	165.9469
2024	84.8356	92.9599	97.6619	106.1920	116.7831	129.0974	141.4517	149.0350	164.1687
2025	83.9695	92.0417	96.7449	105.1496	115.7123	127.9610	140.3582	147.8749	163.2148

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	150.4680	20.4853
2015	152.8527	21.5338
2016	146.8441	22.0211
2017	141.0883	22.3411
2018	133.3786	20.9244
2019	126.1472	18.8076
2020	124.1151	18.1706
2021	120.8275	17.6219
2022	118.4815	17.2269
2023	116.8179	17.0468
2024	115.5745	16.9426
2025	114.6418	16.9017

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	107.9673	117.7184	124.4537	135.7532	149.4932	163.6701	177.6148	185.2053	202.0236
2015	108.0622	119.0777	125.5576	137.4696	151.6541	166.4482	181.5322	189.8232	207.5077
2016	100.9206	112.4182	119.0575	131.4611	145.9396	160.6856	176.0792	184.4376	202.9503
2017	94.2111	106.1965	113.1171	125.6126	140.2054	155.2564	170.5113	179.4797	197.9301
2018	89.4561	100.8488	107.3255	118.8095	132.3236	146.8058	160.8768	169.5585	186.3954
2019	87.1730	97.3051	102.9429	112.9426	125.0293	138.1190	150.8321	158.9615	174.7402
2020	87.1249	96.6348	101.9473	111.3080	122.7507	135.5875	148.1426	156.1061	171.7932
2021	85.7012	94.3861	99.4769	108.3703	119.3558	131.8598	144.2094	152.1788	167.5281
2022	84.4344	92.7879	97.6356	106.2323	116.9380	129.2102	141.4855	149.1533	164.2029
2023	83.3610	91.5437	96.2066	104.7329	115.2382	127.4315	139.5714	147.3175	162.3452
2024	82.5639	90.5336	95.1672	103.4952	113.9471	126.1474	138.3777	145.8315	160.8486
2025	81.7750	89.6573	94.2931	102.5608	113.0310	125.1384	137.3567	144.9184	159.8464

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	6.8170	0.0000
2015	16.6000	0.0000
2016	16.6000	0.0000
2017	16.6000	0.0000
2018	19.1472	3.5459
2019	15.6425	2.5311
2020	13.3648	2.2129
2021	14.1569	2.7227
2022	14.2203	2.8708
2023	14.0802	2.8501
2024	13.9707	2.8391
2025	13.8913	2.8392

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170
2015	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000
2016	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000
2017	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000
2018	11.5387	13.7278	14.7932	16.7295	19.0209	21.2994	23.8390	25.3976	28.7701
2019	10.3033	11.7359	12.5153	13.8954	15.5015	17.2126	18.9695	20.0267	22.2827
2020	9.1348	10.1416	10.7540	11.8191	13.1389	14.6464	16.2701	17.4513	19.6958
2021	9.2963	10.3754	11.0255	12.2312	13.7841	15.6442	17.8776	19.3659	21.9459
2022	9.0849	10.2240	10.8977	12.1752	13.8222	15.8574	18.1481	19.6160	22.3938
2023	8.9655	10.0881	10.7865	12.0527	13.6828	15.7005	17.9865	19.4528	22.1448
2024	8.8686	9.9983	10.6820	11.9442	13.5875	15.6011	17.8531	19.3011	22.0195
2025	8.8252	9.9214	10.5945	11.8685	13.5070	15.5096	17.7716	19.2052	21.9873

Landings x 1000 MT

Year	Average	StdDev
2014	6.8170	0.0000
2015	16.6000	0.0000
2016	16.6000	0.0000
2017	16.6000	0.0000
2018	19.1472	3.5459
2019	15.6425	2.5311
2020	13.3648	2.2129
2021	14.1569	2.7227
2022	14.2203	2.8708
2023	14.0802	2.8501
2024	13.9707	2.8391
2025	13.8913	2.8392

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170
2015	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000
2016	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000
2017	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000	16.6000
2018	11.5387	13.7278	14.7932	16.7295	19.0209	21.2994	23.8390	25.3976	28.7701
2019	10.3033	11.7359	12.5153	13.8954	15.5015	17.2126	18.9695	20.0267	22.2827
2020	9.1348	10.1416	10.7540	11.8191	13.1389	14.6464	16.2701	17.4513	19.6958
2021	9.2963	10.3754	11.0255	12.2312	13.7841	15.6442	17.8776	19.3659	21.9459
2022	9.0849	10.2240	10.8977	12.1752	13.8222	15.8574	18.1481	19.6160	22.3938
2023	8.9655	10.0881	10.7865	12.0527	13.6828	15.7005	17.9865	19.4528	22.1448
2024	8.8686	9.9983	10.6820	11.9442	13.5875	15.6011	17.8531	19.3011	22.0195
2025	8.8252	9.9214	10.5945	11.8685	13.5070	15.5096	17.7716	19.2052	21.9873

Total Fishing Mortality

Year	Average	StdDev
2014	0.1285	0.0190
2015	0.3203	0.0501
2016	0.3159	0.0543
2017	0.2783	0.0534
2018	0.3150	0.0000
2019	0.3150	0.0000
2020	0.3150	0.0000
2021	0.3150	0.0000
2022	0.3150	0.0000
2023	0.3150	0.0000
2024	0.3150	0.0000
2025	0.3150	0.0000

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.0934	0.1012	0.1058	0.1148	0.1263	0.1414	0.1539	0.1616	0.1781
2015	0.2283	0.2480	0.2603	0.2846	0.3150	0.3516	0.3872	0.4091	0.4550
2016	0.2163	0.2400	0.2503	0.2783	0.3099	0.3480	0.3876	0.4146	0.4624
2017	0.1815	0.2047	0.2152	0.2411	0.2710	0.3086	0.3472	0.3728	0.4329
2018	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150
2019	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150
2020	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150
2021	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150
2022	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150
2023	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150
2024	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150
2025	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150

Pollock No Action

AGEPRO VERSION 4.2

pollock new base with 2013 data; no action

Date & Time of Run: 31 Oct 2014 16:21

Input File Name: C:\NIT2\GARM08\OP_UP2014\POLLOCK PROJECTIONS\POLLOCK PROJECTIONS\BASE\75F40\POLLOCK_RUN1_AGEPRO_NOACTION.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 100

Bootstrap File Name: C:\NIT2\GARM08\OP_UP2014\POLLOCK PROJECTIONS\POLLOCK PROJECTIONS\BASE\75F40\RUN1_AGEPRO.BSN

Number of Feasible Solutions: 100000 of 100000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Landings	6817
2015	Landings	2158
2016	Landings	2158
2017	Landings	2158

Recruits 1 Fish

Year Class	Average	StdDev
2014	19256871.3038	9624597.5693
2015	19256365.9647	9702787.6909
2016	19237621.7196	9640432.7406
2017	19221544.8654	9612728.4401

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6792387	7834084	9254082	11498610	17621245	23399420	31706160	39922270	51885730

2015 6781003 7707121 9183671 11496890 17617860 23383710 32059720 40277750 51940410
2016 6793948 7783876 9205423 11497340 17614350 23394160 31811140 39950290 51865190
2017 6791396 7737957 9206435 11497400 17618050 23366440 31762970 39813670 51886300

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	123.7209	17.4965
2015	132.5386	18.6622
2016	146.7390	20.2033
2017	154.8695	20.9600

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	85.9120	95.9598	100.8630	110.9844	123.4073	135.1755	146.2797	153.2908	165.3885
2015	93.9279	102.6075	108.9858	119.2360	131.6295	144.4720	157.0350	163.7416	178.9790
2016	104.9907	115.3090	121.2005	132.0415	145.4588	159.4354	173.7064	181.5369	197.4032
2017	111.4228	122.2034	128.3768	140.0468	153.9258	168.0475	182.9619	190.5165	209.3538

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	150.1761	20.3099
2015	156.6684	21.2024
2016	167.0153	21.9983
2017	174.4810	22.2993

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	107.5429	117.6723	124.3501	135.6207	149.4389	163.3746	176.6456	184.3068	201.0196
2015	112.5076	123.1537	129.9991	141.4954	155.4287	170.0995	184.9946	192.4787	210.2165
2016	121.2531	132.6398	139.2755	151.5812	165.9016	180.8477	196.2867	204.5151	223.0882
2017	127.6867	139.6279	146.4305	159.0137	173.5119	188.5776	203.9983	212.6520	231.3966

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	150.4680	20.4853
2015	160.0596	21.4997
2016	168.1838	21.9729
2017	175.6639	22.2707

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	107.9673	117.7184	124.4537	135.7532	149.4932	163.6701	177.6148	185.2053	202.0236
2015	115.2018	126.3108	132.8492	144.6943	158.8078	173.6374	188.7401	196.8710	214.7080
2016	122.2741	133.8158	140.4340	152.8529	167.2133	182.0111	197.3754	205.6365	224.2508
2017	128.7171	140.9400	147.7492	160.2756	174.6870	189.7702	205.0414	213.9261	232.6678

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	6.8170	0.0000
2015	2.1580	0.0000
2016	2.1580	0.0000
2017	2.1580	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170
2015	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580
2016	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580
2017	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580

Landings x 1000 MT

Year	Average	StdDev
2014	6.8170	0.0000
2015	2.1580	0.0000
2016	2.1580	0.0000
2017	2.1580	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170	6.8170
2015	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580
2016	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580
2017	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580	2.1580

Total Fishing Mortality

Year	Average	StdDev
2014	0.1285	0.0190
2015	0.0385	0.0055
2016	0.0334	0.0046
2017	0.0267	0.0037

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.0934	0.1012	0.1058	0.1148	0.1263	0.1414	0.1539	0.1616	0.1781
2015	0.0281	0.0303	0.0317	0.0345	0.0379	0.0420	0.0459	0.0481	0.0531
2016	0.0244	0.0267	0.0276	0.0301	0.0330	0.0362	0.0395	0.0416	0.0454
2017	0.0192	0.0212	0.0221	0.0242	0.0264	0.0291	0.0316	0.0331	0.0368

Georges Bank Winter Flounder ABC

AGEPRO VERSION 4.2

OA2014 Short Term Projection: OA2014 BRPs; F2015-F2017, F=0.27

Date & Time of Run: 05 Aug 2014 10:08

Input File Name:
L:\WINTERFLDR_GB\2014_ASSESS_UPDATE\REBUILD_PROJECT\OA2014_BRPS_SHORT_FREBUILD.INP

First Age Class: 1
Number of Age Classes: 7
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 100

Bootstrap File Name:
L:\WINTERFLDR_GB\2014_ASSESS_UPDATE\REBUILD_PROJECT\2014_ASSESS_UPDATE_ADDED2011-2013_VPA_BOOT.BSN

Number of Feasible Solutions: 100000 of 100000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1522
2015	F-Mult	0.2700
2016	F-Mult	0.2700
2017	F-Mult	0.2700

Recruits 1000 Fish

Year Class	Average	StdDev
2014	14783.1613	8285.1770
2015	15249.7948	8549.3883
2016	15351.7825	8609.9654
2017	15474.0645	8650.7974

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3820.0630	5475.2140	6592.2530	9050.7300	12873.0950	18377.2300	25177.4200	30614.0100	43735.2300
2015	3905.5440	5613.4070	6815.3360	9355.3990	13310.0400	18936.1800	25977.3900	31336.5800	44841.7600
2016	3971.2270	5679.1810	6856.9880	9409.6510	13392.8400	19028.3600	26136.3800	31612.3100	45481.3700
2017	4025.9680	5719.9560	6922.8090	9526.5250	13519.8500	19180.9900	26289.5200	31791.9700	45402.1100

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	7.3612	1.4507
2015	8.8174	1.7856
2016	8.9700	1.5478
2017	9.4545	1.8480

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	4.5837	5.2468	5.6477	6.3068	7.2614	8.2069	9.2288	9.8754	11.4240
2015	5.2969	6.1842	6.6868	7.5150	8.6717	9.8828	11.1726	11.8501	14.1720
2016	5.9294	6.6692	7.1143	7.8627	8.8619	9.9024	11.0191	11.6750	13.5319
2017	6.1595	6.9086	7.3440	8.1661	9.2209	10.4689	11.8359	12.8025	15.0613

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	14.4156	2.2975
2015	16.6362	3.3505
2016	17.3944	3.5036
2017	18.3133	3.8621

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	9.8125	11.0035	11.6663	12.7378	14.2257	15.8375	17.4830	18.3082	21.2545
2015	10.4828	11.9093	12.7438	14.2924	16.2480	18.5319	20.9615	22.6839	26.5102
2016	11.0593	12.5061	13.3704	14.9365	16.9693	19.3585	21.9282	23.7188	27.7943
2017	11.4532	12.9980	13.8857	15.5825	17.8143	20.4713	23.3573	25.3508	29.8301

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	13.2141	2.2649

2015	14.4436	2.7321
2016	15.3144	3.1256
2017	16.1618	3.5081

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	8.6644	9.8441	10.4616	11.5962	13.0577	14.5751	16.2442	17.1415	19.9584
2015	9.3379	10.5380	11.2330	12.5240	14.1546	16.0198	17.9763	19.3583	22.3779
2016	9.6984	10.9764	11.7240	13.1144	14.9254	17.0659	19.3584	20.9817	24.6163
2017	9.9756	11.3469	12.1419	13.6758	15.7083	18.1257	20.7477	22.5699	26.6121

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.5220	0.0000
2015	2.1585	0.4385
2016	2.2503	0.3870
2017	2.3464	0.4401

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220
2015	1.3062	1.5163	1.6404	1.8408	2.1241	2.4142	2.7402	2.8937	3.4697
2016	1.4807	1.6746	1.7862	1.9738	2.2223	2.4880	2.7608	2.9241	3.3710
2017	1.5471	1.7315	1.8384	2.0397	2.2939	2.5922	2.9141	3.1400	3.6591

Landings x 1000 MT

Year	Average	StdDev
2014	1.5220	0.0000
2015	2.1585	0.4385
2016	2.2503	0.3870
2017	2.3464	0.4401

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220
2015	1.3062	1.5163	1.6404	1.8408	2.1241	2.4142	2.7402	2.8937	3.4697
2016	1.4807	1.6746	1.7862	1.9738	2.2223	2.4880	2.7608	2.9241	3.3710
2017	1.5471	1.7315	1.8384	2.0397	2.2939	2.5922	2.9141	3.1400	3.6591

Total Fishing Mortality

Year	Average	StdDev
2014	0.2289	0.0467
2015	0.2700	0.0000
2016	0.2700	0.0000
2017	0.2700	0.0000

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.1389	0.1616	0.1741	0.1969	0.2233	0.2571	0.2874	0.3117	0.3585
2015	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700
2016	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700
2017	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700	0.2700

Georges Bank Winter Flounder No Action

AGEPRO VERSION 4.2

OA2014 Short Term Projection: OA2014 BRPs; F2015-F2017 = no action

Date & Time of Run: 31 Oct 2014 16:18

Input File Name: C:\NIT2\GARM08\OP_UP2014\GBWINTER\OA2014_BRPS_SHORT_NOACTION.INP

First Age Class: 1
Number of Age Classes: 7
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 100

Bootstrap File Name: C:\NIT2\GARM08\OP_UP2014\GBWINTER\2014_ASSESS_UPDATE_ADDED2011-2013_VPA_BOOT.BSN

Number of Feasible Solutions: 100000 of 100000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1522
2015	Removals	60
2016	Removals	67
2017	Removals	69

Recruits 1000 Fish

Year Class	Average	StdDev
2014	14783.1613	8285.1770
2015	15406.6624	8635.3421
2016	15972.9308	8953.9987
2017	16375.1138	9145.8037

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3820.0630	5475.2140	6592.2530	9050.7300	12873.0950	18377.2300	25177.4200	30614.0100	43735.2300
2015	3946.2120	5672.5320	6888.7330	9454.4400	13449.3350	19133.3100	26235.8900	31643.7600	45271.0700
2016	4132.1130	5914.3840	7135.6040	9794.1780	13933.7350	19784.7500	27188.7900	32878.0500	47334.1500
2017	4259.9120	6050.4230	7335.2430	10087.9800	14309.7150	20305.2800	27827.6000	33593.5400	48139.0700

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	7.3612	1.4507
2015	9.3369	1.8989
2016	11.4563	2.0523
2017	13.7963	2.5140

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	4.5837	5.2468	5.6477	6.3068	7.2614	8.2069	9.2288	9.8754	11.4240
2015	5.6003	6.5360	7.0717	7.9499	9.1800	10.4637	11.8405	12.5632	15.0341
2016	7.4538	8.4140	9.0034	9.9924	11.3124	12.6781	14.1716	15.0371	17.5577
2017	9.0419	10.1722	10.8268	12.0295	13.5387	15.2714	17.0519	18.3076	20.9882

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	14.4156	2.2975
2015	16.6362	3.3505
2016	19.5022	3.7819
2017	22.5645	4.3238

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	9.8125	11.0035	11.6663	12.7378	14.2257	15.8375	17.4830	18.3082	21.2545
2015	10.4828	11.9093	12.7438	14.2924	16.2480	18.5319	20.9615	22.6839	26.5102
2016	12.4869	14.1275	15.1056	16.8458	19.0840	21.6708	24.4057	26.2886	30.5524
2017	14.5204	16.4493	17.5050	19.5050	22.0810	25.0618	28.1783	30.3904	35.1204

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	13.2141	2.2649
2015	15.4761	2.9031
2016	18.3277	3.5035
2017	21.1242	4.0663

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	8.6644	9.8441	10.4616	11.5962	13.0577	14.5751	16.2442	17.1415	19.9584
2015	9.9974	11.2935	12.0427	13.4357	15.1823	17.1715	19.2415	20.6880	23.8372
2016	11.7938	13.3417	14.2243	15.8675	17.9445	20.3443	22.8898	24.6080	28.4555
2017	13.5802	15.3716	16.3748	18.2423	20.6673	23.4789	26.4191	28.4515	32.9201

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.5220	0.0000
2015	0.0600	0.0000
2016	0.0670	0.0000
2017	0.0690	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220
2015	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600
2016	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670
2017	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690

Landings x 1000 MT

Year	Average	StdDev
2014	1.5220	0.0000
2015	0.0600	0.0000
2016	0.0670	0.0000
2017	0.0690	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220	1.5220
2015	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600
2016	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670	0.0670

2017	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690

Total Fishing Mortality

Year	Average	StdDev
2014	0.2289	0.0467
2015	0.0070	0.0015
2016	0.0062	0.0011
2017	0.0053	0.0009

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.1389	0.1616	0.1741	0.1969	0.2233	0.2571	0.2874	0.3117	0.3585
2015	0.0042	0.0050	0.0053	0.0060	0.0069	0.0079	0.0089	0.0096	0.0111
2016	0.0039	0.0046	0.0049	0.0054	0.0061	0.0069	0.0076	0.0082	0.0093
2017	0.0034	0.0039	0.0042	0.0047	0.0053	0.0059	0.0066	0.0070	0.0078

Gulf of Maine Haddock ABC

AGEPRO VERSION 4.2

GoM haddock ASAP_final_temp10 (1977-2011 recruitment)

Date & Time of Run: 04 Jun 2014 12:35

Input File Name:
K:\K_DRIVE_LOCAL\HADDOCK_GOM\SAW_59\REFERENCE_POINTS\AGEPRO\SHORT_TERM\ASAP_FINAL_TEMP10_1977_2011\75FMSY_2014_500MT\ASAP_FINAL_TEMP10_75FMSY_500MT.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 7
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
K:\K_DRIVE_LOCAL\HADDOCK_GOM\SAW_59\REFERENCE_POINTS\AGEPRO\SHORT_TERM\ASAP_FINAL_TEMP10_1977_2011\75FMSY_2014_500MT\ASAP_FINAL_TEMP10_MCMC.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	500
2015	F-Mult	0.3500
2016	F-Mult	0.3500
2017	F-Mult	0.3500
2018	F-Mult	0.3500
2019	F-Mult	0.3500
2020	F-Mult	0.3500

Recruits 1000 Fish

Year Class	Average	StdDev
2014	2113.8225	2387.2409
2015	2095.2435	2388.6322
2016	2161.9981	2415.4853

2017	2154.6634	2430.4964
2018	2141.7581	2406.3266
2019	2156.4185	2450.1039
2020	2183.0481	2465.0965

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	150.1671	205.1791	227.5903	331.1452	1120.8200	2542.1990	6162.8810	6484.1110	11028.6100
2015	149.3512	204.6887	228.6934	334.4683	1120.1820	2541.2640	6152.7080	6487.6110	11048.1000
2016	154.2960	203.8387	225.7294	361.4124	1129.3905	2545.1890	6212.6520	6501.7350	10886.1000
2017	152.0371	210.7372	232.7332	359.0538	1129.9945	2544.1510	6190.1710	6506.0160	11309.1700
2018	153.6666	204.7484	227.5898	349.5553	1122.8935	2544.3130	6203.1390	6499.2570	11243.7600
2019	152.0957	209.2503	231.1399	342.5836	1125.1445	2543.9000	6212.2790	6536.6520	11337.6800
2020	150.5870	206.1237	230.0479	360.4650	1132.4435	2544.9890	6226.1050	6535.5360	11422.0900

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	6.6153	1.5860
2015	10.9497	2.8885
2016	12.1354	3.2389
2017	11.2596	2.9416
2018	9.7577	2.5547
2019	8.3109	2.2935
2020	7.2702	2.1604

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.5200	4.3275	4.7137	5.4851	6.4722	7.5894	8.7222	9.4729	10.9446
2015	5.3946	6.8542	7.5624	8.8232	10.6045	12.7690	14.7986	16.2405	19.0547
2016	6.0831	7.5447	8.3405	9.7695	11.7089	14.1886	16.4956	18.0181	21.4327
2017	5.8444	7.0557	7.7604	9.1054	10.9230	13.1073	15.2505	16.5738	19.3351
2018	5.0229	6.0716	6.6778	7.8845	9.4988	11.3313	13.2128	14.3699	16.7559
2019	4.1012	5.0096	5.5300	6.6113	8.0600	9.7494	11.3593	12.4804	14.6040
2020	3.4524	4.1847	4.6940	5.6607	7.0336	8.5960	10.1475	11.2351	13.2134

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	11.4167	2.9021
2015	13.9657	3.6246
2016	14.3074	3.6711
2017	13.4312	3.4055
2018	11.8826	3.0222
2019	10.2820	2.7571
2020	9.1449	2.6308

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	5.8387	7.3015	8.0296	9.3083	11.0600	13.2142	15.2749	16.6707	19.5190
2015	7.1894	8.8204	9.7234	11.2971	13.5244	16.2526	18.8028	20.6046	24.1617
2016	7.4569	9.0821	9.9828	11.6412	13.8469	16.6212	19.2349	21.0092	24.7098
2017	7.0514	8.5157	9.3510	10.9265	13.0557	15.5414	18.0786	19.5586	22.7040
2018	6.1432	7.4661	8.2076	9.6831	11.5723	13.8040	15.9172	17.3010	20.0001
2019	5.1234	6.2588	6.9250	8.2542	10.0220	12.0310	13.9666	15.2414	17.6794
2020	4.3915	5.3953	6.0050	7.2057	8.8757	10.7527	12.6833	13.9711	16.4435

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	13.5594	3.5654
2015	14.7840	3.9308
2016	14.4270	3.7368
2017	13.1016	3.3721
2018	11.3424	2.9890
2019	9.8525	2.7869
2020	8.8450	2.7174

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6.7743	8.5594	9.4054	10.9301	13.1275	15.7951	18.3751	20.0235	23.4287
2015	7.4270	9.2405	10.1509	11.9080	14.2928	17.2129	20.0508	21.9413	25.7329
2016	7.5175	9.1344	9.9755	11.7252	13.9890	16.7325	19.4812	21.2073	24.7243
2017	6.7587	8.2147	9.0122	10.6189	12.7427	15.2188	17.6285	19.1171	22.3622
2018	5.7228	6.9918	7.7389	9.1681	11.0590	13.2324	15.3014	16.7527	19.4163
2019	4.7957	5.8300	6.4936	7.8310	9.5709	11.5788	13.6005	14.9372	17.5221
2020	4.0673	5.0235	5.6228	6.8446	8.5358	10.5018	12.5115	13.8151	16.6093

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	0.5000	0.0000
2015	1.4952	0.3968
2016	1.8315	0.4893
2017	2.1978	0.5984
2018	2.1606	0.5720
2019	1.8480	0.4869
2020	1.6976	0.4559

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
2015	0.7378	0.9235	1.0261	1.2079	1.4535	1.7423	2.0172	2.2144	2.6036
2016	0.9125	1.1394	1.2551	1.4773	1.7719	2.1293	2.4845	2.7204	3.2044
2017	1.1065	1.3604	1.4945	1.7637	2.1247	2.5583	2.9974	3.2881	3.9392
2018	1.1145	1.3574	1.4859	1.7489	2.0904	2.5080	2.9353	3.1965	3.7728
2019	0.9501	1.1468	1.2658	1.4897	1.7994	2.1480	2.5110	2.7310	3.1608
2020	0.8523	1.0362	1.1469	1.3646	1.6463	1.9864	2.3083	2.5288	2.9154

Landings x 1000 MT

Year	Average	StdDev
2014	0.5000	0.0000
2015	1.4952	0.3968
2016	1.8315	0.4893
2017	2.1978	0.5984
2018	2.1606	0.5720
2019	1.8480	0.4869
2020	1.6976	0.4559

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
2015	0.7378	0.9235	1.0261	1.2079	1.4535	1.7423	2.0172	2.2144	2.6036
2016	0.9125	1.1394	1.2551	1.4773	1.7719	2.1293	2.4845	2.7204	3.2044
2017	1.1065	1.3604	1.4945	1.7637	2.1247	2.5583	2.9974	3.2881	3.9392
2018	1.1145	1.3574	1.4859	1.7489	2.0904	2.5080	2.9353	3.1965	3.7728
2019	0.9501	1.1468	1.2658	1.4897	1.7994	2.1480	2.5110	2.7310	3.1608

2020	0.8523	1.0362	1.1469	1.3646	1.6463	1.9864	2.3083	2.5288	2.9154

Total Fishing Mortality

Year	Average	StdDev
2014	0.2105	0.0583
2015	0.3500	0.0000
2016	0.3500	0.0000
2017	0.3500	0.0000
2018	0.3500	0.0000
2019	0.3500	0.0000
2020	0.3500	0.0000

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.1148	0.1340	0.1461	0.1696	0.2014	0.2412	0.2857	0.3139	0.3952
2015	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500
2016	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500
2017	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500
2018	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500
2019	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500
2020	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500

Gulf of Maine Haddock No Action

AGEPRO VERSION 4.2

GoM haddock ASAP_final_temp10 (1977-2011 recruitment) no action

Date & Time of Run: 03 Nov 2014 15:27

Input File Name:
C:\NIT2\SAW59_GOM_HADDOCK\REFERENCE_POINTS\AGEPRO\SHORT_TERM\ASAP_FINAL_TEMP10_1977_2011\75FMSY_2014_500MT\ASAP_FINAL_TEMP10_NOACTION_500MT.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
C:\NIT2\SAW59_GOM_HADDOCK\REFERENCE_POINTS\AGEPRO\SHORT_TERM\ASAP_FINAL_TEMP10_1977_2011\75FMSY_2014_500MT\ASAP_FINAL_TEMP10_MCMC.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	500
2015	Removals	19
2016	Removals	55
2017	Removals	66

Recruits 1000 Fish

Year Class	Average	StdDev

2014	2135.1277	2384.1676
2015	2113.1285	2397.5202
2016	2165.2877	2445.9560
2017	2180.4717	2443.5586

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	153.3470	205.1057	226.4793	362.7305	1145.2370	2543.6940	6209.5730	6491.0380	10875.4900
2015	149.6876	202.6389	227.9222	339.1589	1120.7880	2542.4790	6181.4160	6495.0110	11022.3200
2016	154.2460	209.0548	230.8277	350.5069	1131.2155	2544.3460	6232.8600	6516.7310	11568.0600
2017	152.4947	207.5686	228.3286	364.7789	1148.3620	2545.9370	6206.8080	6515.4550	11245.5300

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	6.6143	1.5849
2015	11.2745	2.9686
2016	13.8912	3.6907
2017	14.6712	3.8168

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.5004	4.3048	4.7331	5.4667	6.4595	7.6112	8.7281	9.5378	10.8113
2015	5.6004	7.0287	7.7965	9.0877	10.9119	13.1515	15.2375	16.6822	19.6856
2016	6.9234	8.6608	9.5682	11.1957	13.4430	16.2142	18.8586	20.5741	24.4624
2017	7.4294	9.2247	10.1294	11.9027	14.2010	17.0623	19.8476	21.5463	25.4211

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	11.4200	2.8981
2015	13.9715	3.6324
2016	15.7211	4.0360
2017	16.4695	4.1621

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	5.9171	7.2921	8.0237	9.2920	11.0625	13.2501	15.3193	16.6481	19.3909
2015	7.0782	8.7710	9.7030	11.3476	13.5278	16.2716	18.8438	20.5639	24.3288
2016	8.0706	9.9712	10.9370	12.7891	15.2306	18.2706	21.1795	22.9883	26.9398
2017	8.6488	10.4591	11.4989	13.4417	15.9704	19.1102	22.0582	23.9381	27.8137

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	13.5545	3.5547
2015	15.5172	4.1063
2016	16.7532	4.3202
2017	17.1823	4.3645

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	6.8675	8.5374	9.4053	10.9512	13.1143	15.7627	18.3463	20.0402	23.5912
2015	7.7259	9.6997	10.6579	12.5397	14.9988	18.0709	21.0682	22.9768	27.2060
2016	8.5907	10.5783	11.5938	13.6238	16.2251	19.4820	22.6487	24.5808	28.7145
2017	8.9628	10.8965	11.9229	13.9922	16.6645	19.9580	23.0501	25.0710	28.8188

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	0.5000	0.0000
2015	0.0190	0.0000
2016	0.0550	0.0000
2017	0.0660	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
2015	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190
2016	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550
2017	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660

Landings x 1000 MT

Year	Average	StdDev
2014	0.5000	0.0000
2015	0.0190	0.0000
2016	0.0550	0.0000
2017	0.0660	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
2015	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190
2016	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550
2017	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660	0.0660

Total Fishing Mortality

Year	Average	StdDev
2014	0.2103	0.0582
2015	0.0045	0.0012
2016	0.0092	0.0025
2017	0.0080	0.0022

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.1147	0.1336	0.1459	0.1690	0.2015	0.2408	0.2830	0.3152	0.3960
2015	0.0024	0.0028	0.0031	0.0036	0.0043	0.0051	0.0060	0.0067	0.0085
2016	0.0050	0.0058	0.0063	0.0074	0.0089	0.0106	0.0125	0.0138	0.0175
2017	0.0042	0.0050	0.0054	0.0064	0.0077	0.0092	0.0109	0.0121	0.0150

Gulf of Maine Cod M=0.2 Model ABC

AGEPRO VERSION 4.2

GoM cod 2014 update - project (refpoints) - M=0.2

Date & Time of Run: 24 Oct 2014 11:51

Input File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\PDT\GOM_COD_2014_UPDATE_M_02_386ABC.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1

Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\GOM_COD_2013_UPDATE_M_02_MCMC_REV_RECRUIT.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1470
2015	Removals	386
2016	Removals	386
2017	Removals	386

Recruits 1000 Fish

Year Class	Average	StdDev
2014	2736.3650	2059.2167
2015	3544.3331	2762.3233
2016	4892.0972	3687.6594
2017	5906.4290	4265.6922

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	428.7237	602.4060	773.5338	1331.5330	2101.6105	3614.2400	5407.7350	6702.5950	10059.6000
2015	486.7693	733.7759	958.0329	1646.5230	2687.2500	4712.4360	7159.6270	8853.4990	13515.7100
2016	717.5824	1053.1160	1347.2990	2321.6160	3788.6115	6501.8250	9731.5350	11908.9200	18748.5800
2017	1004.2690	1301.9070	1688.1860	3038.2780	4518.1440	7829.4070	11489.8200	14136.0300	21994.5100

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	2.7278	0.6449
2015	3.4530	0.9435
2016	4.9199	1.3185
2017	7.0921	2.1213

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4386	1.7470	1.9666	2.2654	2.6904	3.1193	3.5952	3.8571	4.4938
2015	1.6149	2.0085	2.2880	2.7625	3.3894	4.0554	4.7120	5.0844	6.0368
2016	2.2844	2.9280	3.2789	3.9600	4.8414	5.7506	6.6520	7.2807	8.4347
2017	3.2007	4.0375	4.5631	5.5760	6.8616	8.3548	9.8864	10.9125	12.9845

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	4.3195	0.8625
2015	4.8134	1.2108
2016	6.9046	1.8974
2017	9.9642	3.1854

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%

2014	2.6301	2.9855	3.2722	3.6930	4.2802	4.8479	5.4763	5.8180	6.6308
2015	2.4094	2.9777	3.3108	3.9299	4.7405	5.5693	6.4127	6.9797	8.0469
2016	3.3506	4.1305	4.6182	5.5390	6.7249	8.0657	9.3986	10.3520	12.0694
2017	4.3276	5.5498	6.2714	7.6829	9.5654	11.8041	14.1837	15.8330	19.2207

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	5.2639	1.1681
2015	6.4580	1.6968
2016	9.2087	2.7789
2017	13.3884	4.6392

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	2.9326	3.4555	3.7866	4.3996	5.1966	6.0071	6.8388	7.2612	8.3743
2015	3.2576	3.9600	4.3901	5.2394	6.3134	7.5139	8.7018	9.4871	10.9920
2016	4.2817	5.3463	5.9598	7.2349	8.8730	10.8047	12.8753	14.2737	17.1389
2017	5.5373	7.1215	8.0929	10.0534	12.6916	16.0157	19.5390	22.0397	27.1231

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.3860	0.0000
2016	0.3860	0.0000
2017	0.3860	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2016	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2017	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860

Landings x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.3860	0.0000
2016	0.3860	0.0000
2017	0.3860	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2016	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2017	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860

Total Fishing Mortality

Year	Average	StdDev
2014	0.8538	0.2618
2015	0.1426	0.0486
2016	0.0971	0.0316
2017	0.0686	0.0216

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.4469	0.5201	0.5761	0.6747	0.8042	0.9827	1.1739	1.3397	1.6471
2015	0.0715	0.0862	0.0927	0.1096	0.1321	0.1644	0.2013	0.2340	0.3069
2016	0.0504	0.0595	0.0646	0.0754	0.0904	0.1126	0.1380	0.1572	0.2021
2017	0.0359	0.0417	0.0458	0.0533	0.0643	0.0793	0.0967	0.1092	0.1380

Gulf of Maine Cod M=0.2 Model No Action

AGEPRO VERSION 4.2

GoM cod 2014 update – no action project (refpoints) - M=0.2

Date & Time of Run: 03 Nov 2014 15:24

Input File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\PDT\GOM_COD_2014_UPDATE_M_02_NOACTION.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\GOM_COD_2013_UPDATE_M_02_MCMC_REV_RECRUIT.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1470
2015	Removals	154
2016	Removals	38
2017	Removals	38

Recruits 1000 Fish

Year Class	Average	StdDev
2014	2736.3650	2059.2167
2015	3591.2679	2792.0040
2016	5133.8559	3819.3604
2017	6114.5257	4358.9401

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	428.7237	602.4060	773.5338	1331.5330	2101.6105	3614.2400	5407.7350	6702.5950	10059.6000
2015	495.6884	746.0207	972.2566	1672.6580	2722.9985	4779.1140	7243.3240	8962.2880	13673.5700
2016	775.4957	1124.4580	1428.0340	2490.6790	3970.4205	6882.0430	10213.2600	12455.5800	19538.8300
2017	1138.2700	1352.5340	1781.0960	3219.9510	4583.5035	8187.7140	11515.5100	14333.3700	22690.0700

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	2.7278	0.6449
2015	3.4989	0.9436

2016	5.2071	1.3197
2017	7.7281	2.1225

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4386	1.7470	1.9666	2.2654	2.6904	3.1193	3.5952	3.8571	4.4938
2015	1.6602	2.0538	2.3340	2.8085	3.4337	4.1008	4.7564	5.1313	6.0827
2016	2.5687	3.2122	3.5635	4.2462	5.1292	6.0399	6.9396	7.5687	8.7245
2017	3.8302	4.6712	5.1988	6.2093	7.5017	8.9941	10.5195	11.5477	13.6208

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	4.3195	0.8625
2015	4.8134	1.2108
2016	7.1405	1.8983
2017	10.6044	3.1867

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	2.6301	2.9855	3.2722	3.6930	4.2802	4.8479	5.4763	5.8180	6.6308
2015	2.4094	2.9777	3.3108	3.9299	4.7405	5.5693	6.4127	6.9797	8.0469
2016	3.5834	4.3622	4.8536	5.7746	6.9619	8.3020	9.6369	10.5908	12.3012
2017	4.9592	6.1929	6.9055	8.3232	10.2088	12.4456	14.8329	16.4671	19.8422

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	5.2639	1.1681
2015	6.5726	1.6961
2016	9.6387	2.7814
2017	14.2865	4.6419

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	2.9326	3.4555	3.7866	4.3996	5.1966	6.0071	6.8388	7.2612	8.3743
2015	3.3764	4.0761	4.5059	5.3542	6.4280	7.6283	8.8158	9.6009	11.1056
2016	4.7029	5.7743	6.3869	7.6640	9.3017	11.2351	13.3191	14.7056	17.5664
2017	6.3995	8.0047	8.9828	10.9507	13.5933	16.9300	20.4532	22.9035	27.9798

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.1540	0.0000
2016	0.0380	0.0000
2017	0.0380	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540
2016	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380
2017	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380

Landings x 1000 MT

Year	Average	StdDev

2014	1.4700	0.0000
2015	0.1540	0.0000
2016	0.0380	0.0000
2017	0.0380	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540
2016	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380
2017	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380

Total Fishing Mortality

Year	Average	StdDev
2014	0.8538	0.2618
2015	0.0550	0.0181
2016	0.0087	0.0025
2017	0.0059	0.0016

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.4469	0.5201	0.5761	0.6747	0.8042	0.9827	1.1739	1.3397	1.6471
2015	0.0281	0.0338	0.0363	0.0427	0.0512	0.0634	0.0770	0.0891	0.1157
2016	0.0047	0.0055	0.0060	0.0069	0.0082	0.0100	0.0120	0.0136	0.0168
2017	0.0033	0.0038	0.0042	0.0048	0.0057	0.0068	0.0081	0.0089	0.0108

Gulf of Maine Cod Mramp Model with M=0.2 in projection ABC

AGEPRO VERSION 4.2

GoM cod 2014 update - project (refpoints) - M-ramp

Date & Time of Run: 24 Oct 2014 11:54

Input File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\PDT\GOM_COD_2014_UPDATE_M_RAMP_M02_386ABC.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\GOM_COD_2013_UPDATE_M_RAMP_MCMC_REV_RECRUIT.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1470
2015	Removals	386

2016 Removals 386
2017 Removals 386

Recruits 1000 Fish

Year Class	Average	StdDev
2014	3580.7135	2017.7322
2015	4954.1037	2891.6191
2016	7351.8496	4038.8917
2017	8902.7742	4601.7987

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	780.1684	1071.8080	1328.5830	1990.1180	3317.6100	4678.3780	6125.6590	7176.3100	10222.7900
2015	988.8354	1416.7620	1775.7800	2714.3520	4505.8875	6528.3530	8572.1530	10132.8200	14593.2000
2016	1559.0390	2200.1940	2695.2380	4121.6480	6886.9945	9667.2720	12567.6800	14231.6100	20180.5700
2017	2322.7780	2627.6870	3582.6760	4846.2810	8813.4270	11767.8300	14249.5900	15992.8800	24890.0100

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	3.0850	0.6892
2015	4.2165	1.0689
2016	6.4667	1.5741
2017	9.7217	2.4956

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.8024	2.0658	2.2464	2.5946	3.0088	3.5229	3.9771	4.3434	5.1023
2015	2.2773	2.6800	2.9207	3.4724	4.0778	4.8994	5.6147	6.1568	7.3221
2016	3.5810	4.2225	4.5354	5.3403	6.2966	7.4319	8.5205	9.3615	10.9650
2017	5.2336	6.1794	6.7160	7.9306	9.4409	11.2309	13.0306	14.2835	16.7350

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	4.9851	0.9656
2015	6.1269	1.4260
2016	9.2581	2.2492
2017	13.7301	3.6744

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.2211	3.5797	3.8050	4.3119	4.8804	5.6069	6.2562	6.7217	7.7669
2015	3.5390	4.0944	4.3736	5.1166	5.9738	7.0012	7.9972	8.7392	10.2069
2016	5.1833	6.0497	6.5329	7.6421	9.0203	10.6245	12.2466	13.3930	15.5987
2017	7.2140	8.5476	9.3769	11.0745	13.3001	15.9209	18.5950	20.5497	24.0944

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	6.4454	1.3594
2015	8.4965	2.0127
2016	12.6543	3.2482
2017	18.7484	5.2810

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%

2014	3.8919	4.4873	4.7679	5.4818	6.2905	7.2952	8.2146	8.9395	10.3554
2015	4.8502	5.6239	6.0569	7.0453	8.2817	9.7251	11.1562	12.1723	14.1871
2016	6.8703	8.0843	8.7808	10.2973	12.2871	14.5598	16.9747	18.6978	21.9605
2017	9.3594	11.3063	12.5183	14.8840	18.1306	21.8824	25.7477	28.3886	33.6976

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.3860	0.0000
2016	0.3860	0.0000
2017	0.3860	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2016	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2017	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860

Landings x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.3860	0.0000
2016	0.3860	0.0000
2017	0.3860	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2016	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2017	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860

Total Fishing Mortality

Year	Average	StdDev
2014	0.7955	0.2231
2015	0.1194	0.0355
2016	0.0760	0.0209
2017	0.0501	0.0128

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.4272	0.5019	0.5544	0.6366	0.7596	0.9157	1.0787	1.2061	1.3847
2015	0.0608	0.0739	0.0813	0.0944	0.1142	0.1369	0.1656	0.1837	0.2191
2016	0.0403	0.0477	0.0528	0.0609	0.0732	0.0870	0.1046	0.1130	0.1360
2017	0.0277	0.0323	0.0354	0.0408	0.0484	0.0574	0.0677	0.0732	0.0856

Gulf of Maine Cod Mramp Model with M=0.2 in projection No Action

AGEPRO VERSION 4.2

GoM cod 2014 update – no action project (refpoints) - M-ramp m=0.2

Date & Time of Run: 03 Nov 2014 15:25

Input File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\PDT\GOM_COD_2014_UPDATE_M_RAMP_M02_NOACTION.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\GOM_COD_2013_UPDATE_M_RAMP_MCMC_REV_RECRUIT.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1470
2015	Removals	154
2016	Removals	38
2017	Removals	38

Recruits 1000 Fish

Year Class	Average	StdDev
2014	3580.7135	2017.7322
2015	5007.3890	2915.3322
2016	7622.7068	4133.3135
2017	9052.9806	4643.6378

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	780.1684	1071.8080	1328.5830	1990.1180	3317.6100	4678.3780	6125.6590	7176.3100	10222.7900
2015	1007.1580	1438.1820	1798.3420	2742.8340	4559.3375	6594.7380	8650.5900	10227.7500	14746.2400
2016	1661.1840	2317.2840	2801.1640	4281.4160	7214.8405	10015.1600	12999.5500	14542.4300	20974.6500
2017	2472.3250	2642.8750	3753.2210	4850.9450	9028.4070	11826.9100	14327.3700	16088.5900	25420.1300

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	3.0850	0.6892
2015	4.2619	1.0689
2016	6.7526	1.5751
2017	10.3562	2.4968

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.8024	2.0658	2.2464	2.5946	3.0088	3.5229	3.9771	4.3434	5.1023
2015	2.3236	2.7242	2.9656	3.5175	4.1229	4.9441	5.6592	6.2011	7.3669
2016	3.8673	4.5094	4.8193	5.6264	6.5825	7.7203	8.8067	9.6482	11.2525
2017	5.8606	6.8117	7.3487	8.5626	10.0785	11.8657	13.6641	14.9200	17.3708

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev

2014	4.9851	0.9656
2015	6.1269	1.4260
2016	9.4947	2.2498
2017	14.3746	3.6715

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.2211	3.5797	3.8050	4.3119	4.8804	5.6069	6.2562	6.7217	7.7669
2015	3.5390	4.0944	4.3736	5.1166	5.9738	7.0012	7.9972	8.7392	10.2069
2016	5.4181	6.2844	6.7690	7.8792	9.2570	10.8617	12.4820	13.6300	15.8344
2017	7.8577	9.1781	10.0212	11.7195	13.9483	16.5649	19.2362	21.1727	24.7377

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	6.4454	1.3594
2015	8.6107	2.0122
2016	13.0863	3.2500
2017	19.6604	5.2707

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.8919	4.4873	4.7679	5.4818	6.2905	7.2952	8.2146	8.9395	10.3554
2015	4.9659	5.7388	6.1715	7.1600	8.3960	9.8388	11.2698	12.2857	14.3002
2016	7.2967	8.5175	9.2113	10.7288	12.7189	14.9958	17.4025	19.1387	22.4206
2017	10.2362	12.1774	13.4409	15.8119	19.0636	22.8027	26.6155	29.2465	34.5304

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.1540	0.0000
2016	0.0380	0.0000
2017	0.0380	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540
2016	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380
2017	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380

Landings x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.1540	0.0000
2016	0.0380	0.0000
2017	0.0380	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540
2016	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380
2017	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380

Total Fishing Mortality

Year	Average	StdDev
2014	0.7955	0.2231
2015	0.0464	0.0134
2016	0.0070	0.0018
2017	0.0045	0.0010

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.4272	0.5019	0.5544	0.6366	0.7596	0.9157	1.0787	1.2061	1.3847
2015	0.0240	0.0290	0.0319	0.0369	0.0445	0.0532	0.0639	0.0707	0.0836
2016	0.0038	0.0045	0.0050	0.0057	0.0067	0.0079	0.0094	0.0101	0.0119
2017	0.0026	0.0030	0.0033	0.0037	0.0044	0.0051	0.0059	0.0064	0.0073

Gulf of Maine Cod Mramp Model with M=0.4 in projection ABC

AGEPRO VERSION 4.2

GoM cod 2014 update - project (refpoints) - M-ramp

Date & Time of Run: 24 Oct 2014 11:55

Input File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\PDT\GOM_COD_2014_UPDATE_M_RAMP_M04_386ABC.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\GOM_COD_2013_UPDATE_M_RAMP_MCMC_REV_RECRUIT.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1470
2015	Removals	386
2016	Removals	386
2017	Removals	386

Recruits 1000 Fish

Year Class	Average	StdDev
2014	3371.3623	1904.1909
2015	3733.5257	2195.3596
2016	4648.2739	2686.3536
2017	5759.5099	3411.2461

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	730.0822	1008.1670	1247.2330	1872.8960	3118.8480	4404.5520	5772.4100	6773.4480	9645.6090

2015	733.2946	1063.0360	1325.2940	2041.7850	3377.2090	4926.7150	6491.3490	7672.1050	11069.0000
2016	937.8403	1340.4550	1667.6620	2538.7560	4248.0110	6144.1310	8074.6390	9423.3370	13138.5800
2017	1148.2010	1646.8120	2060.3810	3126.3170	5186.0395	7602.6450	10167.8800	11910.7700	16602.5500

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	2.9047	0.6565
2015	3.1776	0.8304
2016	3.9701	1.0134
2017	4.9593	1.3775

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.6811	1.9339	2.1060	2.4396	2.8324	3.3217	3.7533	4.1028	4.8263
2015	1.6733	1.9873	2.1713	2.5990	3.0707	3.7071	4.2621	4.6865	5.5909
2016	2.1228	2.5250	2.7297	3.2420	3.8591	4.5895	5.2976	5.8285	6.8589
2017	2.5072	3.0175	3.3138	3.9642	4.8072	5.7848	6.7885	7.4823	8.8712

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	4.9851	0.9656
2015	4.9560	1.1779
2016	6.2088	1.5772
2017	7.6824	2.2187

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.2211	3.5797	3.8050	4.3119	4.8804	5.6069	6.2562	6.7217	7.7669
2015	2.8157	3.2759	3.5075	4.1205	4.8280	5.6777	6.4928	7.1208	8.3301
2016	3.3611	3.9685	4.3044	5.0741	6.0353	7.1594	8.2932	9.1140	10.6729
2017	3.8143	4.5876	5.0937	6.0804	7.4035	8.9688	10.6104	11.8189	14.0759

Mean Biomass x 1000 MT

Year	Average	StdDev
2014	5.8173	1.2370
2015	6.3127	1.5485
2016	7.8282	2.1284
2017	9.7184	3.0025

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.4933	4.0351	4.2910	4.9409	5.6767	6.5905	7.4273	8.0866	9.3746
2015	3.5221	4.1102	4.4435	5.1975	6.1508	7.2484	8.3596	9.1561	10.7230
2016	4.0946	4.8482	5.3112	6.2843	7.5776	9.0649	10.6437	11.8054	13.9271
2017	4.4937	5.5751	6.2407	7.5465	9.3312	11.4424	13.6604	15.2066	18.5318

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.3860	0.0000
2016	0.3860	0.0000
2017	0.3860	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2016	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2017	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860

Landings x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.3860	0.0000
2016	0.3860	0.0000
2017	0.3860	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2016	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860
2017	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860	0.3860

Total Fishing Mortality

Year	Average	StdDev
2014	0.8883	0.2531
2015	0.1688	0.0530
2016	0.1342	0.0400
2017	0.1083	0.0308

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.4734	0.5570	0.6165	0.7086	0.8466	1.0222	1.2085	1.3571	1.5565
2015	0.0839	0.1023	0.1130	0.1317	0.1605	0.1940	0.2372	0.2639	0.3200
2016	0.0685	0.0818	0.0909	0.1057	0.1282	0.1543	0.1886	0.2049	0.2522
2017	0.0570	0.0672	0.0739	0.0862	0.1036	0.1249	0.1502	0.1644	0.1974

Gulf of Maine Cod Mramp Model with M=0.4 in projection No Action

AGEPRO VERSION 4.2

GoM cod 2014 update – no action project (refpoints) - M-ramp m=0.4

Date & Time of Run: 03 Nov 2014 15:24

Input File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\PDT\GOM_COD_2014_UPDATE_M_RAMP_M04_NOACTION.INP

First Age Class: 1
Number of Age Classes: 9
Number of Years in Projection: 4
Number of Fleets: 1
Number of Recruitment Models: 1
Number of Bootstraps: 1000
Number of Simulations: 10

Bootstrap File Name:
C:\NIT2\GOMCOD2014UPDATE\PROJECTIONS\GOM_COD_2013_UPDATE_M_RAMP_MCMC_REV_RECRUIT.BSN

Number of Feasible Solutions: 10000 of 10000 Realizations

Input Harvest Scenario

Year	Type	Value
2014	Removals	1470
2015	Removals	154
2016	Removals	38
2017	Removals	38

Recruits 1000 Fish

Year Class	Average	StdDev
2014	3371.3623	1904.1909
2015	3789.7920	2220.2079
2016	4950.6834	2821.0368
2017	6337.7971	3640.5263

Recruits Distribution

Year Class	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	730.0822	1008.1670	1247.2330	1872.8960	3118.8480	4404.5520	5772.4100	6773.4480	9645.6090
2015	752.5899	1082.5440	1351.6520	2077.4050	3439.3455	4995.4760	6576.0240	7761.2040	11201.3800
2016	1025.7730	1442.7970	1797.4950	2709.5120	4560.6730	6532.7770	8537.4030	9937.5250	13874.1700
2017	1329.5370	1853.5510	2328.5160	3472.8930	5823.4605	8369.5780	11070.6700	12934.8800	17916.0200

Spawning Stock Biomass x 1000 MT

Year	Average	StdDev
2014	2.9047	0.6565
2015	3.2255	0.8303
2016	4.2282	1.0144
2017	5.4776	1.3792

Spawning Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.6811	1.9339	2.1060	2.4396	2.8324	3.3217	3.7533	4.1028	4.8263
2015	1.7226	2.0341	2.2194	2.6481	3.1176	3.7557	4.3103	4.7345	5.6391
2016	2.3791	2.7823	2.9858	3.5010	4.1183	4.8488	5.5589	6.0867	7.1199
2017	3.0127	3.5321	3.8284	4.4802	5.3254	6.3021	7.3077	8.0027	9.3817

JAN-1 Stock Biomass x 1000 MT

Year	Average	StdDev
2014	4.9851	0.9656
2015	4.9560	1.1779
2016	6.4218	1.5781
2017	8.2256	2.2248

JAN-1 Stock Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.2211	3.5797	3.8050	4.3119	4.8804	5.6069	6.2562	6.7217	7.7669
2015	2.8157	3.2759	3.5075	4.1205	4.8280	5.6777	6.4928	7.1208	8.3301
2016	3.5693	4.1793	4.5156	5.2847	6.2478	7.3735	8.5105	9.3285	10.8877
2017	4.3368	5.1234	5.6281	6.6217	7.9454	9.5165	11.1707	12.3652	14.6457

Mean Biomass x 1000 MT

Year	Average	StdDev

2014	5.8173	1.2370
2015	6.4235	1.5478
2016	8.2101	2.1301
2017	10.4702	3.0191

Mean Biomass Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	3.4933	4.0351	4.2910	4.9409	5.6767	6.5905	7.4273	8.0866	9.3746
2015	3.6347	4.2222	4.5555	5.3088	6.2615	7.3589	8.4699	9.2660	10.8332
2016	4.4733	5.2297	5.6903	6.6626	7.9607	9.4507	11.0277	12.1995	14.3143
2017	5.2071	6.2976	6.9768	8.2835	10.0799	12.1962	14.4427	16.0098	19.3272

Combined Catch Biomass x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.1540	0.0000
2016	0.0380	0.0000
2017	0.0380	0.0000

Combined Catch Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540
2016	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380
2017	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380

Landings x 1000 MT

Year	Average	StdDev
2014	1.4700	0.0000
2015	0.1540	0.0000
2016	0.0380	0.0000
2017	0.0380	0.0000

Landings Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700	1.4700
2015	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540	0.1540
2016	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380
2017	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380	0.0380

Total Fishing Mortality

Year	Average	StdDev
2014	0.8883	0.2531
2015	0.0650	0.0196
2016	0.0118	0.0031
2017	0.0091	0.0022

Total Fishing Mortality Distribution

Year	1%	5%	10%	25%	50%	75%	90%	95%	99%
2014	0.4734	0.5570	0.6165	0.7086	0.8466	1.0222	1.2085	1.3571	1.5565
2015	0.0329	0.0400	0.0440	0.0512	0.0620	0.0745	0.0904	0.1003	0.1200
2016	0.0064	0.0075	0.0083	0.0096	0.0114	0.0135	0.0162	0.0174	0.0207
2017	0.0052	0.0060	0.0066	0.0075	0.0089	0.0104	0.0122	0.0131	0.0151